PORTFÓLIO DE PROJETOS DE

HEALTHTECH

2024

SAMSUNG OGIN AGÊNCIA DE INOVAÇÃO TECNOLÓGICA E PROPRIEDADE INTELECTUAL UEA UNIVERSIDADE DO ESTADO DO AMAZONAS

APRESENTAÇÃO

É com grande entusiasmo que apresentamos as propostas de projetos na área Healthtech, desenvolvidos pelos docentes da Universidade do Estado do Amazonas (UEA). A UEA, comprometida com a inovação atrelada a saúde, tem concentrado esforços em pesquisas e soluções inovadoras na área de Healthtech, com o objetivo de transformar a saúde e melhorar a qualidade de vida da população da Amazônia e do Brasil. Com a missão de integrar ciência, tecnologia e inovação, é prioritário que a UEA seja responsável na elaboração de políticas públicas na área supracitada necessárias à saúde pública e ao desenvolvimento econômico, social e ambiental.

A UEA tem criado soluções inovadoras no setor de saúde, aproveitando o vasto conhecimento acadêmico e científico, aliado à tecnologia de ponta. Nossa proposta de projetos em Healthtech estão sendo pesquisados em áreas estratégicas, como telemedicina, dispositivos vestíveis para monitoramento de saúde, inteligência artificial para diagnóstico e tratamento, além de iniciativas de educação digital voltadas para a saúde preventiva. Assim sendo, a Gestão Superior da UEA, propõe como indicação as propostas de projetos a seguir: ECG AMAZON, BE- FAST STROKE, CARDIOSENSE, SMART CLIMATE, STRATÉGIE, ECG NOW e WEARABLE.

Acreditamos que a parceria com a Samsung, líder global em tecnologia e inovação em saúde, poderá potencializar ainda mais esses projetos, levando nossas soluções a um novo patamar de excelência. Com a expertise da Samsung em eletrônica, software e recentemente em Healtech. Certamente a UEA poderá colaborar para desenvolver novos produtos que impactem positivamente a saúde da população, não apenas no Amazonas, Brasil e em outros países.

Estamos à disposição para discutir possíveis colaborações e verificar como nossas iniciativas podem se alinhar às metas e estratégias da Samsung na área de Healthtech. Juntos, podemos construir um futuro mais saudável e inovador.

Prof.Titular Dr. ANTONIO DE LIMA MESQUITA

Diretor Executivo da Agência de Inovação da Universidade

do Estado do Amazonas - AGIN/UEA

SUMÁRIO

Request for Proposal

Project Name	AI Models for Physical Activity Correction and Health Promotion based on Smartphone Images (AIPAC&Health)	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	**Laboratório de Mídia**/ Centro de Estudos Superiores de Itacoatiara /UEA	Contact Point (Local)	Dr. João da Mata Libório Filho jlfilho@uea.edu.br / 92 99121-2208
Project Duration	24 months	Document Date	Ago/2024
Summary/ Goal	The project aims to create specialized datasets and deep learning models of physical exercise postures to analyze movement correctness, establishing a foundation for future health monitoring applications for mobile devices.		
Research Scope	- The project involves data collection using the Galaxy S24 and Galaxy Watch 7 devices, the creation of specialized datasets for deep learning model training, and the execution of a proof of concept to validate the effectiveness of these models. The implementation of a complete commercial system based on the developed models may be considered in a future project.		
Output/ Specifications	- Anonymous Data Sets: o Datasets including video recordings of exercise postures, heart rate signals, ECG data, and biomechanical movement data. o Properly data anonymization to ensure confidentiality and comply with ethical and data protection regulations. o Additional related information, such as gold-standard health assessments or diagnostics, to provide context for the data. - Computational AI Models and Software: o Deep learning models and algorithms developed to analyze exercise postures, heart rate signals, ECG data, and biomechanical data. o Software modules for processing and interpreting the data to generate insights, recommendations, and identify health trends. o Proof of concept demonstrating the effectiveness of the models in real-world scenarios for exercise correction and health monitoring.		
Requests	Project in partnership with university team (PhD and MSc professors and undergraduate students)		
Comments	Technical Proposals must be submitted until **September/2024**		

1. Motivation

The growing awareness of the importance of health and well-being has driven interest in technological solutions that help improve the practice of physical activities[2, 3]. The correct practice of physical exercises is essential for promoting health and preventing injuries[1]. Recent studies have employed machine learning to classify images of physical exercises, predominantly focusing on identifying the exercise performed — rather than its correctness — in image datasets captured in controlled scenario

s[4, 5, 6]. Thus, the lack of real-world data and the scarcity of accurate models that analyze the corre ctness of physical exercise movements and their impact on health hinder the creation of effective sol utions, especially for mobile devices. This project aims to create datasets of exercise videos capture d by smartphones in real environments and to train deep learning models that can be used to develo p future health monitoring applications.

[1] Ueblacker, P., Gebauer, M., Ziegler, M., Braumann, K. M., & Rueger, J. M. (2005). Verletzungen u nd Fehlbelastungsfolgen im Sport [Sports injuries and overuse syndromes]. *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz*, *48*(8), 927–938. https://doi.org/10.1007/s00103-005-1096-4

[2] Knippenberg, E., Timmermans, A., Palmaers, S. et al. Use of a technology-based system to motiv ate older adults in performing physical activity: a feasibility study. BMC Geriatr 21, 81 (2021). https://doi.org/10.1186/s12877-021-02021-3

[3] Liu, Y., Zhang, H., & Xu, R. (2023). The impact of technology on promoting physical activities and mental health: a gender-based study. *BMC psychology*, *11*(1), 298. https://doi.org/10.1186/s40359-023-01348-3

[4] Khanal, Salik Ram, Dennis Paulino, Jaime Sampaio, Joao Barroso, Arsénio Reis, and Vitor Filipe. 2022. "A Review on Computer Vision Technology for Physical Exercise Monitoring" Algorithms 15, no . 12: 444. https://doi.org/10.3390/a15120444

[5] Çalışkan, A. (2023). Detecting human activity types from 3D posture data using deep learning mo dels. In Biomedical Signal Processing and Control (Vol. 81, p. 104479). Elsevier BV. https://doi.org/10.1016/j.bspc.2022.104479

[6] Dey, A., Dutta, A., & Biswas, S. (2023). WorkoutNet: A Deep Learning Model for the Recognition o f Workout Actions from Still Images. In 2023 3rd International Conference on Intelligent Technologies (CONIT). 2023 3rd International Conference on Intelligent Technologies (CONIT). IEEE. https://doi.org/10.1109/conit59222.2023.10205926

2. Purpose

The purpose of the project is to create specialized datasets and develop deep learning models for an alyzing postures, heart rate signals, ECG, and biomechanics of movements during physical exercise, culminating in a proof of concept that demonstrates the viability of these models.

3. Confidentiality

The data collected and the models developed will be handled with strict confidentiality, and in compli ance with ethical and data protection regulations. Only authorized personnel will have access to sens itive data, and all datasets will be anonymized before being shared or used in research.

4. Objectives:

- Create robust datasets that include videos of postures, heart rate signals, ECG, and biomec hanical data collected during physical exercise.
- Build and train deep learning models to analyze and classify the collected data.
- Conduct a proof of concept to validate the effectiveness of the models in identifying postural corrections and analyzing health signals during exercise.
- Establish a solid foundation for future applications and health monitoring systems based on a rtificial intelligence.

5. Deliverables

- Datasets: Video datasets, heart rate signals, ECG, and biomechanics of movements during p hysical exercises.
- Deep Learning Models: Models trained to analyze and classify the collected data.
- Proof of Concept: Demonstration of the effectiveness of the models in identifying postural co rrections and signs of health risks.
- Technical Documentation: Documentation of the data collection processes, development and training of the models, and results of the proof of concept.
- Publication of two scientific articles in internationally renowned journals, as well as the online availability of the datasets and trained models.

6. PROJECT SCOPE

The project involves collecting data using the Galaxy S24 and Galaxy Watch 7 mobile devices, g enerating specialized datasets for training deep learning models, and creating a proof of concept to validate the viability of the developed models. A complete system for commercial use, based o n the models developed in this project, may be part of a future initiative.

To this end, the project will require 4 research professors and 11 undergraduate students from co mputer science and physical education courses. Additionally, 15 smartphones will be needed to c ollect images and videos of the exercises being performed, and 15 smartwatches will be required to obtain physiological data (such as heart rate and blood oxygenation). Together with the image s and videos, this data will form the dataset to be constructed.

Moreover, for use by the technical team, 15 laptops (with Microsoft Windows and Office licenses) and 15 monitors will be needed. These are essential for the physical education and computer sci ence teams to carry out the project activities. Furthermore, network equipment, a server (for mod el training), and a printer will be required for the proper functioning of the workspace and model t raining.

Finally, financial resources will be needed for the purchase of technical computer books and offic e supplies, travel expenses (for participation in events and eventual presentation of work), admin istrative expenses (such as taxes), modernization and repairs of physical facilities, and training fo r the computer team.

7. EXPECTED RESULTS

a) Creation of a high-quality dataset that can be used to train AI models in future research a nd product development.
b) Trained and validated deep learning models demonstrating the ability to analyze exercise data and identify necessary corrections.
c) Successful proof of concept demonstrating the potential use of the models in health and wellness applications.
d) Establishment of a foundation for future innovations in mobile-based health monitoring, i ncluding smartphones and wearables, as well as deep learning research.

8. ASSUMPTIONS

- Availability of participants to collect relevant data, ensuring diversity and representation in th e dataset.
- Access to Galaxy S24 and Galaxy Watch 7 devices for data collection.
- Adequate infrastructure for the development and training of deep learning models.

- Collaboration with physical education experts to guide data collection and with deep learning experts for model development.

9. PROJECT DEVELOPMENT

The project will be developed in phases, beginning with the data collection and dataset creation phase, followed by the development and training phase of the deep learning models, and concluding with the proof of concept phase, where the models will be tested and validated.

10. ACTIVITIES

- Data Collection Planning: Defining the types of data to be collected and establishing collection protocols.
- Data Collection: Capturing videos, heart rate signals, ECG, and biomechanical data during physical exercise.
- Developing Deep Learning Models: Creating and training models using the collected datasets.
- Proof of Concept: Testing the models in real scenarios to validate their effectiveness.
- Publishing Results: Writing scientific articles to publish the results and making the data and models available to support future research.

11. SCHEDULE OF ACTIVITIES

Months 1-3: Planning data collection and preparing devices.
Months 4-10: Data collection and dataset creation.
Months 11-16: Development and training of deep learning models.
Months 17-20: Proof of concept and adjustments to the models.
Months 21-24: Scientific and technical publication of results.

12. MILESTONES

- Planning Completion (Month 3): Planning is completed, and data collection begins.
- Complete Dataset Creation (Month 10): Datasets are completed and ready for model training.
- Trained Models (Month 16): Deep learning models are finished and prepared for testing.
- Proof of Concept (Month 20): Execution and validation of the proof of concept.
- Documentation Completed (Month 24): Publication of final documentation and research data.

13. RESOURCES

The estimated budget to implement this project is **R$ 4,870,924.17 (Four million, eight hundred seventy thousand, nine hundred twenty-four reais and seventeen centavos)**. See the detailed description of each item in the table in Section 6.

Items	Total (R$)	%
Equipments	1,338,840.50	27.5%
Human Resources	2,148,552.48	44.1%
Books	10,000.00	0.2%
Materials	10,000.00	0.2%

Trips	29,000.00	0.6%
Training	93,000.00	1.9%
Technical Services	429,710.50	8.8%
TOTAL Expenses	**4,059,103.48**	
Admin tax	811,820.70	
TOTAL	**4,870,924.17**	

14. DETAILS OF NEEDED RESOURCES

A) EQUIPMENTS

A1) HARDWARE

Description	Quantity	Price	Total
Samsung Galaxy S24 Ultra Mobile Phone 1TB | 12GB RAM | 6.8" Display | Galaxy AI | Black Titanium	15	R$ 11,699.10	R$ 175,486.50
Galaxy Watch Ultra (LTE, 47mm)	15	R$ 4,999.00	R$ 74,985.00
Galaxy Book4 Ultra	15	R$ 18,999.00	R$ 284,985.00
Odyssey OLED G8 32" Gaming Monitor	15	R$ 9,999.00	R$ 149,985.00
SWITCH POE GIGABIT 48P 4 SFP+ (UBIQUITI)	2	R$ 17,000.00	R$ 34,000.00
Professional Access Point Cisco	1	R$ 6,000.00	R$ 6,000.00
GPU Server A+ Client System AS-4125GS-TNRT1	1	R$ 450,000.00	R$ 450,000.00
AI Big TV 85" Neo QLED 4K 85 QN85D 2024	1	R$ 21,899.00	R$ 21,899.00
Rack 44U x 670mm	1	R$ 5,000.00	R$ 5,000.00
APC Smart-UPS, 3000VA, 120v	2	R$ 10,500.00	R$ 21,000.00
Multifunctional monochrome printer	1	R$ 6,000.00	R$ 6,000.00

Total Cost **of R$ 1,229,340.50**

A2) SOFTWARE

Description	Quantity	Price	Total
Microsoft 365 Business Standard License (36 meses)	15	R$ 5,700.00	R$ 85,500.00
Windows 11 Pro License	15	R$ 1,600.00	R$ 24,000.00

Total Cost of **R$ 190,500.00**

B) HUMAN RESOURCES

B1) DIRECT RH

- Professors:
  - Main Researcher:
    - PhD. João da Mata Libório Filho: PhD in Computer Science, will serve as the project coordinator, responsible for the overall coordination of all project activities.
    - PhD. Kleber Padovani: PhD in Computer Science, will serve as a researcher in the field of data science, responsible for the research team and the development of AI models using images.
    - MSc. Ronem Matos Lavareda Filho: MSc in Computer Science, will serve as a researcher in the field of data science, responsible for the research team and the development of AI models with heart rate signals, ECG, and biomechanics of movements.
    - 1 specialist in physical education, responsible for the field data collection team.
- Undergraduates (iniciação científica)
  - 3 Scientific Initiation scholarship holders in the field of Physical Education
  - 8 Scientific Initiation scholarship holders in the field of Computing

C) BOOKS & JOURNALS

As instruments of research and capacitating, books will be acquired, and publication fees for open-access journals in the project's research field will be paid, with an estimated cost of **R$ 10,000.00.**

D) MATERIALS

To support the research activities will be acquired desk materials and other informatics goods (toner for printers, pencils & pens, etc) with an estimated cost of **R$ 10,000,00**.

E) TRIPS

Resources needed to participate in national and international conferences with an estimated cost of **R$ 29.000,00.**

F) TRAINING

Cost related to training and capacitating, (conference fees, for instance), with an estimated cost of **R$ 93,000.00.**

G) TECHNICAL SERVICES

Technical service for engineering, electrical, data network, and furniture for modernization of research, development, and innovation laboratory infrastructure with an estimated cost of **R$ 429,710.50**.

H) ADMIN TAX

Cost related to incurred costs and establishment of the reserve with an estimated cost of **R$ 811,820.70**.

Request for Proposal

Project Name	BIOFIT AI	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	36 months	Document Date	Ago/2024
Summary/ Goal	Este projeto tem como objetivo desenvolver um algoritmo inovador de inteligência artificial para melhorar a precisão das medições realizadas pelos dispositivos vestíveis da Samsung, como relógios e anéis inteligentes. Com base em um estudo recente de Bennett et al. (2022), que comparou os dispositivos Wearables (W-BIA) com métodos laboratoriais como Scanner DXA e balança de bioimpedância de análise bioelétrica octopolar (8-BIA), foi constatado que, apesar de fornecerem medições estáveis e confiáveis, os dispositivos W-BIA apresentam precisão ligeiramente inferior, especialmente em relação à massa livre de gordura (FFM) e gordura corporal (FM). Para superar essas limitações, o projeto utilizará um espaço amostral de 500 voluntários, abrangendo uma ampla diversidade étnica, faixas etárias e diferentes composições corporais. Serão analisados e comparados parâmetros corporais obtidos por bioimpedância de padrão ouro, como percentual de gordura corporal, massa magra, massa óssea e água corporal total, com os dados fornecidos pelos dispositivos Samsung. O foco estará em ajustar e aprimorar a precisão das medições dos dispositivos em cada grupo, utilizando o algoritmo de inteligência artificial desenvolvido. Esse algoritmo permitirá que os dispositivos ofereçam recomendações de saúde e bem-estar mais personalizadas e precisas, levando em consideração as variações individuais e garantindo que as medições sejam confiáveis em um amplo espectro de usuários.		
Research Scope	- Coleta de Dados: Serão coletados dados utilizando métodos de bioimpedância de padrão ouro e, paralelamente, utilizando os dispositivos Samsung (relógio e anel) em grupos diversificados de 500 participantes, abrangendo diferentes faixas etárias, tons de pele e composições corporais. - Desenvolvimento de Algoritmos: A partir da comparação entre os dados coletados pela bioimpedância e pelos dispositivos Samsung, será desenvolvido um algoritmo de inteligência artificial capaz de ajustar as medidas dos dispositivos levando em consideração as diferenças individuais. - Teste e Validação: O algoritmo será testado e validado com novos grupos de participantes, assegurando que as medições realizadas pelos dispositivos Samsung sejam aprimoradas em precisão e consistência. - Resultados e Impacto: Espera-se que o algoritmo desenvolvido aumente a confiabilidade das medições de parâmetros corporais pelos dispositivos Samsung, promovendo uma maior personalização e precisão nas recomendações de saúde e bem-estar.		
Output/ Specifications	- Desenvolvimento de algoritmo de IA: Criação de um algoritmo de inteligência artificial projetado para melhorar a precisão das medições de composição corporal realizadas por dispositivos vestíveis, considerando variáveis como etnia, idade e composição corporal. - Amostra diversificada de 500 voluntários: Coleta de dados de um grupo diversificado de 500 indivíduos para garantir que o algoritmo funcione eficazmente em diferentes populações. - Integração e calibração com padrões de bioimpedância: Ajuste das medições dos dispositivos vestíveis com base em padrões de ouro, como DXA e 8-BIA, para aumentar a precisão.		

Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)
Comments	Technical Proposals must be submitted until **September/2024** **Budget – R$ 10 Mi**

Request for Proposal

Project Name	CardioSense: Intelligent Heart Failure Monitoring	Requesting Team	Universidade do Estado do Amazonas
Contact Point (HQ)	TBD	Contact Point (Local)	Escola Superior de Ciências da Saúde
Project Duration	24 months	Document Date	September/2024
Summary/ Goal	**Title:** Clinical Study to Investigate Decompensation in Heart Failure (HF) Patients Using Smartwatches for Clinical Parameter Monitoring **Objective:** To investigate the effectiveness of daily monitoring of bioimpedance, step count, heart rate, blood pressure, third heart sound and electrocardiogram, measured by smartwatches, in the early detection of heart failure decompensation. Additionally, develop and validate artificial intelligence (AI) models that can predict hospitalizations based on these parameters.		
Research Scope	**Study Design:** A prospective cohort clinical study with 200 ambulatory patients, aged ≥18 years, diagnosed with chronic heart failure (HF) (New York Heart Association [NYHA] functional class III and IV), and a left ventricular ejection fraction (LVEF) ≤40%. **Independent Variables:** Bioimpedance (to detect variations in fluid accumulation, indicative of volume overload), step count (to assess changes in mobility), heart rate and blood pressure (to detect alterations in pressure and cardiac rhythm), electrocardiogram (to monitor arrhythmias and abnormalities in electrical cardiac conduction), and the detection of the third heart sound (S3), an important indicator of heart failure decompensation. These parameters are validated for clinical monitoring of HF decompensation in outpatient settings. **Data Collection and Follow-up:** Each patient will be monitored for 90 days, with daily measurements analyzed using an artificial intelligence models to identify patterns preceding heart failure decompensation. Monthly in-person follow-ups will include NT-proBNP testing and a 6-minute walk test, with echocardiograms performed quarterly to validate the accuracy of the smartwatch measurements. **Primary Outcomes:** Hospitalization due to heart failure or outpatient increases in diuretic medication. **Secondary Outcomes:** Self-reported worsening of heart failure symptoms, assessed through Kansas City Cardiomyopathy Questionnaire and NYHA functional class.		
Output/ Specifications	**An anonymized and comprehensive dataset of heart failure** (HF) patients, including daily physiological data such as bioimpedance, heart rate, blood pressure, step count, electrocardiogram, and third heart sound, will be created. **Development and validation of AI-based models** utilizing the collected data to detect early signs of decompensation in HF patients. These algorithms will enable preventive interventions by identifying patterns that indicate impending deterioration in the patient's condition. **A comparison report evaluating the effectiveness** of the parameters monitored by smartwatches against standard clinical tests (such as echocardiograms and laboratory tests) to validate the accuracy of wearable measurements and the clinical value of continuous monitoring. **Development of an integrated software system** designed to provide early warning alerts to users and allow remote monitoring by healthcare professionals, facilitating timely interventions based on real-time physiological data.		
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)		

Comments	Technical Proposals must be submitted until **September/2024**

1. MOTIVATION

The motivation for the CardioSense project arises from the increasing prevalence of heart failure (HF) and the associated challenges in managing this chronic condition effectively. HF affects millions globally and is a leading cause of hospital admissions, with significant impacts on patient morbidity and mortality (Boehmer, 2023). The current healthcare model, reliant on periodic clinical visits, often fails to detect early signs of decompensation, resulting in delayed treatments and adverse outcomes. Consequently, more proactive and continuous monitoring tools are necessary to prevent complications and improve patient prognosis (Funk, 2005)

Wearable devices offer a promising solution by enabling real-time, non-invasive monitoring of key physiological parameters, such as heart rate, blood pressure, bioimpedance, and electrocardiogram (ECG) data. Continuous monitoring allows for early identification of fluid retention—one of the primary indicators of heart failure decompensation—facilitating timely interventions (Molina, 2023). The use of artificial intelligence (AI) to process these data further enhances the predictive capabilities of the system, potentially improving patient outcomes and reducing hospitalizations (Duque-Carrillo, 2023).

In addition, this project is driven by the potential to significantly improve patients' quality of life by shifting from reactive to preventive care models, offering personalized, data-driven insights that can reduce the burden of hospital admissions and enhance long-term management of HF.

2. PURPOSE

The CardioSense project aims to investigate and develop a novel approach for the early detection and management of heart failure (HF) decompensation using wearable technologies. The core purpose of the project is to assess the effectiveness of smartwatches equipped with bioimpedance, heart rate, blood pressure, electrocardiogram (ECG), and third heart sound monitoring capabilities in identifying early signs of fluid retention, arrhythmias, and hemodynamic instability in patients with chronic heart failure.

By leveraging real-time physiological data and applying artificial intelligence algorithms, the project seeks to enable earlier interventions that could prevent hospitalizations, improve patient outcomes, and reduce the healthcare burden associated with frequent HF exacerbations. Ultimately, this project aims to validate the use of continuous, non-invasive monitoring in improving the quality of life for patients, enhancing clinical decision-making, and personalizing the management of heart failure.

The project's success could lead to a paradigm shift from reactive, episodic care to proactive, continuous health management, ensuring timely interventions based on objective, real-time data.

3. CONFIDENTIALITY

The contents of the present RFP is fully confidential and should be handled with maximum care by all bid participants.

4. OBJECTIVES

The CardioSense project aims to evaluate the effectiveness of smartwatches in the early detection and prevention of heart failure (HF) decompensation by monitoring key physiological parameters, such as bioimpedance, heart rate, blood pressure, third heart sound, electrocardiogram (ECG), and physical activity. The goal is to reduce hospitalizations, improve patient outcomes, and enhance the quality of life of individuals with chronic heart failure through continuous, non-invasive monitoring.

Specific Objectives:

- Develop Predictive Algorithms: Create and validate artificial intelligence (AI) algorithms that can analyze real-time data from smartwatches to predict early signs of heart failure decompensation, such as fluid retention, arrhythmias, and reduced physical activity.

- Validate Bioimpedance Monitoring: Assess the reliability and accuracy of bioimpedance measurements in detecting fluid overload, a key indicator of heart failure exacerbation, and compare it with standard clinical diagnostics.
- Monitor Physical Activity as a Decompensation Marker: Utilize step count and physical activity levels recorded by the smartwatch to identify declines in mobility, which may serve as early indicators of heart failure decompensation, and correlate these with other physiological markers to improve predictive accuracy.
- Compare Smartwatch Measurements with NT-proBNP Blood Levels, a gold standard biomarker for cardiac stress and fluid overload: Evaluate the correlation between daily physiological parameters collected by smartwatches, including bioimpedance, third heart sound, heart rate, and blood pressure, with plasma levels of N-terminal pro b-type natriuretic peptide (NT-proBNP), a biomarker for heart failure severity.
- Compare Clinical Outcomes: Evaluate the impact of continuous wearable monitoring on the reduction of heart failure-related hospitalizations and emergency interventions compared to standard care.
- Integration with Healthcare Systems: Investigate the feasibility of integrating wearable data into clinical workflows, ensuring that physicians can access and act upon real-time physiological data efficiently.
- Establish Long-Term Monitoring Feasibility: Evaluate the practicality and patient adherence to long-term use of wearable devices for continuous heart failure monitoring.

5. DERIVAREBLES

The **CardioSense** project will have the following key deliverables:

- **Clinical Data Set**: A comprehensive, anonymized data set of physiological parameters (bioimpedance, heart rate, blood pressure, ECG, step count, third heart sound) from 200 patients, collected over the duration of the study, alongside corresponding NT-proBNP blood levels for validation purposes. This data set will serve as the foundation for further analysis and research.
- **Predictive Algorithms**: Development of AI-driven predictive models for early detection of heart failure decompensation, based on wearable data. These algorithms will analyze trends in the monitored parameters and generate alerts when decompensation is likely.
- **Validation Report**: A detailed report comparing the accuracy of smartwatch-derived physiological data (e.g., bioimpedance) with clinical biomarkers like NT-proBNP and traditional diagnostic methods. This report will include statistical analyses on sensitivity, specificity, and predictive power of the wearable devices.
- **Clinical Outcomes Analysis**: A comparison of patient outcomes, including hospitalizations and quality of life improvements, between those using the continuous monitoring system and those under standard care. This will include statistical assessments of reduced hospitalizations and interventions.
- **Wearable Monitoring System**: An integrated software platform capable of receiving, processing, and visualizing data from the smartwatches in real-time. This system will enable healthcare providers to monitor patients remotely and intervene when necessary.
- **Scientific Publications**: One or more peer-reviewed publications describing the study design, methodology, results, and implications for heart failure management using wearable technologies.
- **Final Project Report**: A comprehensive document summarizing the overall outcomes of the project, challenges encountered, lessons learned, and recommendations for future studies or real-world applications of the technology in clinical practice.

These deliverables are designed to ensure the practical application of the project findings and provide valuable resources for ongoing research and clinical practice.

6. PROJECT SCOPE

A prospective cohort study involving 200 ambulatory patients aged ≥18 years, all diagnosed with chronic heart failure (HF) and classified as functional class III or IV by the New York Heart Association (NYHA). Patients must have a left ventricular ejection fraction (LVEF) ≤40%.

Independent Variables:

- Bioimpedance: Monitoring daily changes in fluid accumulation, indicative of volume overload. This

parameter will track variations in fluid retention, a common sign of heart failure decompensation.
- Step Count: Measuring daily physical activity to capture changes in mobility. A reduction in step count may indicate worsening heart failure symptoms.
- Heart Rate and Blood Pressure: Continuous monitoring for alterations in heart rate (arrhythmias) and blood pressure (hypertension or hypotension), which are predictive of heart failure progression.
- Third Heart Sound (S3): A key clinical marker associated with heart failure decompensation.
- Electrocardiogram (ECG): Daily monitoring to detect arrhythmias and electrical conduction abnormalities, which are clinically validated markers for cardiac decompensation.

The data collection for this study will involve continuous daily monitoring of physiological parameters using the **Samsung Galaxy Watch (Galaxy Watch 3, Galaxy Watch Active2, Galaxy Watch 4, Galaxy Watch 4 Classic, Galaxy Watch 5, Galaxy Watch 5 Pro**) to acquire key metrics such as bioimpedance, heart rate, blood pressure, step count, third heart sound, and electrocardiogram (ECG). Each patient will wear the Samsung Galaxy Watch for a period of 90 days, during which time the device will transmit real-time data to a central system for analysis. An artificial intelligence (AI) algorithm will process this data to detect patterns that may precede heart failure decompensation, allowing for early identification of potential issues.

Follow-up will be conducted by specialist physicians, ensuring that all clinical assessments are performed by experienced heart failure professionals. Monthly in-person visits will include measurements of NT-proBNP, a biomarker for heart failure, and the 6-minute walk test, which evaluates the patient's physical functional capacity. In addition, every three months, patients will undergo an echocardiogram to validate the smartwatch data against standard clinical evaluations. This follow-up by specialists ensures that any abnormalities detected by the smartwatch are corroborated by traditional diagnostic methods, thereby enhancing the reliability and accuracy of the intervention.

The primary outcomes will be a composite outcome of hospital admissions due to heart failure decompensation and diuretic medication up-titration prescribed on an outpatient basis as an indicator of worsening heart failure. The secondary outcomes will be a self-reported worsening of heart failure, assessed of heart failure symptoms through patient-reported outcomes (Kansas City Cardiomyopathy Questionnaire) and New York Heart Association [NYHA] functional class.

7. EXPECTED RESULTS

The expected results for the CardioSense project include several key outcomes:

- Creation of Encrypted Software Tools: Development of a set of software tools that will securely handle data generated from the smartwatches, ensuring encryption of all transmitted and stored data. This will maintain the confidentiality of clinical and personal information, protecting patient privacy throughout the study.
- Generation of a Labeled Database: Establishment of a comprehensive and anonymized database containing labeled data on bioimpedance, heart rate, blood pressure, third heart sound, ECG, step count, and NT-proBNP levels. This database will serve as a resource for future research and development, providing robust data for ongoing analysis of heart failure decompensation patterns.
- Development of Analytical Tools: Creation of advanced analytical tools to enable visual analysis and consultation of the physiological data collected from smartwatches. These tools will facilitate the validation of patterns detected by the AI algorithms and support clinical decision-making through real-time data visualization.
- Predictive Modeling: The development of a machine learning-based predictive model that identifies patterns in the physiological data associated with heart failure decompensation. This model will assist in forecasting trends related to patient health, potentially preventing decompensation events before they occur.
- Scientific Publications: The production of peer-reviewed scientific publications in both health and technology fields. These papers will detail the findings from the study, the performance of the predictive models, and the clinical implications of using wearable technology to manage heart failure. The results will be published nationally and internationally, contributing to advancements in telemedicine and chronic disease management.

These deliverables are designed to enhance the use of wearable technology in chronic disease

management, improving patient outcomes and advancing the field of digital health. In addition, the potential of wearable technology in providing continuous, non-invasive monitoring that enhances heart failure management, reduces hospitalizations, and improves overall patient care.

8. ASSUMPTIONS

The following assumptions are requirements to the success of this project:

- Patient Compliance: All participants must consistently wear the smartwatches and follow the protocol for daily data collection, including completing the necessary follow-up visits and tests.
- Technology Reliability: The Samsung Watch and associated software must function without significant technical failures, providing accurate and consistent physiological data (bioimpedance, heart rate, blood pressure, third heart sound, ECG, and step count).
- Data Security: The software tools developed for data transmission and storage must maintain high levels of encryption to ensure confidentiality of patient information throughout the study.
- AI Algorithm Performance: The machine learning algorithms must be capable of accurately processing and analyzing the physiological data to identify early signs of heart failure decompensation.
- Adequate Follow-up by Specialists: The specialist physicians responsible for follow-up must reliably interpret the smartwatch data and provide timely interventions based on AI-driven insights.
- Sufficient Sample Size and Participation: A minimum of 200 patients must be enrolled and retained throughout the study period to ensure statistically significant results and valid conclusions.

These assumptions are critical for ensuring that the project meets its objectives of reducing heart failure decompensation events and hospitalizations through wearable technology and data-driven interventions.

9. PROJECT DEVELOPMENT

The development of the CardioSense project is structured to ensure a systematic and well-coordinated approach that integrates all essential phases, from initial planning and data collection to the development and validation of AI algorithms. The project will unfold over a 24-month timeline, divided into key phases designed to progressively build on one another to meet the project's objectives.

The initial phase is centered around establishing a strong foundation through detailed planning. This will involve the creation of a comprehensive project plan, securing necessary ethical approvals from relevant committees, and setting up protocols for the data collection process. During this stage, all necessary wearable devices, including Samsung Watches, and software tools will be selected, tested, and prepared for use.

Following the planning phase, the project will move into the data collection phase, where physiological parameters such as bioimpedance, heart rate, blood pressure, step count, third heart sound and electrocardiograms (ECG) will be continuously gathered from the smartwatches. This phase is critical for ensuring the collection of high-quality, reliable data from the 200 enrolled heart failure patients, as these data will serve as the foundation for subsequent analysis and algorithm development. Monthly clinical follow-ups will also include NT-proBNP tests and 6-minute walk tests to validate the smartwatch data with gold-standard clinical evaluations.

After data collection begins, the project will transition into the data processing and algorithm development phase. During this stage, the raw data collected from the smartwatches will undergo preprocessing, followed by the design, development, and validation of AI algorithms. These algorithms will be developed to predict heart failure decompensation, with a specific focus on analyzing patterns in bioimpedance and step count data to identify early signs of fluid retention and reduced mobility. The AI models will be trained using advanced machine learning techniques and validated against clinical outcomes, including NT-proBNP levels and echocardiogram results, to ensure accuracy and clinical relevance.

Throughout the project, ongoing monitoring and evaluation will be implemented to track progress and ensure that each phase adheres to the project timeline and objectives. Regular meetings with the research team and clinical partners will help to identify and address any challenges promptly.

The project will culminate in the creation of a comprehensive dataset, validated AI algorithms, and the publication of scientific papers detailing the results and implications for heart failure management. Additionally, a final technical report will document all findings, providing a foundation for potential future clinical applications of wearable technology in heart failure monitoring and management.

10. ACTIVITIES

- Project Management and Planning (Months 1-24)

This activity covers the full lifecycle of the CardioSense project, starting with the kickoff meeting in the first month, where the project team will be formed, roles assigned, and project objectives confirmed. During the first two months, a detailed project plan will be developed, outlining timelines, milestones, and resource allocation. This plan will include ethical approvals, device procurement (Samsung Watches), and software setup. Throughout the project, regular monthly meetings will monitor progress, identify risks, and adjust strategies as needed. In the last two months, a final review of the project's outcomes will be conducted, with all necessary documentation completed, and the project formally closed.

- Data Collection (Months 2-15)

Data collection begins in the second month with the design and setup of protocols, ensuring all processes receive ethical approval. The collection will involve daily monitoring of bioimpedance, heart rate, blood pressure, step count, and ECG from Samsung Watches. Recruitment of participants starts in the fifth month, and the systematic collection continues until the fourteenth month. Monthly clinical follow-ups, including NT-proBNP tests and 6-minute walk tests, will validate the wearable data. Continuous validation of the data is crucial to maintaining its quality and ensuring the success of subsequent analysis and AI algorithm development.

- Development of AI Algorithms (Months 6-22)

This phase starts with preprocessing the collected data from the sixth month, which includes cleaning, labeling, and organizing the data for machine learning purposes. From months thirteen to eighteen, the project will focus on designing and developing AI algorithms capable of predicting heart failure decompensation, particularly through bioimpedance and step count analysis. The validation and refinement of these algorithms will occur between months nineteen and twenty-two, ensuring that they meet necessary performance standards and are ready for deployment in clinical settings.

- Scientific Dissemination and Knowledge Transfer (Months 18-24)

Starting in the eighteenth month, research papers based on the project's findings will be prepared and submitted to peer-reviewed journals. Presentations of the results will be made at two national or international conferences between the twentieth and twenty-fourth months. These activities aim to facilitate knowledge exchange and gather feedback from the scientific community. The potential for patents based on the AI algorithms or other outcomes will be explored in collaboration with the university and Samsung during the final phase of the project.

- Final Deliverables and Project Closure (Months 22-24)

The final activity focuses on completing and delivering all project outputs. This includes finalizing the data repository (containing bioimpedance, heart rate, and other physiological parameters) and documenting the AI algorithms developed during the project. These deliverables will be handed over to relevant stakeholders by the twenty-third month, with the final project closure occurring in the last month. This phase ensures that all documentation is completed, and the project is closed with a clear path forward for future clinical applications or research initiatives.

10. SCHEDULE OF ACTIVITIES

Activity	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
Project Management	X	X	X	X	X	X	X	X	X	X	X	X

and Planning												
Data Collection		X	X	X	X	X	X	X	X	X	X	X
Development of AI Algorithms						X	X	X	X	X	X	X
Scientific Dissemination and Knowledge Transfer												
Final Deliverables and Project Closure												

Activity	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24
Project Management and Planning	X	X	X	X	X	X	X	X	X	X	X	X
Data Collection		X	X	X								
Development of AI Algorithms	X	X	X	X	X	X	X	X	X	X	X	X
Scientific Dissemination and Knowledge Transfer						X	X	X	X	X	X	X
Final Deliverables and Project Closure										X	X	X

12. MILESTONES

Milestone 1 at M3: Project Setup and Initial Planning Completed

By the third month, the project will have completed its initial setup and planning phase. This includes the creation of the Project Charter, outlining the project scope, objectives, team structure, and the initial timeline. A detailed project plan will also be finalized, covering timelines, resource allocation, risk management strategies, and key milestones. A kickoff meeting will be held to confirm roles and responsibilities, marking the official start of the project. This milestone establishes the foundation for subsequent activities.

Milestone 2 at M5: Data Collection Protocols Finalized and Ethical Approval Obtained

By the fifth month, the project will finalize all protocols for data collection, ensuring that procedures for collecting bioimpedance, heart rate, blood pressure, step count, third heart sound, and ECG data from the Samsung Watch are in place. Ethical approval will be obtained from the relevant authorities, ensuring compliance with regulatory standards. A participant recruitment plan will also be completed, detailing strategies for recruiting a diverse group of patients with heart failure. This milestone ensures that the project is ready to begin the data collection phase.

Milestone 3 at M10: Initial Data Collection and Preliminary Data Validation Completed
By the tenth month, initial data collection will have begun, with the first batch of physiological data from the Samsung Watch successfully collected and preliminarily validated. The validation process will ensure data accuracy and quality, identifying any issues early on. A progress report will summarize the number of participants recruited, types of data collected, and any challenges encountered. This milestone confirms the project's ability to generate reliable data for the subsequent phases.

Milestone 4 at M14: Complete Data Collection and Transition to Data Preprocessing
By the fourteenth month, the data collection phase will be completed, with the project transitioning into data preprocessing. A complete dataset will be prepared, annotated, and labeled for the development of machine learning models. A report documenting the participant demographics, data volume, and quality will be produced, ensuring that the dataset is ready for the next phase of AI models development.

Milestone 5 at M18: AI Models Development Initiated
By the eighteenth month, the project will begin developing AI models aimed at detecting heart failure decompensation. This involves training machine learning models using preprocessed data, focusing on the accuracy of detecting early signs of fluid overload and mobility reductions. The progress will be documented with initial performance metrics and identified areas for refinement. This milestone marks the start of technical development for predictive tools.

Milestone 6 at M22: AI Models Validation and Scientific Dissemination Prepared
By the twenty-second month, the AI models will have undergone final validation, ensuring they meet the necessary performance standards for clinical use. The project will also start preparing scientific papers for submission to peer-reviewed journals and develop presentation materials for international conferences. This phase ensures that the project's findings are ready to be shared with the broader scientific and medical communities.

Milestone 7 at M24: Project Closure and Final Deliverables Completed
By the twenty-fourth month, the project will be formally concluded. All final deliverables, including the data repository and AI code, will be completed, fully documented, and prepared for future use. A comprehensive final report summarizing the project's outcomes, challenges, and lessons learned will be produced. The project will be formally handed over to stakeholders, ensuring a smooth transition for potential future applications or research initiatives.

13. RESOURCES

The estimated budget to implement this project is **R$ R$ 9.271.426,50**

	MONTHS	**24**
SUMMARY	**VALUE**	**%**
Computer Programs, Machines, Equipment, Appliances and Instruments	R$ 1.744.200,00	**18,81%**
Implementation, Expansion or Modernization of Laboratory	R$ 800.000,00	**8,63%**
Direct and Indirect Human Resources	R$ 4.704.000,00	**50,74%**
Third-Party Technical Services	R$ 120.000,00	**1,29%**
Consumables	R$ 100.000,00	**1,08%**
Other expenses	R$ 210.000,00	**2,27%**
Subtotal 1	**R$ 7.678.200,00**	**82,82%**
Costs Incurred (15%)	**R$ 1.151.730,00**	**12,42%**
Subtotal 2	**R$ 8.829.930,00**	**95,24%**
ISS (5%)	**R$ 441.496,50**	**4,76%**
Total	**R$ 9.271.426,50**	**100,00%**

Request for Proposal

Project Name	**CELESTE**	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	36 meses	Document Date	Ago/2024
Summary/ Goal	Projeto de desenvolvimento de algoritmos autorais para smartwatch/anel que permitam o cálculo de parâmetros biomecânicos durante a marcha e a corrida para melhorar a qualidade de vida e performance dos usuários.		
Research Scope	- Elaboração de um estudo clínico aplicado através de análise biomecânica utilizando tecnologia padrão ouro para determinar parâmetros biomecânicos da marcha e da corrida em pessoas com diferentes características; - Dados de 200 voluntários com medidas utilizando equipamentos padrão ouro, de diferentes grupos etários e sexo, para compilar informações de parâmetros biomecânicos realizando caminhada e corrida. E depois comparação, com dados coletados dos wearables Samsung. - Desenvolvimento de algoritmo autoral a partir de dados coletados na utilização do smartwatch que correlacione com os parâmetros biomecânicos da marcha e da corrida. - Gerenciamento do projeto por uma equipe experiente na execução de PD&I utilizando modelo em espiral para mitigar falhas e manter o processo em retroalimentação constante.		
Output/ Specifications	- Algoritmo autoral validado com cálculo de variáveis biomecânicas coletadas no Smartwatch que permitam análise de performance e indicadores de saúde na corrida e na marcha; - Big Data com os dados coletados pelos dispositivos - Pesquisa e publicação de artigos em revistas de alto impacto sobre o tema proposto.		
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)		
Comments	**Valor total: R$ 12 milhões**		

Request for Proposal

Project Name	ClinicWS	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	LAICP-EST-UEA: Prof. Dr. J.R. Sicchar. jvilchez@uea.edu.br
Project Duration	24 months	Document Date	Set/2024
Summary/ Goal	The ClinicWS project aims to develop an intelligent support system for the prevention and monitoring of sudden health events and sleep quality. The proposal is to create an integrated solution, compatible with wearables, which utilizes technologies such as Artificial Intelligence, Machine Learning, Data Science, and Big Data to acquire, process, and analyze digital biomarkers in real time. As a result, the system will be capable of identifying health trends and supporting proactive clinical interventions.		
Research Scope	- Definition of Biomarkers and Data Collection: Identification of key biomarkers related to sleep quality and sudden health event risk. Implementation of wearables and biosensors to continuously and in real-time collect data on blood pressure, heart rate, oxygen saturation, respiratory rate, and body temperature. - Development of Computational Models: Creation of Artificial Intelligence and Machine Learning algorithms to analyze the collected data, detect patterns and anomalies, and generate personalized predictions and recommendations. - Data Integration and Processing: Utilization of Big Data platforms to store and process large volumes of data, ensuring the capability to perform complex and real-time analyses. - Clinical Validation: Development of a clinical validation platform where the outputs generated by the computational models can be reviewed and validated by healthcare professionals, ensuring the reliability of the results and compliance with clinical standards. - Project Management: Coordination and management of the project according to best practices in software development, including quality management, timelines, scope, and compliance with data security and privacy standards.		

Output/ Specifications	- Dataset: Collection and construction of a robust database containing information on digital biomarkers, covering various classifications, including preventive data and continuous monitoring. - Artificial Intelligence Models: Development of advanced computational models, algorithms, and software modules capable of processing the collected data to generate insights, recommendations, and predictions about sleep quality and sudden health risks. - Reports and Academic Publications: Production of detailed reports and academic publications documenting the scientific discoveries and technological advancements achieved throughout the project, contributing to the advancement of knowledge in the field of Health 4.0.
Requests	Project in partnership with a university team (Professors, Postdoctoral Researchers, PhD, and master's Students)
Comments	Technical Proposals must be submitted until **September/2024**

1. Motivation

Sleep quality and the prevention of critical events such as sudden cardiac arrest are increasingly important public health issues. In a world where the modern pace of life and constant stress directly affect the population's health, sleep disorders, such as apnea, have become common, negatively impacting quality of life, and increasing the risk of severe conditions like cardiovascular diseases and sudden cardiac events.

Studies show that the lack of restorative sleep can trigger a range of health complications, from cognitive and emotional difficulties to the exacerbation of chronic illnesses. Furthermore, sudden cardiac arrest, often related to silent heart conditions, remains one of the leading causes of sudden mortality, frequently occurring without sufficient warning signs for effective preventive intervention.

The era of Health 4.0, characterized by the convergence of advanced technologies such as the Internet of Things (IoT), Big Data, and Artificial Intelligence (AI), offers a unique opportunity to transform how we monitor and manage health. In the context of Health 4.0, wearables and continuous monitoring devices have the capability to collect physiological data in real-time, providing a comprehensive and continuous view of an individual's health conditions. However, the true potential

of this data can only be realized through advanced analysis and prediction tools, such as those offered by Artificial Intelligence.

The use of AI in health monitoring enables the creation of predictive models capable of identifying subtle patterns in the data that would otherwise go unnoticed. This allows not only for the early detection of potential complications but also for personalized care, adjusting preventive interventions according to the specific needs of everyone.

The ClinicWS project emerges as a response to this growing need, aiming to develop an intelligent and portable system capable of integrating with wearables to monitor critical biomarkers such as cardiovascular pressure continuously and accurately, oxygen saturation, respiratory and heart rates, and body temperature. The proposal is that, through AI-based analyses, the system can map sleep patterns (REM and NREM), detect signs of apnea and other anomalies, and provide detailed data such as oximetry curves and electrocardiograms.

2. Purpose

ClinicWS aims to implement a system that not only monitors vital parameters such as heart rate, oxygen saturation, and blood pressure but also integrates telemedicine functionalities to enable remote and continuous patient monitoring. The proposal includes the creation of proof-of-concept models that demonstrate the system's ability to identify trends and early signs of health conditions, even in the absence of evident symptoms.

Additionally, the project will develop a platform capable of generating detailed reports that healthcare professionals can use to interpret and evaluate patient conditions, supporting diagnoses and medical decisions based on concrete data. The objective is to particularly benefit individuals in high-risk groups by providing a tool that facilitates the prevention of critical events and improves quality of life through a personalized, data-driven approach.

Therefore, ClinicWS seeks to establish a new standard in digital health by integrating cutting-edge technologies and telemedicine practices to offer a comprehensive and effective solution for health monitoring and management.

3. Confidentiality

This project is strictly confidential. All information and data must be protected and cannot be disclosed or shared without express authorization.

4. Objectives:

- Continuously monitor physiological parameters such as heart rate, blood pressure, and oxygen saturation, while also performing sleep stratification and apnea mapping.
- Analyze sleep stages and identify disorders using AI algorithms, integrating oximetry curve analysis and decision trees to optimize the detection of critical patterns.
- Develop predictive models based on Big Data to identify and forecast cardiovascular complications, incorporating real-time inferences to facilitate clinical decision-making.
- Integrate telemedicine functionalities to enable remote and efficient patient monitoring, facilitating proactive health prevention and management through interactive dashboards.
- Design and validate proof-of-concept models that demonstrate the platform's effectiveness in identifying trends and early signs of health conditions.
- Ensure that the developed models can generate detailed reports for interpretation and use by healthcare professionals, even in the absence of evident symptoms.
- Develop algorithms and software modules to process the collected data and provide accurate health insights for users.
- Develop an access dashboard for clinical validation of the outputs, allowing the visualization of statistical evolution and clinical mapping.
- Conduct comprehensive testing to ensure the platform's full functionality and effectiveness in real-world usage scenarios.

5. Deliverables

- Artificial Intelligence Software: Development of AI software for the diagnosis and monitoring of sleep quality and the prevention of sudden illness. The software will be designed to analyze health data, perform inferences, make predictions, and provide recommendations based on advanced algorithms, focusing on sleep and cardiovascular medicine.
- Structured Database: Creation of a database containing digital biomarker data validated by healthcare professionals. This database will include information on health parameters, such as sleep quality, heart rate, and respiratory rate, necessary for the training and evaluation of AI models.
- Data Validated by Healthcare Professionals: Collection and validation of data through gold-standard exams and diagnostics conducted by healthcare professionals. These data will serve as a reference to ensure the accuracy of the system's models and algorithms.
- Inferences and Predictions: Generation of health inferences and predictions based on analyzed data. This includes diagnostics and preventive recommendations for sleep quality and sudden illness risk, enabling early interventions and continuous monitoring.

- Report Generation and Test Evaluation: Preparation of detailed reports on monitored health parameters, test results, and algorithm effectiveness. These reports will provide information for medical interpretation and system evaluation, supporting clinical and treatment decisions.
- Scientific Articles and Publications: Production of scientific articles documenting the project's methodology, results, and implications for sleep and cardiovascular medicine. These articles will be submitted to academic journals to share findings and validate the project's scientific contributions.

6. PROJETO SCOPE

The project's methodology will be divided into four main stages (Figure 1):

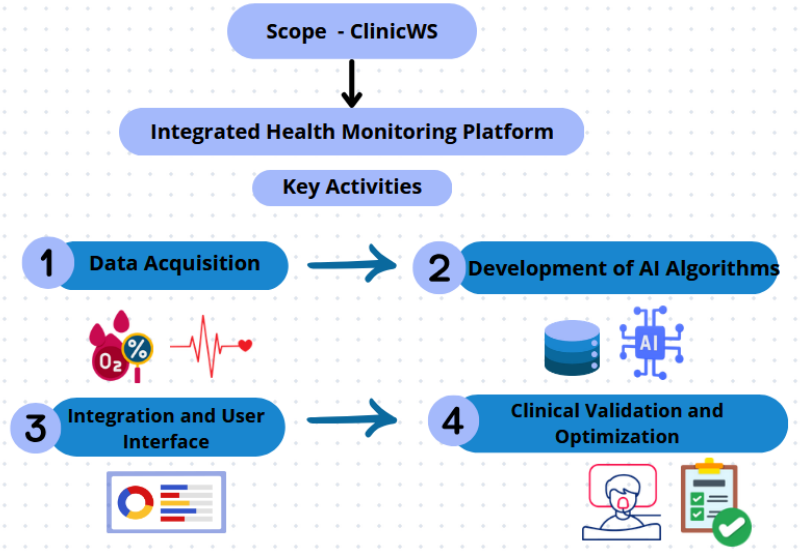


Figure 1 - Scope Clinic WS.

Data Acquisition:

- Continuous data collection through IoT devices and wearables.
- Structuring a robust database to store large volumes of clinical data and patient history.
- Development of preprocessing algorithms to filter and normalize the collected data.

Development and Application of AI:

- Use of neural networks and deep learning techniques for analyzing the collected data.
- Implementation of machine learning algorithms for detecting anomalous patterns and predicting critical events, such as arrhythmias and sleep apnea.
- Integration of recommendation systems to suggest medical interventions based on analyzed results.

Implementation and Integration of Technologies:

- Development of a user interface, allowing for remote and real-time monitoring.
- Integration with Big Data platforms for large-scale analysis and predictive modeling.

- Simulation tests and validation of the system in a clinical environment.

Clinical Validation and System Optimization:

- Conducting clinical studies to validate the effectiveness and accuracy of the developed models.
- Continuous adjustments and refinement of the system based on medical feedback.
- Final implementation of the system with optimizations based on the results of clinical tests.

7. EXPECTED RESULTS

a) Acquisition of essential health monitoring data, including accurate measurements of systolic and diastolic blood pressure, heart rate, oxygen saturation, respiratory rate, and heart rate variability (HRV) for comprehensive cardiovascular assessment, detection of hypertension, arrhythmias, apnea, and oxygenation efficiency.

b) Implementation of wearable devices and emerging technologies for continuous and precise data collection, enabling real-time monitoring and increased diagnostic accuracy.

c) Monitoring and analysis of sleep cycles, determining sleep quality and identifying disorders such as insomnia and sleep apnea.

d) Generation of detailed graphs of blood oxygen levels over time to monitor saturation and identify critical desaturation episodes.

e) Recording and analysis of the heart's electrical activity (ECG) to detect anomalies and monitor cardiovascular health comprehensively.

f) Processing the collected data using advanced data science algorithms and Big Data techniques to generate meaningful clinical insights, identify patterns and trends, and provide recommendations for diagnostics and medical interventions.

g) Integration of data and analyses with telemedicine platforms, allowing remote health monitoring and real-time treatment adjustments.

h) Contribution to advancements in sleep and cardiovascular medicine, enhancing treatment and prevention strategies based on robust data and detailed analyses.

i) Ensuring that data and diagnostics are reviewed and validated by healthcare professionals, ensuring accuracy, reliability, and compliance with clinical standards.

8. ASSUMPTIONS

The following assumptions are requirements to the success of this project:

- The integrity and reliability of measurements are crucial for the effectiveness of the analyses and recommendations generated by the platform.

- The project requires a robust technological infrastructure for the efficient storage and processing of large volumes of data. The capability to integrate with telemedicine systems and Big Data platforms must be ensured to guarantee the full functionality of the system.
- All data and diagnostics provided by the platform must be validated by qualified healthcare professionals. Clinical validation is essential to ensure the accuracy of results and patient safety.
- The project team should include experts in data science, software development, medicine, and healthcare professionals to ensure that all aspects of the project are addressed efficiently and effectively.
- The project must adhere to all relevant standards and regulations for data protection and patient privacy. Compliance with applicable laws and regulations is essential to ensure ethical and legal conformity.

9. PROJECT DEVELOPMENT

The execution plan outlines the activities necessary for the development of ClinicWS, which involves four main platforms: Data Acquisition, Processing, Clinical Validation, and Artificial Intelligence. Each of these platforms contributes to the collection, analysis, and validation of health information. Figure 2 illustrates the structure and interaction between these platforms.

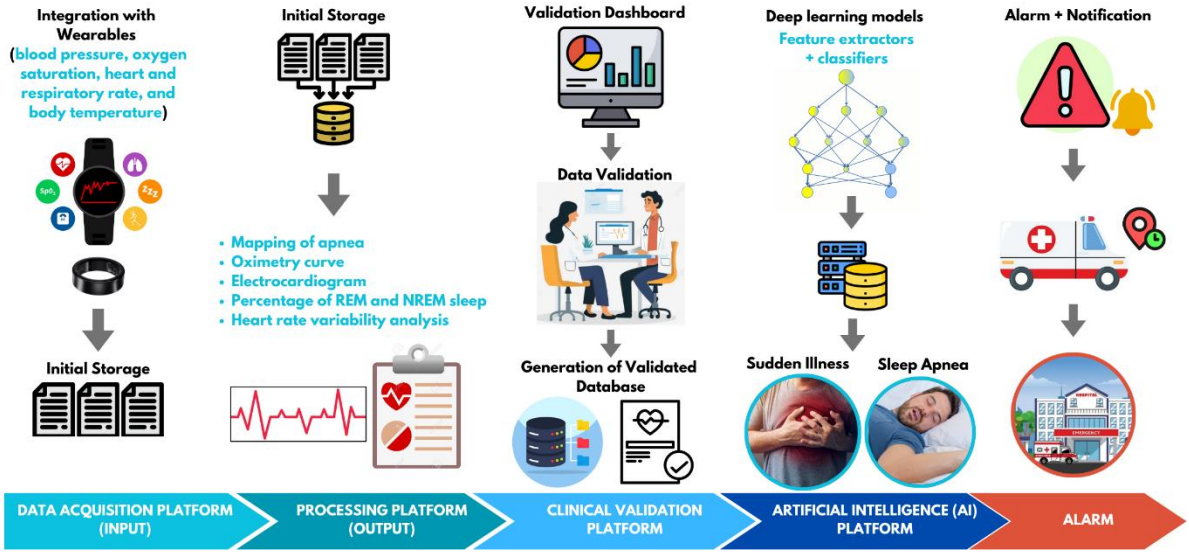


Figure 2 - Structure and Interaction of the Four Platforms in ClinicWS.

DATA ACQUISITION PLATFORM (INPUT) - The Data Acquisition Platform is responsible for collecting real-time health information. This platform integrates devices and wearables to obtain essential data, such as:

- Monitored Health Parameters: Includes blood pressure, oxygen saturation, heart and respiratory rate, and body temperature.
- Integration with Wearables: Uses wearable technologies, such as Samsung devices and new readers, to capture data accurately and in real-time.
- Initial Storage: Collected data is temporarily stored before being processed, ensuring that information is readily available for subsequent analysis.

PROCESSING PLATFORM (OUTPUT) - The Processing Platform is designed to store and analyze the data collected by the acquisition platform. Its main functions include:

- Data Storage and Management: Stores large volumes of health data in a structured database, ensuring the integrity and security of the information.
- Processing Algorithms: Applies data science algorithms to transform raw data into useful information, such as REM and NREM sleep percentages, apnea mapping, and oximetry curves.
- Preparation for Analysis: Processes and organizes data for more detailed analysis and for generating insights, reports, and forecasts about health conditions.

CLINICAL VALIDATION PLATFORM - The Clinical Validation Platform ensures that the information and results generated by the other platforms are validated by healthcare professionals. This platform includes:

- Validation Dashboard: Provides an interface for doctors and specialists to review and validate the data and insights generated. Includes visualizations of statistical evolution and clinical mapping.
- Data Validation: Confirms the accuracy and relevance of data and results using clinical standards and gold-standard tests.
- Validated Database Generation: Creates a database with clinically validated information, ensuring the reliability of the data used for analysis and reporting.

ARTIFICIAL INTELLIGENCE (AI) PLATFORM - The AI Platform uses advanced artificial intelligence techniques to support data interpretation and generate recommendations. Its main functionalities are:

- Development of Predictive Models: Creates and trains machine learning models to predict health trends and identify patterns, such as sudden health risks and sleep issues.
- Data Analysis and Inferences: Uses AI algorithms to generate inferences and detailed reports based on collected data, offering diagnoses and recommendations.
- Clinical Decision Support: Provides valuable insights that assist doctors in making clinical decisions, helping in disease prevention and patient health management.

ALARM - In the event of detecting a risk of sudden illness or severe sleep disorders, wearables automatically send alerts to emergency services and emergency contacts, ensuring a rapid response.

- Real-Time Detection: Wearables continuously monitor vital signs and sleep patterns to detect risks such as sudden illness or severe sleep disorders.

- Automated Alerts: Upon detecting a critical risk, wearables automatically send alerts to emergency services and designated contacts.
- Real-Time Location: The user's location is transmitted in real-time along with the alert, enabling emergency responders to reach the site quickly.

10. ACTIVITIES

- Activity Name: Project Coordination and Management
  Description: Coordinate and manage all activities of the ClinicWS project, ensuring effective communication among the team, adherence to deadlines, and efficient allocation of resources. This activity includes supervising project phases, managing risks, and maintaining progress reports to ensure that project objectives are achieved according to the established scope.
- Activity Name: State-of-the-Art Analysis and Literature Review
  Description: Conduct a comprehensive review of existing literature on health monitoring technologies, artificial intelligence applied to healthcare, and telemedicine. This review aims to identify best practices, emerging technologies, and gaps in current research to inform the development of the project.
- Activity Name: Study, Development, and Testing of Data Simulations
  Description: Conduct data simulations to evaluate and validate algorithms for processing and analyzing physiological data. This includes adjusting and evaluating models in simulated scenarios to ensure the accuracy and robustness of the proposed methods before applying them to real data.
- Activity Name: Creation and Structuring of Dataset and Database
  Description: Collect and organize a representative dataset for the project, including creating a structured database with digital biomarker information. This database will be essential for training, testing, and validating AI models, as well as supporting health trend analysis.
- Activity Name: Integration of Telemedicine Features and System Testing
  Description: Integrate telemedicine features into the ClinicWS platform, enabling remote monitoring and communication with healthcare professionals. Perform comprehensive testing to verify the functionality and usability of the system in real-world scenarios, ensuring that features meet user needs.
- Activity Name: Clinical Validation and Evaluation of Results
  Description: Conduct a clinical validation of the system with the participation of healthcare professionals to assess the accuracy, relevance, and utility of the generated results. This process will include analyzing reports generated by the platform and verifying the effectiveness of recommendations for managing health conditions.

- Activity Name: System Refinement and Optimization
  Description: Adjust and refinements to algorithms and the platform based on feedback obtained during clinical validation and testing. This final stage includes optimizing AI models, improving the user interface, and implementing adjustments to ensure the system's maximum effectiveness and accuracy.

11. SCHEDULE OF ACTIVITIES

Activity	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
Project Coordination and Management												
State-of-the-Art Analysis and Literature Review												
Study, Development, and Testing of Data Simulations												
Creation and Structuring of Dataset and Database												
Integration of Telemedicine Features and System Testing												

Activity	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24
Project Coordination and Management												
Clinical Validation and Evaluation of Results												
System Refinement and Optimization												

12. MILESTONES

Milestone 1 - M3: Completion of State-of-the-Art Analysis and Literature Review

Deliverables:

- Comprehensive report on the literature review and state-of-the-art analysis.
- Identification of knowledge gaps and opportunities for project development.
- Detailed action plan based on the findings of the review.

Milestone 2 - M5: Completion of Study, Development, and Testing of Data Simulations

Deliverables:

- Technical report with results of the simulations and tests conducted.
- Proof of concept demonstration of the simulations.
- Detailed documentation of the data models used, and the results obtained.

Milestone 3 - M7: Creation and Complete Structuring of Dataset and Database

Deliverables:

- Structured and documented dataset.
- Created and validated database for future integrations and queries.
- Technical report describing the database architecture and characteristics of the collected data.

Milestone 4 - M10: Integration of Telemedicine Features and System Testing

Deliverables:

- Integrated telemedicine system with developed features.
- System testing report, including results and performance analysis.

- Functional proof of concept of the integration with practical demonstrations.

Milestone 5 - M14: Clinical Validation and Evaluation of Results

Deliverables:

- Clinical validation report with comparative results.
- Feedback from clinical experts on the system's effectiveness and accuracy.
- Final adjustments to the system based on clinical validation results.

Milestone 6 - M17: Final Refinement and Optimization of the System

Deliverables:

- Definitive version of the system optimized for performance and usability.
- Complete system documentation, including user manuals.

13. RESOURCES

The estimated budget to implement this project is **R$ 3.731.685,88 (three million and seven hundred and thirty-one thousand, sixty hundred and eighty-five, eighty-eight cents).** See the detailed description of each item in the table in Section 6.

Items	Total (R$)	%
Equipments	512.944,25	15,9
Human Resources	1.872.000,00	57,7
Books	40.000,00	1,2
Materials	450.000,00	13,7
Trips	50.000,00	1,6
Training	120.000,00	3,8
Technical Services	200.000,00	6,1
TOTAL Expenses	**3.244.944,25**	**100**
Admin tax	15%	
TOTAL	**3.731.685,88**	

14. DETAILS OF NEEDED RESOURCES

A) EQUIPMENTS

A1) HARDWARE

Notebook with high processor INTEL i9, twelfth generation, 34 GB of RAM memory process, SSD module with 1 TB, video screen package for AI process, voltage source of 850 watts and cool water ventilation. Important to data process with AI algorithms, and data-science. Beside

data acquisition (on external work) statistic process. Number requirement: 12.

Estimated cots unitary: R$ 12.865,55. **Partial cost: R$ 154.386,60.**

PC computer and Monitor: with high processor INTEL i9 fourteener generation, 34 GB of RAM memory process, SSD module with 1 TB, video screen package for AI process, voltage source of 850 watts and cool water ventilation. Important to data process with machine learning algorithms, and deep learning and another AI algorithm. Beside modeling of software, hardware, and architecture also firmware workflow to app interfaces. Number requirement: 10.

Estimated cots unitary: R$ 11.800,24. **Partial cost: R$ 118.002,40.**

AI Workstation with high processor INTEL i9, twelfth generation, 128 GB of RAM memory process, SSD module with 10 TB, voltage source of 1000 watts and cool water ventilation. Important to big data store and reinforcement process with AI algorithms, and data-science statistics models. In owing to obtained efficient inferences and forecasting predictions and pattern-recognition of data sets and metrical patterns of data sets.

Number requirement: 1. **Estimated cots unitary: R$ 50.000,00.**

3D Printer with pro quality 3D print using flex kind filaments (PLA, ABS, Nylon, Polyacetal also metal). Important to print and obtained some prototype to integrate the computing improving resources into wearables replica (smartwatch and ring).

Number requirement: 2. **Estimated cots unitary: R$ 37.500,00.**

Partial cost: R$ 75.00,00.

Welding station: with resources welding into integrated circuit. Important to weld into integrated and control devices of hardware device prototype.

Number requirement: 4. **Estimated cots unitary: R$ 5.000,00.**

Partial cost: R$ 20.000,00.

SMD machine: with pro quality welding into integrated circuit. Important to weld integrated and embedded system into hardware device prototype.

Number requirement: 1. **Estimated cots unitary: R$ 35.555,25.**

Total Cost of R$ 452.944,25.

A2) LICENCES SOFTWARE

Some software is necessary to develop each stage of software, hardware, and firmware architecture of project. Thus. Its considered licenses for two years of Matlab, Inventor, IDE of specific microcontrollers and like a Proteus environment, and others. Important to process and

obtained models of datasets diseases (Matlab) also to model and obtained prototypes using 3D printing (Inventor). Besides to develop, modeling and implementing integrated circuits schema of hardware system (Proteus and Arduino IDE to Raspberry Pi 4.0).

Number requirement: 3. **Estimated cots unitary: R$ 20.000,00.**

Total Cost of R$ 60.000,00.

Equipment's Total Cost of R$ 512.944,25.

B) HUMAN RESOURCES

B1) Direct Human Resources

- Professors:
  - 1 Doctor in Electrical Engineering:
    - Role: Responsible for overall project coordination, supervision of research activities, development of biomedical signal acquisition and processing systems, and mentoring undergraduate and graduate students.
  - 3 Doctor in Computer Engineering or Control Automation or Mechatronic:
    - Role: Coordinator of artificial intelligence algorithm development, data processing, and integration with Big Data systems. Also supervises students in activities related to data analysis and machine learning.
  - 2 Doctors in Cardiology, Sleep Specialists, or related fields:
    - Role: Responsible for clinical validation of the collected and processed data, development of clinical parameters, and integration of findings with medical practice. They guide medical students and collaborate in defining clinical requirements for the systems.
- Undergraduate Students:
  - 8 Control and Automation Engineering Students:
    - Role: Involved in the implementation and testing of data acquisition systems and integration.
  - 2 Computer Engineering Students:
    - Role: Development of software, creation of data processing algorithms, and support in integrating AI modules with the overall platform.
  - 2 Medical Students:
    - Role: Assist in collecting clinical data, validating medical parameters, and preliminary analysis of results. They collaborate with doctors to ensure that systems meet clinical needs.

RH's Total Cost of R$ 1.872.000.

C) BOOKS & JOURNALS

As instruments of research and capacitating will be acquired books in the research field of the project with an estimated cost of **R$ 40.0000.**

D) MATERIALS

To support the research activities will be acquired desk materials and other informatics goods (special biosensors to wearables, filament to 3D printers, electronic components, stain weld refill, microcontrollers with IoT modules, wearables (smartwatches and rings to emulates data process with AI developed), etc.) with an estimated cost of **R$ 450.000**.

E) TRIPS

Resources needed to participate in national and international conferences with an estimated cost of **R$ 50.000,00.**

F) TRAINING

Cost related with training and capacitating, (conference fees, for instance), with an estimated cost of **R$ 120.000.**

G) TECHNICAL SERVICES

Technical team by specific providers to developed biosensors for wearables, in owing to improve the prototype integration with embedded resources developed in the project (AI, Big-data models and Data science algorithms) as well as system design of wearables. Besides, services of suitability of laboratory to development environment.

With an estimated cost of **R$200.000**.

H) ADMIN TAX applied: 15%.

Cost related to University, Institute/Faculty (up to 20% of the project cost).

Request for Proposal

Project Name	Dockagem Molecular Voltado a Praticantes de Atividades Físicas - MDPhysicalHealth	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)		Contact Point (Local)	CESIBIOLA/EST e CESIT/UEA
Project Duration	36 meses	Document Date	Ago/2024
Summary/ Goal	Reduzir o tempo de uso de moléculas novas na geração de suplementos alimentares em benefício da saúde e bem-estar de praticantes de atividades físicas com o objetivo de gerar produtos em diferentes formulações, aplicando técnicas de Inteligência Artificial para identificar padrões que gerem a descrição inteligente viabilizada por dockagem molecular. Por fim, coletar dados para medição da eficácia destas novas moléculas através de *wearables* como *smartwatches/rings* e *smartphones*.		
Research Scope	- Identificar espécies arbóreas amazônicas em áreas de manejo florestal - Análises químicas de partes da amostra coletada que não comprometam seu biociclo afim de identificar moléculas de interesse - Aplicar técnicas de dockagem para aproximar com outras moléculas já registradas na ANVISA, reduzindo o tempo de uso para produção dos novos suplementos. - Identificar e coletar parâmetros corporais (índice de massa corpórea, gordura visceral, pressão, temperatura, frequência cardíaca, peso informado pelo usuário periodicamente) registrados por *waerables* e smartphones através de aplicativos voltados aos mesmos - Desenvolver algoritmo de Inteligência Artificial para gerar um perfil automático com base nos dados coletados dos *gadgets* dos usuários e que possibilite realizar inferência sobre a eficácia da molécula e a evolução física dos envolvidos		
Output/ Specifications	- A utilização das técnicas de dockagem garantem o respeito à legislação vigente na ANVISA reduzindo a necessidade da realização de testes clínicos - As novas moléculas serão registradas para garantir a propriedade intelectual.		

	- A amostra será composta por no mínimo 100 indivíduos praticantes de atividades físicas regulares de qualquer natureza e que façam a ingestão do suplemento durante 3 meses
Requests	Equipe composta por biólogo, engenheiros florestais, desenvolvedores, especialista em machine learning, farmacêutico e químico, além de estudantes de graduação, mestrado e doutorado.
Comments	Technical Proposals must be submitted until **September/2024**

1. Motivation

Digital transformation brings with it a new way of seeing the world. Operational processes, before performed bureaucratically, become increasingly optimized, while assistance earns tools that broaden patient safety and satisfaction. With smartphones, wearables and the widespread advancement of health mobility, it is urgent to think of ways to integrate data collected by applications to the patient's medical records in order to ensure the expected results with the adoption of these technologies.

With the Internet of Things (IoT), connected devices collect vital signs and other health information from real-time individuals, generating a large mass of data. This collaborates for the continuity of treatment, since the monitoring of the patient's vital signs can be done remotely, 24 hours a day, seven days a week. This provides the health professional accurate information, which allow the distance care and monitoring of the individual's health status in real time. In addition, technology assists and guides the patient about simple actions, which must be made outside the hospital environment.

2. Purpose

SRBR intends to receive formal proposals of Innovative Software Development project proposal applying Artificial Intelligence techniques to implement, or at least develop proof-of-concept models for human digital-bio-markers monitoring and identify trends on health conditions.

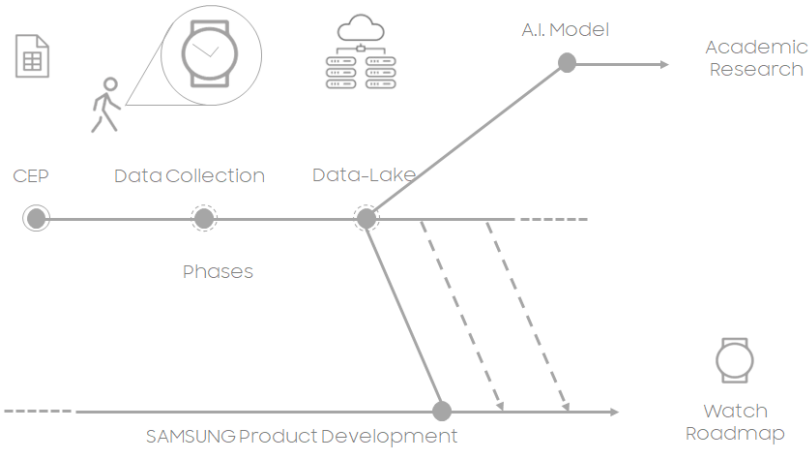
3. Confidentiality

The contents of the present RFP is fully confidential and should be handled with maximum care by all

bid participants.

4. Objectives:

The diagram below represents a simplified Innovative Software Development project main phases. You are invited to present a development proposal to turn them into high-quality, robust, and fully functional software development research and development project. The commercial software solution is not mandatory to be part of the project scope proposal. It can be considered as a potential evolvement of the concepts developed as of the research scope; but it is an exclusive decision of Samsung according to its product lineup.



5. Deliverables

- Anonymous data-set of digital-bio-markers and any proper additional related information (like gold-standard exams and diagnostics) of volunteers enough to describe its health conditions;
- Computational AI models, algorithms and software modules to process digital-bio-markers to generate insights, recommendations and/or health trend conditions,
- And Academic publications to document and share the academic relevant achievements

6. PROJETO SCOPE

- XXXXX
- XXXXX

7. EXPECTED RESULTS

a) XXXXXXXXXXXXXXXXXX

b) XXXXXXXXXXXXXXXXXX

8. ASSUMPTIONS

The following assumptions are requirements to the success of this project:

- XXXXXXXXXXXXXXXX
- XXXXXXXXXXXXXXXX

9. PROJECT DEVELOPMENT

The execution plan shows the main necessary activities to conclude all the goals of this project. These activities are preliminaries, thus, they may change during the development of project. Any change of the content must be in common agreement between the parts.

10. ACTIVITIES

- Name of the activity: Explanation of the activity itself.
- Name of the activity: Explanation of the activity itself
- XXX

11. SCHEDULE OF ACTIVITIES

<Please, insert a simple table (or GANT GRAPHIC) showing the activities during the 18 months of the project. >:

Activity	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12

Activity	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24

12. MILESTONES

<A set of activities must complete a Milestone>. Please, include the milestones and explain the deliverable (surveys, reports, demos, proof of concepts, etc):

- Milestone 1 at M3: XXX
- Milestone 2 at M5: XXX
- Milestone 3…

13. RESOURCES

The estimated budget to implement this project is **R$ XXXXXXX (XXXXXXXXXXXXXXXXXXXX)**. See the detailed description of each item in the table in Section 6.

Items	**Total (R$)**	**%**
Equipments		
Human Resources		
Books		
Materials		
Trips		
Training		
Technical Services		
TOTAL Expenses		
Admin tax		
TOTAL		

14. DETAILS OF NEEDED RESOURCES

A) EQUIPMENTS

A1) HARDWARE

XXXXXX

XXXXXX

Total Cost **of R$ XXXXXXXXXXXXX**

A2) SOFTWARE

XXXXXX

XXXXXX

Total Cost of **R$ XXXXXXXXXXXXX**

B) HUMAN RESOURCES

<Estimate the number of researchers that must participate in the project and include their roles and responsibilities>

B1) DIRECT RH

- Professors: <up to 02>
    - Main Researcher: <explain main role>
- Undergraduates (iniciação científica)
    - <role in the project>
    - <role in the project>
- Master Students
    - Role in the project>
    - Role in the project>
- PhD Students
    - Role in the project>
    - Role in the project>
- Post Doctorate Students
    - Role in the project

C) BOOKS & JOURNALS

As instruments of research and capacitating will be acquired books in the research field of the project with an estimated cost of **R$ XXXXXXXX.**

D) MATERIALS

To support the research activities will be acquired desk materials and other informatics goods (tonner for printers, pencils & pens etc) with an estimated cost of **R$ XXXXXXXX**.

E) TRIPS

Resources needed to participate in national and international conferences with an estimated cost of **R$ XXXXXXXX.**

F) TRAINING

Cost related with training and capacitating, (conference fees, for instance), with an estimated cost of **R$ XXXXX.**

G) TECHNICAL SERVICES

It is expected a consultant to support technically the project team in specific research area <explain role and responsibilities> with an estimated cost of **R$ XXXXX** (up to 20% of the human resources cost).

H) ADMIN TAX

Cost related to University, Institute/Faculty (up to 20% of the project cost).

Request for Proposal

Project Name	ECG Amazon Intelligence	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	24 months	Document Date	Ago/2024
Summary/ Goal	Develop a disruptive technological tool based on the collection of ECG measurements from patients with various previously diagnosed arrhythmias and healthy individuals; supported by AI technology, this tool aims to identify potential arrhythmias in patients, with the goal of aiding in the early diagnosis of diseases and develop a robust dataset of ECG measurements from medical-grade equipment and Samsung wearable devices, alongside AI algorithms that enhance the accuracy and reliability of arrhythmia detection. Through systematic data collection, rigorous algorithm development, and scientific dissemination, the project aims to advance the field of cardiovascular diagnostics, providing a foundation for future innovations in wearable health technology and artificial intelligence in medical applications.		
Research Scope	- Data Collection: Systematic collection of ECG data from both medical-grade equipment and Samsung wearable devices, ensuring a comprehensive and diverse dataset. - Data Science Techniques for Insight Discovery: The project will employ advanced data science techniques to analyze the collected data, aiming to uncover insights that correlate ECG data with arrhythmias. A key focus will be to establish relationships between data obtained from traditional 12-lead ECGs and/or Holter monitor results with the data gathered from the wearable devices used in the study. This analysis will provide a deeper understanding of how wearable technology compares to conventional methods in arrhythmia detection. - AI Algorithm Testing and Model Development: Evaluation of multiple existing machine learning algorithms to identify those that yield the best results for the studied problem. Based on this evaluation, models will be developed to detect specific types of arrhythmias from ECG data. - Scientific Dissemination: Preparation and submission of research findings to peer-reviewed journals and presentations at international conferences. - Final Deliverables: Delivery of a fully documented ECG dataset and AI models, ready for future use and potential patent exploration.		
Output/ Specifications	Robust dataset of ECGs collected from medical-grade equipment and Samsung wearable devices, along with validated AI models for cardiac arrhythmia detection. Additionally, the project will include scientific publications and the necessary technical documentation to support the use and integration of the results in future research and clinical applications.		
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)		
Comments	Technical Proposals must be submitted until **September/2024**		

1. Motivation

The Electrocardiogram (ECG) is a simple, low-cost, and non-invasive test that provides critical insights into an individual's cardiac condition and can potentially identify life-threatening situations, such as those at risk for sudden cardiac death. Recognized as the gold standard for the non-invasive diagnosis of arrhythmias and conduction disorders, the ECG is particularly important in diagnosing coronary ischemic conditions. It offers higher sensitivity and specificity for detecting arrhythmias and conduction disorders than for identifying structural or metabolic changes.

Advancements in computer technology have enabled the enhanced capture of signals and the evaluation of complex algorithms, greatly expanding the capabilities and applications of the ECG. Cardiac arrhythmias, which result from disruptions in the formation and/or conduction of the electrical impulses through myocardial tissue, fundamentally alter the heart's normal electrical activity. Given this, the ECG remains the preferred method for studying and diagnosing these disturbances.

Accurately identifying the arrhythmic origin of symptoms such as palpitations, dizziness, and syncope depends on capturing the ECG during the event, which can be achieved through prolonged ECG monitoring systems. The ability to correlate symptoms with the precise timing of arrhythmic events is facilitated by marker devices that patients can activate during episodes, helping healthcare providers to pinpoint the cause during analysis.

Cardiac rhythm disturbances, including bradyarrhythmias (heart rate below 50 bpm) and tachyarrhythmias (heart rate above 100 bpm), are common in the general population, especially among individuals with pre-existing heart conditions. While some patients may remain asymptomatic, others may experience significantly impaired quality of life or, in severe cases, be at risk of sudden death. This broad spectrum of presentations and risks makes managing cardiac arrhythmias a persistent challenge for healthcare professionals, including emergency physicians, general practitioners, and cardiologists. Patients with the most varied heart diseases can present arrhythmias, such as ischemic heart disease, cardiomyopathies, heart failure, among others and these arrhythmias can be the cause of death in these patients.

2. Purpose

The development of an innovative and disruptive strategy capable of accurately predicting which patients are at high risk for malignant cardiac arrhythmias would allow for more effective preventive measures and a more rational allocation of healthcare resources. Modern smartwatches, equipped with advanced sensors, can perform electrocardiograms, thus assisting in the diagnosis of arrhythmias. These devices have demonstrated the ability to safely detect cardiac irregularities, enabling patients to seek specialist care more quickly. Beyond detecting atrial fibrillation, these technologies hold the potential to identify other bradyarrhythmias and tachyarrhythmias, increasing the chances of timely and effective arrhythmia management.

Given the prominence of cardiovascular diseases as the leading cause of death in Brazil and the critical role of early detection in the management of cardiac arrhythmias, this project aims to harness the potential of wearable devices, such as smartwatches, in conjunction with traditional ECG data, to enhance the prediction and treatment of arrhythmias through artificial intelligence. By integrating conventional ECGs with real-time data from wearable technology, the project seeks to improve the accuracy and accessibility of arrhythmia detection, ultimately contributing to a reduction in mortality associated with cardiovascular diseases.

As part of this initiative, a pilot study will be conducted using these innovative technologies in patients undergoing induced cardiac arrhythmias in an electrophysiology lab. The simultaneous use of the Samsung smartwatch by patients will allow for the collection of real-time electrocardiographic records, including both intracavitary ECG and the 30-second ECG from the smartwatch, offering new insights into arrhythmia management.

3. Confidentiality

The contents of the present RFP is fully confidential and should be handled with maximum care by all bid participants.

4. Objectives:

The main objective of this project is to develop a disruptive technological tool based on the collection of ECG measurements from patients with various previously diagnosed arrhythmias and healthy individuals; supported by AI technology, this tool aims to identify potential arrhythmias in patients, with the goal of aiding in the early diagnosis of diseases. To achieve this, the specific objectives are planned as follows:

- Identify arrhythmia patterns in the data resulting from ECG measurements.
- Compare the arrhythmias of patients with the condition and record them in real-time during the arrhythmia induction in the electrophysiological study.
- Design the data structure to ensure the persistence of the collected data, define information requirements, and establish information quality standards.
- Determine the specificities and sensitivity that the Smartwatch device should detect, through its sensors, during aortic clamping in a high-complexity cardiac surgery.
- Develop an application to collect data from ECG measurements in patients with previously diagnosed arrhythmias and healthy individuals.
- Analyze the collected data using Data Science techniques to identify useful insights in the population study and establish a relationship between the ECG and the information collected by the Smartwatch.
- Monitor the clinical and laboratory aspects of the study participants.
- Track the clinical and laboratory parameters of the study participants.
- Use (configure, train, test, and evaluate) AI-based models to identify potential arrhythmias in patients from the collected and stored ECG data.
- Develop an application that integrates the results of the conducted research to, based on the Smartwatch's measurements, alert patients to potential related diseases.

5. Deliverables

The project will produce two primary deliverables. First, a comprehensive dataset consisting of ECG measurements collected from both medical-grade equipment and Samsung wearable devices, such as smartwatches and smart rings. This dataset will serve as a critical resource for current and future research, capturing a diverse array of arrhythmias as well as baseline readings from healthy individuals.

Second, the project will deliver a set of artificial intelligence (AI) models to enhance the detection and analysis of arrhythmias using the collected ECG data. These models will be developed and validated within the scope of this project, focusing on improving the accuracy and variability of arrhythmia detection. The models will be provided as code, ready for integration and further refinement.

In addition to these technical deliverables, the project aims to contribute to the scientific community through participation on international conferences and the submission of at least one peer-reviewed journal article. Additionally, the project will explore the potential for a patent, to be pursued in agreement with the University, the project management, and Samsung, should the innovation merit such protection.

6. PROJETO SCOPE

The overall vision of the project is to collect, process, and store the results of traditional 12-lead electrocardiogram (ECG) measurements and single-lead measurements using Samsung smartwatches. The study will involve a sample of 250 patients, including both healthy individuals and those with diagnosed arrhythmias, accounting for a 20% dropout rate. The project will employ data science techniques to analyze the collected information, aiming to identify insights by establishing relationships or dependencies between traditional ECG data and smartwatch data. Additionally, artificial intelligence (AI) technology will be utilized to detect potential cardiac arrhythmias in data from both sources, based on pre-identified patterns.

Participants will be aged 18 or older and will have been under monitoring for at least three months as outpatients and inpatients of a terciary cardiology center To ensure high-quality data collection, the following reference devices will be provided to patients during the study:

1. **Samsung Galaxy Watch (Galaxy Watch 3, Galaxy Watch Active2, Galaxy Watch 4, Galaxy Watch 4 Classic, Galaxy Watch 5, Galaxy Watch 5 Pro)**: These Samsung smartwatches have the capability to perform electrocardiograms (ECG). They use the Samsung Health Monitor app to measure the heart's electrical activity and provide ECG readings, which can be used to detect normal heart rhythms or irregularities such as atrial fibrillation (AFib). This functionality is available on compatible smartwatches when paired with Galaxy smartphones.
2. **Traditional 12-lead Electrocardiogram (ECG) Devices**: Measurements can be conducted using various devices, including resting ECG machines, Holter monitors, portable ECG machines, and advanced ECG systems that allow for remote data transmission.

Healthcare professionalsof a tertiary cardiology center, such as doctors and nurses, will collect data related to patient monitoring, which will be incorporated into the study database.

The software solution responsible for data collection must integrate interfaces for communication with both the devices and the database. The application should have the following quality characteristics:

- **Interoperability**: The solution must interact seamlessly with all selected devices, managing both data collection and storage.
- **Efficiency**: As a distributed solution, it should optimize resource usage, including application server resources and those of mobile and wearable devices.
- **Reliability**: The solution must be fully fault-tolerant, considering the unpredictable nature of each monitored user's environment.
- **Accuracy**: Both the data collected and that processed by Data Science and AI algorithms must be precise.
- **Operability**: Given the high complexity of communications managed by the solution, its operation must be as simple as possible.

As observation and data collection progress, the obtained and processed data will form a structured and anonymized database. This database will serve as a foundation for generating knowledge and innovation through Data Science and for training AI models. Various algorithms will be explored to create classification models, with careful consideration given to selecting the most appropriate algorithm based on the application's specific requirements.

7. EXPECTED RESULTS

The expected results for this project include several key outcomes:

- Creation of Encrypted Software Tools: Development of a set of software tools capable of generating encrypted keys, allowing for the secure storage and correlation of anonymized information, thereby ensuring the confidentiality of clinical and personal data.
- Generation of a Labeled Database: The creation of a comprehensive database with labeled data, incorporating distinct and correlated parameters, providing a robust foundation for ongoing research and analysis.
- Development of Analytical Tools: The creation of a tool for the consistent and visual analysis and consultation of information, facilitating the validation of inferences and conclusions derived from the data.
- Predictive Modeling: The development of a machine learning-based predictive model for pattern recognition, providing indications or trends in the data related to arrhythmias based on processed and analyzed physiological parameters.
- Scientific Publications: The production and publication of scientific papers, both nationally and internationally, in the fields of health and technology. These publications will be based on the inferences and results obtained through the analysis of the collected data, ensuring consistency, confidentiality, integrity, indexing, and appropriate cloud storage.

In addition to these primary project outcomes, it is expected that the creation and analysis of the database will allow for various inferences regarding the relationships between physiological parameters. This may suggest potential clinical and laboratory changes in users with diabetes mellitus, with or without associated comorbidities. The monitoring of patient parameters will also enable real-time tracking of signal and symptom variations, improving self-control and continuous self-care of the evaluated conditions, as well as promoting active user participation in the health-disease process.

8. ASSUMPTIONS

The following assumptions are requirements to the success of this project:

The successful execution and completion of this project depend on several key assumptions:

- Availability of High-Quality Data: It is assumed that both medical-grade ECG data and data from Samsung wearable devices will be readily available, of high quality, and sufficient quantity to support the development of robust AI algorithms. The dataset must cover a diverse population, including individuals with various types of arrhythmias and healthy subjects.

- Collaboration with Medical and Technical Experts: The project assumes active collaboration between healthcare professionals, data scientists, and software engineers. This interdisciplinary cooperation is crucial to ensure that the algorithms are clinically relevant, scientifically valid, and technically feasible.
- Access to Computational Resources: It is assumed that adequate computational resources will be available to handle the processing and analysis of large datasets, as well as to train and validate complex AI models. This includes access to high-performance computing (HPC) facilities or cloud-based platforms capable of supporting big data analytics and machine learning workloads.
- Regulatory Compliance and Ethical Approval: The project assumes that all necessary regulatory approvals, including ethical clearance, will be obtained in a timely manner. This is essential for the legal and ethical collection, processing, and storage of sensitive medical data, ensuring that the project adheres to applicable privacy and data protection laws.
- Stakeholder Support and Engagement: The success of the project assumes continued support and engagement from all stakeholders, including the university, project management, and Samsung. This includes the alignment of goals, effective communication, and the commitment of resources necessary to achieve the project's objectives.
- Technological Stability of Wearable Devices: It is assumed that the Samsung wearable devices used in the project will operate reliably and consistently throughout the data collection phase. Any technical issues or variations in the device’s performance could impact the quality of the data and the overall success of the project.
- Feasibility of AI Models Development: The project assumes that the development of AI models for arrhythmia detection is technically feasible within the given time frame and resource constraints. This includes the expectation that the algorithms will achieve a level of accuracy and reliability that meets or exceeds current clinical standards.
- Timely Completion of Milestones: The project’s success depends on the timely completion of key milestones, such as data collection, algorithm development, and validation. Delays in any of these areas could impact the overall timeline and success of the project.

9. PROJECT DEVELOPMENT

The development of this project is structured to ensure a systematic approach that integrates all necessary phases, from planning and data collection to the creation and validation of AI models. The project will unfold over 24 months, divided into key phases that progressively build upon one another to achieve the project’s objectives.

The initial phase focuses on establishing a solid foundation through detailed planning, including the creation of a comprehensive project plan, securing ethical approvals, and setting up protocols for data collection. This phase also includes the selection and preparation of the necessary devices and software tools that will be used throughout the project.

Following the planning stage, the project will move into the data collection phase, where ECG measurements will be gathered from both medical-grade equipment and Samsung wearable devices. This phase is critical for ensuring the collection of high-quality, reliable data, which will serve as the foundation for subsequent analysis and algorithm development.

Once data collection is underway, the project will enter the data processing and algorithm development phase. Here, the focus will shift to the preprocessing of the collected data, followed by the design, development, and validation of AI models aimed at enhancing arrhythmia detection. The models will be developed using state-of-the-art machine learning techniques and validated against established clinical standards to ensure their effectiveness and reliability.

Throughout the project, ongoing monitoring and evaluation will be conducted to ensure that each phase progresses according to plan and that any challenges are addressed promptly. The project will culminate in the creation of a robust ECG dataset and validated AI models, along with scientific publications and comprehensive technical documentation. These deliverables will lay the groundwork for future innovations and potential clinical applications.

10. ACTIVITIES

- Project Management and Planning (Months 1-24)

This activity encompasses the initial setup and ongoing oversight of the project. It begins with a kickoff meeting in the first month, where the project team is established, roles are defined, and the objectives are confirmed. In the first two months, a detailed project plan is developed, including timelines, milestones, and resource allocation. Throughout the project, regular monitoring, including monthly progress meetings, status reports, and risk assessments, ensures that the project stays on track. Finally, in the last two months, a comprehensive review of the project's outcomes is conducted, and the project is formally closed, with all necessary documentation and reports completed.

- Data Collection (Months 2-15)

Data collection is a critical phase that begins with the design and setup of data collection protocols in the second month, ensuring that all processes are ethically approved and technically sound. This phase also includes the development of applications to facilitate the data collection process, as well as the modeling of a robust database structure to store the collected ECG data. Methods for collecting data from both medical-grade equipment and Samsung wearable devices will be established. Recruitment of participants begins in the fifth month, with systematic data collection continuing until the fourteenth month. Throughout this period, data will be continuously validated to ensure accuracy and completeness, and securely stored in the database, ensuring high data quality across the project.

- Development of AI models (Months 6-22)

The development of AI models is central to the project and begins with the preprocessing and preparation of the collected data from the sixth month onward. This phase involves cleaning, labeling, and organizing the data for effective use in training the machine learning models. From the thirteenth to the eighteenth month, various AI algorithms will be tested, with a focus on selecting the most suitable algorithms, tuning their parameters, and training them to create models that can accurately detect arrhythmias. These models will then be validated and refined between the nineteenth and twenty-second months, ensuring that they meet the necessary performance standards and are ready for deployment.

- Scientific Dissemination and Knowledge Transfer (Months 18-24)

This activity is dedicated to sharing the findings of the project with the wider scientific community. It includes the preparation and submission of research papers to peer-reviewed journals, beginning in the eighteenth month. Additionally, the project results will be presented at two international conferences between the twentieth and twenty-fourth months, facilitating knowledge exchange and feedback from peers. If the project's outcomes suggest potential for a patent, this will be explored in collaboration with the university and Samsung towards the end of the project timeline.

- Final Deliverables and Project Closure (Months 22-24)

The final activity focuses on wrapping up the project and delivering the key outputs. This includes finalizing the ECG data repository and the AI code, ensuring both are well-documented and accessible by the twenty-third month. The project will then be formally handed over to the relevant stakeholders, complete with all necessary documentation and reports, in the final month. This phase ensures that all deliverables are in place and that the project is closed successfully, with clear outcomes and a path forward for future initiatives.

11. SCHEDULE OF ACTIVITIES

Activity	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
Project Management and Planning	X	X	X	X	X	X	X	X	X	X	X	X
Data Collection (Including the design and development of applications for data collection)		X	X	X	X	X	X	X	X	X	X	X
Development of AI Models						X	X	X	X	X	X	X
Scientific Dissemination and Knowledge Transfer												
Final Deliverables and Project Closure												

Activity	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24
Project Management and Planning	X	X	X	X	X	X	X	X	X	X	X	X
Data Collection (Including the design and development of applications for data collection)		X	X	X	X	X						
Development	X	X	X	X	X	X	X	X	X	X	X	X

of AI Algorithms												
Scientific Dissemination and Knowledge Transfer						X	X	X	X	X	X	X
Final Deliverables and Project Closure										X	X	X

12. MILESTONES

Milestone 1 at M3: Project Setup and Initial Planning Completed
By the end of the third month, the project will have successfully completed the initial setup and planning phase. This milestone includes the creation of the Project Charter, which will outline the scope, objectives, team structure, and initial timeline. Additionally, a detailed project plan will be developed, providing a comprehensive roadmap that includes timelines, resource allocation, and risk management strategies. The kickoff meeting will also be held, and the outcomes of this meeting will be documented, ensuring that roles and responsibilities are clearly defined. This milestone marks the official start of the project and establishes the foundation for all subsequent activities.

Milestone 2 at M5: Data Collection Protocols Finalized and Ethical Approval Obtained
By the fifth month, the project will finalize all data collection protocols and secure the necessary ethical approvals, allowing for the commencement of data collection. This includes the development of detailed procedures for collecting ECG data from medical-grade equipment and Samsung wearable devices. Ethical approval will be obtained from the relevant authorities, ensuring compliance with legal and ethical standards. Additionally, a participant recruitment plan will be prepared, outlining strategies to recruit a diverse participant pool to ensure the quality and comprehensiveness of the data collected.

Milestone 3 at M10: Initial Data Collection and Preliminary Data Validation Completed
By the tenth month, the project will have initiated data collection and completed the preliminary validation of the initial dataset. This milestone involves the successful collection of the first batch of ECG data from both medical-grade equipment and Samsung wearable devices. The preliminary data validation process will be conducted to ensure data quality and to identify any potential issues or anomalies. A progress report will also be generated, summarizing the number of participants involved, the types of data collected, and any challenges encountered during this initial phase.

Milestone 4 at M14: Complete Data Collection and Transition to Data Preprocessing
By the fourteenth month, the data collection phase will be completed, and the project will begin data preprocessing. This milestone marks the transition from data collection to the preparation of the dataset for algorithm development. A finalized dataset will be prepared, including all necessary annotations and labels. The project will also produce a report documenting the completion of data collection, including a summary of participant demographics, data volume, and overall data quality. The next step will involve the detailed planning of data preprocessing activities, ensuring that the dataset is ready for use in developing AI algorithms.

Milestone 5 at M18: AI Models Development Initiated
By the eighteenth month, the project will have started the development of AI models for arrhythmia detection using the preprocessed ECG data. This milestone involves the design and initial development of machine learning models, with a focus on improving the accuracy and reliability of arrhythmia detection. The progress of algorithm development will be documented, including initial performance metrics and areas identified for refinement. This phase is critical as it lays the groundwork for the final validation of the AI models.

Milestone 6 at M22: AI Models Validation and Scientific Dissemination Prepared
By the twenty-second month, the AI models will be validated and prepared for dissemination to the scientific community. This milestone includes the final validation of the AI models, ensuring they meet the required standards for accuracy and reliability. The project will also begin preparing research papers for submission to peer-reviewed journals and developing materials for presentation at international conferences. This phase ensures that the project's findings are shared with the broader scientific and medical communities, contributing to advancements in the field.

Milestone 7 at M24: Project Closure and Final Deliverables Completed
By the end of the twenty-fourth month, the project will conclude with the finalization of all deliverables and formal project closure. This milestone involves the completion of the final data repository and the AI code, both of which will be fully documented and ready for future use. A comprehensive final report will be produced, summarizing the entire project, including key outcomes, challenges, and lessons learned. The project will then be formally handed over to the relevant stakeholders, ensuring a smooth transition and setting the stage for potential future work.

13. RESOURCES

The estimated budget to implement this project is **R$ 13.851.474,00**

	MONTHS	**24**
SUMMARY	**VALUE**	**%**
Computer Programs, Machines, Equipment, Appliances and Instruments	R$ 2.735.200,00	**19,75%**
Implementation, Expansion or Modernization of Laboratory	R$ 2.000.000,00	**14,44%**
Direct and Indirect Human Resources	R$ 5.736.000,00	**41,41%**
Third-Party Technical Services	R$ 100.000,00	**0,72%**
Consumables	R$ 400.000,00	**2,89%**
Other expenses	R$ 500.000,00	**3,61%**
Subtotal 1	**R$ 11.471.200,00**	**82,82%**
Costs Incurred (15%)	**R$ 1.720.680,00**	**12,42%**
Subtotal 2	**R$ 13.191.880,00**	**95,24%**
ISS (5%)	**R$ 659.594,00**	**4,76%**
Total	**R$ 13.851.474,00**	**100,00%**

Project Name	**ECGNOW**	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	24 meses	Document Date	Ago/2024
Summary/ Goal	A pandemia trouxe à tona um problema crescente na prática clínica: o aumento de pacientes relatando sintomas cardiovasculares, como dor torácica, taquiarritmias, mal-estar e pré-síncope. Esses sintomas, intermitentes e muitas vezes difíceis de capturar em exames convencionais, criam um desafio significativo, pois podem estar associados tanto a condições potencialmente fatais, como doenças cardiovasculares, quanto a transtornos emocionais, como crises de ansiedade. O objetivo desse projeto é desenvolver e validar um hardware (bracelete) para coleta de dados de stress e transtorno de ansiedade (síndrome do pânico).		
Research Scope	- Coleta de Dados: Coleta sistemática de dados cardiovasculares usando smartphone Samsung, anel eletrônico Samsung, bracelete, garantindo um conjunto de dados abrangente e diversificado. Além disso será coletado o relato gravado do paciente descrevendo o problema, dado importante para o médico diagnosticar o problema. A ideia é analisar cerca de 400 pacientes oriundos de consultórios médicos. - Desenvolvimento de um Hardware de baixo custo (bracelete) - Desenvolvimento de um Algoritmo de IA para analisar os resultados -		
Output/ Specifications	- protótipo do bracelete - big data com dados de coletados dos dispositivos - Algoritmo de IA autoral validado com os dados clínicos - Pesquisa e publicação de artigos em revistas de alto impacto sobre o tema.		
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)		
Comments	**Valor total: R$ 8 milhões**		

Motivação

As doenças cardiovasculares são a principal causa de morte no mundo, representando aproximadamente 31% de todas as mortes globais, de acordo com a Organização Mundial da Saúde (OMS). Entre as condições cardiovasculares, as arritmias desempenham um papel significativo, sendo responsáveis por uma grande parcela de complicações cardíacas, como acidentes vasculares cerebrais (AVC) e insuficiência cardíaca.

Globalmente, as arritmias afetam milhões de pessoas, com a fibrilação atrial sendo a arritmia mais comum, afetando cerca de 33 milhões de pessoas em todo o mundo. Segundo a American Heart Association (AHA), aproximadamente 1 em cada 4 pessoas acima dos 40 anos desenvolverá fibrilação atrial ao longo da vida. As arritmias são uma das principais causas de acidente vascular cerebral (AVC) e insuficiência cardíaca, contribuindo significativamente para a carga global de doenças cardiovasculares.

Estima-se que cerca de 20 milhões de brasileiros sofram de arritmias cardíacas, de acordo com a Sociedade Brasileira de Arritmias Cardíacas (SOBRAC). Dentre essas, a fibrilação atrial é a arritmia mais comum, afetando aproximadamente 1,5 milhão de pessoas no país. As arritmias são responsáveis por uma parcela significativa das internações hospitalares e são uma das principais causas de morte súbita, com estimativas sugerindo que até 300 mil pessoas morram anualmente no Brasil devido a essas condições.

Muitos pacientes com arritmias potencialmente fatais experimentam sintomas cardiovasculares esporádicos, como palpitações, tontura e sensação de desmaio. No entanto, esses sintomas geralmente ocorrem quando o paciente não está sendo monitorado, e a arritmia pode cessar até o paciente chegar ao Pronto Socorro resultando em diagnósticos atrasados ou errados como o diagnóstico de Ansiedade ou algum outro diagnóstico psiquiátrico.

Além das arritmias ainda temos os outros sintomas cardiovasculares. No Brasil, estima-se que mais de 300 mil infartos do miocárdio ocorram anualmente, com

muitas dessas situações sendo precedidas por sintomas cardiovasculares que não foram monitorados adequadamente. A identificação precoce desses sintomas por meio de um ECG pode ser crucial para a intervenção imediata e prevenção de danos permanentes ao coração.

Infelizmente dispositivos como smartwatch tem uma limitação no registro eletrocardiográfica do paciente porque nesse não conseguimos representar as 12 derivações do eletrocardiograma e estas são necessárias para fechar alguns diagnósticos.

Dado o número significativo de pacientes com arritmias e sintomas cardiovasculares no Brasil e no mundo, e considerando a importância de um diagnóstico precoce e preciso, o desenvolvimento de um dispositivo que se propõe-se a realizar um eletrocardiograma a qualquer momento por um leigo, fora do ambiente hositalar é fundamental. Este dispositivo não só permitirá que os pacientes capturem dados críticos no momento exato em que experimentam sintomas, mas também melhorará a capacidade dos profissionais de saúde de diagnosticar e tratar essas condições de forma eficaz, reduzindo a mortalidade e melhorando a qualidade de vida dos pacientes.

Objetivo

O objetivo deste trabalho é desenvolver um dispositivo inovador, que seja operável por leigos,de preferência que seja operado pelo próprio paciente e seja capaz de realizar um ECG de 12 derivações em ambiente extra-hospitalar no momento que surgirem sintomas cardiovasculares, como palpitações ou dor no peito. Este dispositivo será capaz de captar e transmitir sinais eletrocardiográficos para um smartphone via Wi-Fi, onde um software dedicado analisará, armazenará e permitirá o compartilhamento imediato do ECG com o cardiologista do paciente.

Objetivos Específicos:

1. **Desenvolver um dispositivo compacto de fácil operacionalização que realize uma eletrocardiograma de 12 derivações.**
    - Criar um dispositivo de tamanho reduzido que poderá ser transportado em bolsas ou bolsos, que contenha 10 eletrodos pré-configurados e aderentes, capazes de capturar os sinais elétricos do miocárdio e transforme esses dados em um ECG de 12 derivações. O desafio será transformar uma máquina de eletrocardiograma de 12 derivações, que hoje é operada por profissionais de saúde treinados e em ambiente hospitalar, em um equipamento vestível, que possa ser operado por leigos e instalado a qualquer momento em qualquer lugar.
2. **Assegurar o posicionamento preciso dos eletrodos:**
    - Implementar um sistema de guias ou mecanismos que ajudem o paciente a posicionar os eletrodos corretamente no tórax, garantindo que o ECG capturado seja fidedigno e preciso.
3. **Criar sensores de alta sensibilidade:**
    - Desenvolver sensores que possam captar com precisão os sinais elétricos do coração e transmitir esses sinais de forma estável e segura e com nenhuma ou mínima interferência para um smartphone.
4. **Desenvolver um software Integrado para smartphones:**
    - Criar um aplicativo móvel que seja capaz de receber os sinais dos sensores, gerar um registro completo do eletrocardiograma (ECG), realizar análises automáticas preliminares e armazenar os dados com segurança.
    - O software também permitirá o compartilhamento imediato dos dados com profissionais de saúde, facilitando intervenções rápidas.
5. **Facilitar a substituição de eletrodos:**

- Projetar eletrodos aderentes substituíveis para garantir que o dispositivo possa ser reutilizado várias vezes sem perda de funcionalidade ou precisão.

6. **Garantir a conectividade e a segurança dos dados:**
    - Assegurar que a transmissão dos dados eletrocardiográficos seja feita de forma segura, utilizando tecnologias de criptografia, para proteger a privacidade dos pacientes.

Para avaliar a eficácia do dispositivo será feito um recrutamento com 250 pacientes que estejam em acompanhamento cardiológico e que apresentem sintomas cardiovasculares. Os cardiologistas serão convidados a participar do projeto dando sua contribuição com a percepção deles e de seus pacientes a cerca do dispositivo.

O **ECGNow** tem como etapas do projeto criar um dispositivo vestível, de fácil manipulação que capte os sinais elétricos cardíacos e os envie a um software que converta esses sinais e os transforme em um eletrocardiograma de 12 derivacões, tal qual aquele realizado em clínicas e hospitais. Esse dispositivo após os testes no laboratório onde testaremos sua facilidade de manipulação e precisão, será entregues à cardiologistas para que eles validem o dispositivo testando-o em pacientes reais e a partir dessa etapa gere dados para fortalecer e definir novos parâmetros na investigação diagnóstica de doenças cardiovasculares.

Confidencialidade

A confidencialidade é um aspecto crucial deste projeto, dada a natureza sensível das informações envolvidas e o potencial impacto dessas informações nos desenvolvimentos futuros. Todos os dados, documentos, comunicações e qualquer outro material relacionado ao projeto são considerados estritamente confidenciais e devem ser tratados com o mais alto nível de sigilo por todas as partes envolvidas.

Os participantes do projeto, incluindo membros da equipe de pesquisa, parceiros acadêmicos, consultores e quaisquer terceiros, devem aderir a acordos de confidencialidade, assegurando que nenhuma informação seja divulgada. Isso inclui, mas não se limita a informações técnicas, dados dos participantes do estudo, resultados preliminares, estratégias de desenvolvimento de software, algoritmos, e qualquer descoberta ou inovação resultante do projeto.

Além disso, os dados coletados durante o projeto, serão anonimizados para garantir a privacidade dos indivíduos envolvidos. O acesso a esses dados será restrito e monitorado, de forma a prevenir qualquer uso indevido ou divulgação não autorizada.

Justificativa

O desenvolvimento de um dispositivo portátil como o **ECGNow**, capaz de registrar um eletrocardiograma (ECG) de 12 derivações, é fundamental para melhorar a precisão e a eficácia no diagnóstico de arritmias e outras condições cardiovasculares. Abaixo estão os principais pontos que justificam a importância deste projeto:

Importância das 12 derivações no diagnóstico

O eletrocardiograma de 12 derivações é o padrão ouro no diagnóstico de arritmias e outras condições cardíacas. Ele fornece uma visão abrangente e precisa da atividade elétrica do coração, captando diferentes ângulos e regiões do miocárdio, algo que dispositivos com menos derivações não conseguem fazer de maneira tão eficaz.

Cada uma das 12 derivações oferece informações específicas e essenciais sobre a condução elétrica em diferentes partes do coração:

- As derivações precordiais (V1-V6) ajudam a detectar alterações no ventrículo esquerdo e direito.

- As derivações dos membros fornecem uma visão dos impulsos elétricos ao longo de eixos diferentes do coração.

A capacidade de registrar o ECG de 12 derivações permite aos médicos identificar com precisão a localização e o tipo de arritmia, como fibrilação atrial, flutter atrial, taquicardias ventriculares e outros distúrbios de condução. Sem essas informações completas, o diagnóstico pode ser limitado, levando a potenciais erros ou falta de precisão no tratamento.

Limitações dos smartwatches e dispositivos de pulso

Os dispositivos de pulso, embora populares, possuem limitações significativas no monitoramento de arritmias e na obtenção de dados detalhados do coração. A maioria desses dispositivos é equipada com apenas uma ou duas derivações, o que restringe a análise do coração a um único ponto de visualização. Isso os torna incapazes de fornecer o mesmo nível de detalhamento que um ECG de 12 derivações.

Essas limitações tornam os smartwatches menos eficazes em situações em que é essencial capturar o evento cardíaco no momento em que ele ocorre e a partir de múltiplos ângulos.

Dificuldade em documentar arritmias

Muitas arritmias, como a fibrilação atrial paroxística ou as taquicardias ventriculares intermitentes, são de difícil documentação, pois ocorrem de forma irregular e muitas vezes desaparecem antes que o paciente possa chegar ao hospital ou realizar um ECG convencional. Além disso, o estresse de uma visita ao hospital ou clínica pode alterar o estado do paciente, dificultando a replicação dos sintomas que estavam presentes anteriormente.

Essa dificuldade em capturar o evento cardíaco no momento certo pode retardar o diagnóstico e o tratamento. O **ECGNow** ao permitir que o paciente registre um ECG completo e preciso assim que os sintomas começam, resolve esse problema, oferecendo uma oportunidade de capturar o evento no momento exato e proporcionar dados essenciais para o diagnóstico correto.

Confusão com doenças psiquiátricas

Devido à alta variabilidade dos sintomas cardiovasculares, como palpitações, tontura e falta de ar, muitos pacientes com arritmias ou outras doenças cardíacas são frequentemente diagnosticados erroneamente com condições psiquiátricas, como transtorno de ansiedade ou síndrome do pânico. Isso ocorre porque os sintomas podem ser fugazes e difíceis de documentar, levando os médicos a buscar outras explicações para os relatos dos pacientes.

O desenvolvimento do **ECGNow** visa mitigar essa confusão, permitindo que os pacientes documentem com precisão suas condições cardíacas no exato momento dos sintomas. O ECG de 12 derivações fornecerá dados objetivos e inquestionáveis sobre a presença de arritmias ou outros distúrbios cardíacos, diferenciando com maior clareza os sintomas de origem cardíaca de problemas psiquiátricos.

Resultados Esperados

O **ECGNow** tem o potencial de impactar positivamente milhões de pessoas ao redor do mundo, especialmente aquelas que convivem com doenças cardiovasculares e estão em risco de arritmias. A Organização Mundial da Saúde (OMS) estima que 17,9 milhões de pessoas morrem anualmente em decorrência de doenças cardíacas, representando 31% de todas as mortes globais. No Brasil, as doenças cardiovasculares são responsáveis por cerca de 400 mil mortes anuais. Dado esse contexto, o **ECGNow** surge como uma solução indispensável para o diagnóstico e monitoramento dessas condições, com potencial para beneficiar uma parcela significativa da população.

Com a possibilidade de realizar um eletrocardiograma de 12 derivações — o padrão ouro no diagnóstico de condições cardíacas — o ECGNow é essencial para detectar condições graves, como a fibrilação atrial, que afeta cerca de 33,5 milhões de pessoas globalmente e é responsável por até 30% dos acidentes vasculares cerebrais isquêmicos. A detecção precoce dessas arritmias, proporcionada pelo **ECGNow**, pode reduzir drasticamente o risco de complicações e morte.

Além de aumentar a precisão diagnóstica, o **ECGNow** oferece aos pacientes a capacidade de monitorar seus sintomas em tempo real, algo que pode melhorar significativamente a qualidade de vida. Atualmente, cerca de 70% das pessoas com arritmias não conseguem capturar os eventos no momento em que ocorrem, resultando em diagnósticos tardios ou incorretos. O **ECGNow** resolve esse problema, permitindo que os pacientes realizem um eletrocardiograma assim que os sintomas aparecem. Isso oferece a oportunidade de capturar dados precisos no exato momento do evento, o que pode ser compartilhado com cardiologistas em tempo real, facilitando uma intervenção médica mais rápida e eficaz.

O dispositivo também se apresenta como uma solução acessível e inclusiva, uma vez que a maioria dos pacientes não tem acesso fácil a equipamentos de monitoramento cardíaco ou consultas regulares. Dispositivos tradicionais de ECG são caros e exigem equipe treinada para sua correta realização e infraestrutura hospitalar, o que limita seu uso fora do ambiente clínico. Ao contrário, o **ECGNow** será compacto, acessível e fácil de usar, permitindo que pacientes monitorem sua saúde cardíaca no conforto de suas casas ou em qualquer lugar. Isso se alinha à crescente necessidade de tecnologias que ampliem o acesso ao monitoramento médico contínuo, especialmente em países com sistemas de saúde sobrecarregados como o Brasil, onde são realizados mais de 1,4 milhão de atendimentos de emergência cardiológica por ano, muitos dos quais poderiam ser evitados com um dispositivo como o **ECGNow**.

A economia gerada pelo uso do **ECGNow** também será significativa. A detecção precoce de arritmias pode reduzir substancialmente as hospitalizações de emergência e os custos associados ao tratamento de complicações cardíacas graves. Estudos da American College of Cardiology indicam que intervenções rápidas, possibilitadas pela monitorização contínua, podem reduzir em até 30% os custos com hospitalizações de emergência. Em escala global, isso representaria bilhões de dólares economizados anualmente, tanto para pacientes quanto para sistemas de saúde.

Por fim, o impacto do ECGNow vai além do tratamento clínico imediato. Ele também será uma ferramenta poderosa para a pesquisa médica, permitindo a

coleta e análise de grandes quantidades de dados eletrocardiográficos em tempo real. Isso proporcionará uma base sólida para estudos sobre a ocorrência e evolução de arritmias e outras condições cardíacas, contribuindo para o desenvolvimento de novas abordagens de tratamento e prevenção.

A capacidade do dispositivo de fornecer dados precisos em tempo real revolucionará a detecção de arritmias e outras condições cardíacas, permitindo intervenções mais rápidas e eficazes. Com essa inovação, a cardiologia avança para uma nova era, onde a medicina de precisão não apenas transforma o diagnóstico, mas redefine o futuro do cuidado cardíaco, proporcionando tratamentos mais personalizados e assertivos para nossos pacientes.

Project Name	**E-OBESIDADE**	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	24 meses	Document Date	Ago/2024
Summary/ Goal	O principal objetivo deste projeto é desenvolver uma aplicação para smartphones que avalie o risco de obesidade em adultos e adolescentes, utilizando tecnologia “Wearable”. O sistema será concebido para recolher e monitorizar dados sobre atividade física, gasto calórico e perfis de saúde personalizados. A tecnologia visa proporcionar uma solução acessível e eficaz para pais, profissionais de saúde e educadores, permitindo uma intervenção precoce e baseada em dados para prevenir e combater a obesidade de todos os tipos. O projeto também considera a integração de gamificação e recomendações personalizadas para incentivar hábitos saudáveis entre os utilizadores, com a possibilidade de acompanhamento em tempo real e feedback ajustável às necessidades individuais de cada adulto ou adolescente		
Research Scope	O âmbito da investigação inclui a identificação de fatores de risco para a obesidade, levando em consideração elementos como o sedentarismo, má alimentação, fatores genéticos, e fatores psicológicos e sono (Sahoo et al., 2015). A pesquisa também abordará os seguintes aspetos: • Exploração da tecnologia de wearables (relógios inteligentes, pulseiras de atividade, etc.) e a sua eficácia na medição de parâmetros como passos, calorias queimadas, frequência cardíaca, padrões de sono e índices glicêmicos. • Uso de algoritmos de machine learning para a personalização das recomendações de atividade física e controlo calórico com base nos perfis de saúde individualizados. • Revisão de estudos clínicos e literatura académica sobre a eficácia de intervenções tecnológicas no combate à obesidade.		

	• Investigação sobre a aceitação e usabilidade da aplicação entre as jovens e adultos, educadores e responsáveis.
Output/ Specifications	O produto final será uma aplicação para smartphones com integração de dispositivos vestíveis que fornecerá as seguintes funcionalidades: - Monitorização em tempo real: Capacidade de sincronizar com dispositivos vestíveis para captar informações diárias de atividade física (passos, distâncias percorridas, frequência cardíaca) e padrões de sono. - Avaliação do risco de obesidade: Cálculo contínuo de indicadores de saúde para fornecer uma avaliação precisa do risco de obesidade. - Perfis de saúde personalizados: Geração de perfis únicos para cada criança/adolescente com base em dados de altura, peso, idade, género e histórico familiar de saúde. - Recomendações personalizadas: Sugestões de atividade física e ajustes na dieta, com base nas metas de calorias queimadas e na saúde geral, tendo em consideração fatores individuais. - Gamificação e incentivo: Utilização de técnicas de gamificação para motivar as crianças a seguir as recomendações de atividades, com recompensas e conquistas virtuais. - Relatórios para pais e educadores: Criação de relatórios semanais e mensais sobre o progresso de cada utilizador, com sugestões de intervenção quando necessário. - Interface amigável: Um design simples e intuitivo, adequado para uso por jovens e adultos, mas com áreas dedicadas a pais e educadores para análise detalhada." -
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)
Comments	**Valor total: R$ 8 milhões**

Request for Proposal

Project Name	**FITCAM**	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	36 months	Document Date	Ago/2024
Summary/ Goal	This project aims to develop an innovative application that uses computer vision and artificial intelligence to analyze body composition and offer personalized recommendations for physical exercises and healthy eating. The initiative addresses the global increase in obesity and overweight, using cutting-edge technology to promote health and well-being among the population. The project will collect and integrate physical and nutritional data from a diverse sample of 500 people, which will be analyzed by machine learning algorithms to provide accurate and individualized guidance. Funded by Samsung and conducted by the State University of Amazonas (UEA), the application will be integrated with Samsung wearable devices to ensure greater precision in recommendations.		
Research Scope	- Development of artificial intelligence and computer vision algorithms for body composition analysis. - Collection and integration of physical and nutritional data from 500 participants across different age groups and social classes. - Creation and testing of an application that provides personalized health and wellness recommendations. - Integration of the application with Samsung wearable devices. - Validation of the algorithms and the application through testing with pilot groups. - Dissemination of scientific results and protection of innovations through patents.		
Output/ Specifications	- Physical Analysis and Bioimpedance Database: Creation of a comprehensive database with information collected from 500 participants, including bioimpedance measurements and data captured by computer vision. - Physical and Nutritional Analysis Algorithms: Development of machine learning algorithms for the integration and analysis of the collected data, comparing the results from computer vision with bioimpedance analyses.		

	- Physical and Nutritional Analysis Application: A functional application that uses the developed algorithms to provide personalized exercise and dietary recommendations, with integration into Samsung wearable devices. - Testing and Validation Reports: Detailed documentation of the tests conducted with the application, including validation of the accuracy of the computer vision algorithms compared to bioimpedance analyses, as well as feedback from pilot group participants. - Scientific Articles and Publications: Production of scientific articles for submission to journals and conferences, presenting the project's results and innovations, with a focus on the comparison between analysis methods. - Patent Proposals: Preparation of patent proposals to protect the technological innovations developed, including the created algorithms and methods. - Conference Presentations: Participation in conferences and scientific workshops to disseminate the project's advancements and results, promoting knowledge exchange with other researchers and professionals in the field.
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)
Comments	Technical Proposals must be submitted until **September/2024** **Valor do Projeto: R$ 10 milhões**

Project Name	**Fitness Monitor**	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	24 meses	Document Date	Ago/2024
Summary/ Goal	Projeto de desenvolvimento de algoritmos autorais para smartwatches que permitam o cálculo de parâmetros biomecânicos durante a marcha e a corrida para melhorar a qualidade de vida e performance dos usuários.		
Research Scope	- Research Scope - Formação de um time de pesquisadores com expertise em biomecânica e computação composto por professores e estudantes de diferentes formações acadêmicas; - Elaboração de um estudo clínico aplicado através de análise biomecânica utilizando tecnologia padrão ouro para determinar parâmetros biomecânicos da marcha e da corrida em pessoas com diferentes características; - Desenvolvimento de algoritmo autoral a partir de dados coletados na utilização do smartwatch que correlacione com os parâmetros biomecânicos da marcha e da corrida. - Gerenciamento do projeto por uma equipe experiente na execução de PD&I utilizando modelo em espiral para mitigar falhas e manter o processo em retroalimentação constante.		
Output/ Specifications	- Algoritmo autoral validado com cálculo de variáveis biomecânicas coletadas no Smartwatch que permitam análise de performance e indicadores de saúde na corrida e na marcha; - Big Data com os dados coletados pelos dispositivos - Pesquisa e publicação de artigos em revistas de alto impacto sobre o tema proposto.		
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)		
Comments	**Valor total: R$ 8 milhões**		

Project Name	**Panic Monitor**	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	24 meses	Document Date	Ago/2024
Summary/ Goal	A pandemia trouxe à tona um problema crescente na prática clínica: o aumento de pacientes relatando sintomas cardiovasculares, como dor torácica, taquiarritmias, mal-estar e pré-síncope. Esses sintomas, intermitentes e muitas vezes difíceis de capturar em exames convencionais, criam um desafio significativo, pois podem estar associados tanto a condições potencialmente fatais, como doenças cardiovasculares, quanto a transtornos emocionais, como crises de ansiedade. O objetivo desse projeto é desenvolver e validar um hardware (bracelete) para coleta de dados de stress e transtorno de ansiedade (síndrome do pânico).		
Research Scope	- Coleta de Dados: Coleta sistemática de dados cardiovasculares usando smartphone Samsung, anel eletrônico Samsung, bracelete, garantindo um conjunto de dados abrangente e diversificado. Além disso será coletado o relato gravado do paciente descrevendo o problema, dado importante para o médico diagnosticar o problema. A ideia é analisar cerca de 400 pacientes oriundos de consultórios médicos. - Desenvolvimento de um Hardware de baixo custo (bracelete) - Desenvolvimento de um Algoritmo de IA para analisar os resultados -		
Output/ Specifications	- protótipo do bracelete - big data com dados de coletados dos dispositivos - Algoritmo de IA autoral validado com os dados clínicos - Pesquisa e publicação de artigos em revistas de alto impacto sobre o tema.		
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)		

Comments	**Valor total: R$ 8 milhões**

Project Name	**Clinical Big Data**	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	36 meses	Document Date	Ago/2024
Summary/ Goal	O prontuário eletrônico é um repositório de informações mantidas de forma eletrônica, ao longo da vida de um indivíduo. Nele estão armazenadas as informações de saúde, clínicas e administrativas, originadas das ações das diversas categorias profissionais que compõem a Atenção Primária a Saúde (APS). Além disso, é necessário que tenha pelo menos as seguintes características principais: • registro de anamnese, exame objetivo e variáveis clínicas; • prescrição de medicamentos ou outros métodos terapêuticos; • emissão de atestados e outros documentos clínicos; • solicitação de exames e outros métodos diagnósticos complementares; • encaminhamentos a outros pontos da rede de atenção à saúde; e • acesso rápido aos problemas de saúde e intervenções atuais O objetivo do projeto é desenvolver um prontuário eletrônico que possa ser usado por instituições públicas de saúde e criar uma big data e algoritmos de IA que analisem os dados dos pacientes para melhorar os diagnósticos		
Research Scope	- Coleta de Dados: Coleta sistemática de dados clínicos usando os prontuários médicos garantindo um conjunto de dados abrangente e diversificado. A ideia é analisar cerca de 200 pacientes oriundos de hospitais públicos de Manaus. - Desenvolvimento de um software de prontuário eletrônicos web/mobile - Desenvolvimento de algoritmos de IA que ajudem o diagnóstico e administração do hospital -		
Output/ Specifications	- Software de prontuário eletrônico web/mobile interligado ao ConecteSUS - big data com dados de coletados dos prontuários - algoritmos de IA que ajudem o diagnóstico e administração do hospital		

	- Pesquisa e publicação de artigos em revistas de alto impacto sobre o tema.
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)
Comments	**Valor total: R$ 16 milhões**

Project Name	**ALIVE**	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	24 meses	Document Date	Ago/2024
Summary/ Goal	Segundo a Demografia Médica no Brasil 2023, o Amazonas tem 4,2 milhões de habitantes e 5,7 mil médicos, com uma proporção de 1,36 médicos para cada mil habitantes. No levantamento geral, o estado está atrás apenas do Pará, que tem 1,18, e do Maranhão, que tem 1,22 de razão. A proporção de profissionais da área atuando em municípios pequenos e mais distantes dos grandes centros urbanos é ainda menor, contribuindo para a falta de acesso de parte da população a serviços básicos de saúde. Desenvolver um sistema inteligente baseado em Big Data e Inteligência Artificial (IA) que seja capaz de coletar e analisar dados de nutrição, saúde física e mental dos usuários de de um relógio ou anel Samsung ajudará a alertar sobre possíveis problemas de saúde aos usuários. O sistema fornecerá uma análise personalizada para cada usuário com base em suas rotinas cadastradas manualmente ou coletadas automaticamente por sensores do dispositivo. Com essas informações, o sistema oferecerá alertas sobre a saúde do usuário e recomendações para melhorar seu bem-estar geral de acordo com análise médica recomendada. Após a coleta das informações, os resultados ficarão disponíveis para visualização no banco de dados pelo médico especialista, e este número de médicos em Manaus registrou crescimento de 229% na quantidade de médicos. A cidade conta agora com 283 médicos e médicas — recebeu 197 novos profissionais entre janeiro de 2023 e junho de 2024. Em dezembro de 2022, eram 86.		
Research Scope	- **Coleta de Dados Automatizada:** Sensores do relógio inteligente irão coletar informações sobre a saúde física (ex: frequência cardíaca, nível de atividade física, qualidade do sono), nutrição (através de inputs manuais ou automáticos de alimentação) e indicadores de saúde mental (ex: níveis de estresse, padrões de sono). - **Rotinas Personalizadas:** Usuários poderão cadastrar rotinas personalizadas no aplicativo Samsung Health, como horários de refeições, sono, atividades físicas e outros hábitos de vida. Além disso, o sistema será capaz de detectar padrões		

	automaticamente de rotina de acordo com os dados coletados automaticamente. - **Análise de Dados e IA:** Algoritmos de IA e Big Data serão usados para processar e analisar os dados coletados. A IA fará projeções e estimativas sobre a saúde do usuário, fornecendo métricas personalizadas, tais como calorias queimadas, ingestão nutricional, padrões de sono, níveis de estresse, entre outros. - **Alertas de Saúde:** O sistema emitirá alertas automáticos quando os dados indicarem desvios preocupantes dos níveis de saúde física ou mental (ex: aumento repentino na frequência cardíaca, aumento no nível de estresse ou falta de sono adequado). - **Recomendações Personalizadas:** Com base nos dados analisados, o sistema fornecerá recomendações para a melhoria da saúde física e mental, incluindo sugestões sobre nutrição, rotinas de exercício físico e práticas de relaxamento ou meditação
Output/ Specifications	- Um sistema funcional e escalável capaz de analisar de forma precisa e personalizada a saúde física, nutricional e mental dos usuários, fornecendo alertas e recomendações que visem melhorar sua qualidade de vida e prevenir problemas de saúde. A partir dos dados coletados e analisados, o sistema poderá gerar conteúdo informativo e personalizado. Esse conteúdo pode ser oferecido diretamente no aplicativo Samsung Health, por meio de notificações ou seções dedicadas, como dicas de saúde, desafios personalizados, sugestões de exercícios e nutrição baseados no histórico do usuário
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)
Comments	**Valor total: R$ 8 milhões**

Project Name	**REVEDUA**	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	24 meses	Document Date	Ago/2024
Summary/ Goal	Segundo a Demografia Médica no Brasil 2023, o Amazonas tem 4,2 milhões de habitantes e 5,7 mil médicos, com uma proporção de 1,36 médicos para cada mil habitantes. No levantamento geral, o estado está atrás apenas do Pará, que tem 1,18, e do Maranhão, que tem 1,22 de razão. A proporção de profissionais da área atuando em municípios pequenos e mais distantes dos grandes centros urbanos é ainda menor, contribuindo para a falta de acesso de parte da população a serviços básicos de saúde. Desenvolver um sistema inteligente baseado em Big Data e Inteligência Artificial (IA) que seja capaz de coletar e analisar dados de nutrição, saúde física e mental dos usuários de de um relógio ou anel Samsung ajudará a alertar sobre possíveis problemas de saúde aos usuários. O sistema fornecerá uma análise personalizada para cada usuário com base em suas rotinas cadastradas manualmente ou coletadas automaticamente por sensores do dispositivo. Com essas informações, o sistema oferecerá alertas sobre a saúde do usuário e recomendações para melhorar seu bem-estar geral de acordo com análise médica recomendada. Após a coleta das informações, os resultados ficarão disponíveis para visualização no banco de dados pelo médico especialista, e este número de médicos em Manaus registrou crescimento de 229% na quantidade de médicos. A cidade conta agora com 283 médicos e médicas — recebeu 197 novos profissionais entre janeiro de 2023 e junho de 2024. Em dezembro de 2022, eram 86.		
Research Scope	- **Coleta de Dados Automatizada:** Sensores do relógio inteligente irão coletar informações sobre a saúde física (ex: frequência cardíaca, nível de atividade física, qualidade do sono), nutrição (através de inputs manuais ou automáticos de alimentação) e indicadores de saúde mental (ex: níveis de estresse, padrões de sono). - **Rotinas Personalizadas:** Usuários poderão cadastrar rotinas personalizadas no aplicativo Samsung Health, como horários de refeições, sono, atividades físicas e outros hábitos de vida. Além disso, o sistema será capaz de detectar padrões		

	automaticamente de rotina de acordo com os dados coletados automaticamente. - **Análise de Dados e IA:** Algoritmos de IA e Big Data serão usados para processar e analisar os dados coletados. A IA fará projeções e estimativas sobre a saúde do usuário, fornecendo métricas personalizadas, tais como calorias queimadas, ingestão nutricional, padrões de sono, níveis de estresse, entre outros. - **Alertas de Saúde:** O sistema emitirá alertas automáticos quando os dados indicarem desvios preocupantes dos níveis de saúde física ou mental (ex: aumento repentino na frequência cardíaca, aumento no nível de estresse ou falta de sono adequado). - **Recomendações Personalizadas:** Com base nos dados analisados, o sistema fornecerá recomendações para a melhoria da saúde física e mental, incluindo sugestões sobre nutrição, rotinas de exercício físico e práticas de relaxamento ou meditação
Output/ Specifications	- Um sistema funcional e escalável capaz de analisar de forma precisa e personalizada a saúde física, nutricional e mental dos usuários, fornecendo alertas e recomendações que visem melhorar sua qualidade de vida e prevenir problemas de saúde. A partir dos dados coletados e analisados, o sistema poderá gerar conteúdo informativo e personalizado. Esse conteúdo pode ser oferecido diretamente no aplicativo Samsung Health, por meio de notificações ou seções dedicadas, como dicas de saúde, desafios personalizados, sugestões de exercícios e nutrição baseados no histórico do usuário
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)
Comments	**Valor total: R$ 8 milhões**

Project Name	ClinicWS - Intelligent support for assessment of sudden illness and sleep quality	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	24 months	Document Date	Ago/2024
Summary/ Goal	The project aims to develop an intelligent and portable system integrated with wearable devices that will enable real-time data collection, monitoring, and evaluation related to sudden illness and sleep quality. By utilizing cutting-edge technologies such as IoT, machine learning, and data science, the system will provide a comprehensive platform for remote clinical supervision, offering proactive and reliable support for the prevention and early detection of health anomalies. The goal is to significantly improve the quality of medical follow-up, enhance the effectiveness of adverse event prevention, and provide an accessible and efficient tool for both healthcare professionals and patients.		
Research Scope	- Data Acquisition: Use of Samsung wearables and new readers for monitoring sleep disruptions, cardiovascular pressure, stress levels, melatonin levels, and heart rate. - User Platform: Configuration of wearables for sudden illness and sleep quality monitoring, and receiving results via a web platform. - Processing Platform: Data storage, machine learning for clinical detection, and data science for statistical disease progression analysis and patient mapping. - Web Platform: Web-based application for accessing results, online medical records, and integration with central health system supervision.		
Output/ Specifications	- Wearable Integration: Full compatibility with Samsung wearable devices, with new configurable features for monitoring sudden illness and sleep quality. - Data Acquisition and Transmission: Real-time data collection and transmission via IoT communication, using biosensors and new readers for measurements of sleep, cardiovascular pressure, stress, melatonin levels, and heart rate. - Machine Learning for Clinical Detection: Implementation of machine learning algorithms for the detection of clinical anomalies and continuous patient condition assessment. - User and Web Platforms: Intuitive web application, accessible via notebooks, tablets, and smartphones, for remote and real-time patient monitoring, including online medical records and integration with central health system supervision. - Data Storage and Security: Secure storage of collected data with advanced encryption,		

	ensuring the protection and confidentiality of patient information. - Automated Reporting: Automatic generation of reports for healthcare professionals based on real-time data analysis and patient progress mapping.
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)
Comments	**Valor do projeto: R$ 7 milhões**

Project Name	**STRATÉGIE**	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	24 meses	Document Date	Ago/2024
Summary/ Goal	Distribuição geográfica, muitas vezes referida apenas como distribuição, é um termo utilizado pela biologia, geografia e linguística para delimitar a área em que determinada ocorrência se verifica (Giullietti & Pirani, 1988). No caso do cometimento de crimes, a distribuição geográfica aponta os locais em que condutas consideradas como crime, pela legislação em vigor, mais ocorrem (Beato, 2019). Esse trabalho é desenvolvido com base no registro das ocorrências criminais, que passam a ser georreferenciadas no mapa, formando uma mancha (daí o nome de **mancha criminal**). O índice mais utilizado atualmente no Brasil é o IVC (Índice de Violência Criminalizada). Tal índice é formado pela conjugação de indicadores que são constituídos por grupo de variáveis criminais (Lira, 2015). Por meio da correlação com informações socioeconômicas, o IVC visa a facilitar uma aproximação do entendimento sobre os fatores estruturais que provavelmente influem na dinâmica criminal, bem como fornecer subsídios para a proposição de políticas públicas e estratégias de prevenção e controle da violência, bem como servir de alerta para que a própria população possa ficar vigilante no que tange a sua segurança. O projeto **STRATÉGIE** tem como objetivo desenvolver uma plataforma de software baseada em IA possa criar uma mancha criminal baseado em dados da Secretaria de Segurança Pública colhidos por meio de smartphones Samsung e Anéis Samsung e alertar seus usuários sobre sua movimentação física em possível área de risco (em se tratando de local com índice elevado de violência), a fim de que eles fiquem mais atentos à sua segurança.		

Research Scope	- Análise dos dados da mancha criminal da secretaria de segurança utilizando Ciência de Dados e Inteligência Artificial - Desenvolvimento de da plataforma Web/Mobile dotada de IA para geração de uma nova mancha criminal e alerta de usuários
Output/ Specifications	- Dados coletados de smartphones e anéis utilizados por policiais militares dos batalhões - Big Data dos dados criminais - plataforma Web/Mobile dotada de IA - Pesquisa e publicação de artigos em revistas de alto impacto sobre o tema.
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)
Comments	Valor total: R$ 4 milhões

Project Name	**SMARTCLIMATE**	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	24 months	Document Date	Ago/2024
Summary/ Goal	Proposal for an innovative software development project applying numerical models and Artificial Intelligence for monitoring and forecasting extreme weather events, such as: droughts and floods. The development of these models will contribute to supporting decision makers in planning actions to reduce and mitigate extreme weather events.		
Research Scope	- Development of numerical models and artificial intelligence for monitoring and forecasting precipitation and air temperature. - Development of numerical models and artificial intelligence for monitoring and forecasting river levels. - Development numerical models and artificial intelligence for monitoring and forecasting river discharge. - Development of numerical models and artificial intelligence for monitoring and forecasting the flood area - Research team allocation, composed by professors, students and other professionals. - Project execution management according to the best practices and ITLaw rules		
Output/ Specifications	- Anonymous dataset of climatic and hydrological parameters that support decision-making to mitigate extreme climate events. - Numerical models and artificial intelligence software for diagnosis and prognosis of extreme weather events necessary for planning and decision making		
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)		
Comments	**Valor do Projeto: R$ 5 milhões**		

Request for Proposal

Project Name	GreenChip para administração de medicamentos em pacientes crônicos.	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)		Contact Point (Local)	CESIBIOLAB/EST e CESIT/UEA
Project Duration	36 months	Document Date	Ago/2024
Summary/ Goal	O produto será um chip biodegradável, produzido com matéria prima vegetal, extraída da resina de espécies arbóreas concentradas em áreas de exploração florestal. A proposta é usar resina natural, extraída de árvores. Um dispositivo dessa natureza para administrar medicações pode ser facilmente aceito pelo organismo, reduzindo problemas de rejeições e trazendo alívio ao corpo. Pesquisas recentes com material de outra natureza, publicado na *Science* destacou que um dispositivo biodegradável pode se tornar em breve uma importante estratégia para o alívio de dores, atuando por meio de um implante no corpo sem a necessidade de medicamentos. Por isso, os responsáveis pela iniciativa acreditam que o aparelho, primeiro do tipo, será uma alternativa às medicações analgésicas com alto poder aditivo, como os opioides. O biochip proposto será construído de resina natural com análise química, trabalhado para que não perca as propriedades biodegradáveis, adicionando-se principalmente nanopartículas, definidas como um pequeno objeto que se comporta como uma unidade inteira em termos de seu transporte e propriedades e conterá circuitos eletrônicos que possam ser codificados para administrar medicamentos e ser facilmente aproveitado pelo corpo humano, usando impressão 3D (será quimicamente projetado para essa funcionalidade na produção). O diferencial competitivo é desenvolver um chip biodegradável programado para administração do medicamento, não existe ainda no mercado nenhum produzido com resinas de árvores, existe chip comestível que administra medicamentos enviando alerta celular para tratar principalmente doenças crônicas. O que existe no mercado é ofertado envolvendo custos elevados e o proposto reduzirá esses custos ao utilizar matéria prima disponível em abundância e sem a necessidade de retirada das árvores. Um biochip pode proporcionar vantagens para o cliente na administração do medicamento, programando dosagens, reduz os		

	efeitos/consequências na absorção pelo corpo, efeitos colaterais, pode melhorar o compromisso num tratamento, garantindo que seja cumprido de forma eficiente e de acordo com cronograma estabelecido, pode ser personalizado, reduzir os riscos de rejeição e infecções. A produção de chips biodegradáveis é uma tecnologia muito recente e lançar um com apelo amazônico, reduzindo custos, será uma grande vantagem de mercado e demonstração de uso dos recursos florestais de forma sustentável. Em resumo, a proposta é pesquisar e identificar materiais biodegradáveis para gerar um biochip a partir de resina vegetal, mantendo suas propriedades e que possam ser utilizados como filamentos para impressão 3D. Além disso, serão dotados de circuitos eletrônicos que serão responsáveis pelo monitoramento das respostas corporais à administração de medicamentos.
Research Scope	- Levantamento de espécies - Análises morfológicas para identificação - Coleta da resina - Análise biológica da resina - Definir os critérios para utilização de nanopartículas - Aplicar técnicas físicas para síntese de nanopartículas - Tabulação e seleção de nanopartículas - Preparo das amostras - Identificação da composição química da resina - Inserção de nanopartículas - Análises de manutenção das propriedades biodegradáveis - Aplicar técnicas de microscopia eletrônica para identificar a existência de nanopartículas - Análises de manutenção das propriedades biodegradáveis - Teste de resistência do material biodegradável - Desenvolver soluções voltadas a *waerables* e *smartphones* que possibilitem o acompanhamento e aplicação das medicações a fim de garantir que a dosagem e a periodicidade estejam de acordo com as orientações do profissional de saúde.
Output/ Specifications	- Desenvolver produto de acordo com as especificações mercadológicas para que seja possível ser utilizado por profissionais de saúde em clínicas e hospitais - A amostra será composta por no mínimo 100 pacientes portadores de doenças crônicas ou hospitalizados

	- Proporcionar vantagens para o cliente na administração do medicamento, programando dosagens, reduzindo os efeitos/consequências na absorção pelo corpo, previsão de diminuição dos efeitos colaterais, garantir a administração das doses de acordo o cronograma estabelecido, reduzir os riscos de rejeição e infecções
Requests	Equipe composta por biólogo, engenheiros florestais, desenvolvedores, especialista em machine learning, farmacêutico e químico, além de estudantes de graduação, mestrado e doutorado.
Comments	Technical Proposals must be submitted until **September/2024**

1. Motivation

Digital transformation brings with it a new way of seeing the world. Operational processes, before performed bureaucratically, become increasingly optimized, while assistance earns tools that broaden patient safety and satisfaction. With smartphones, wearables and the widespread advancement of health mobility, it is urgent to think of ways to integrate data collected by applications to the patient's medical records in order to ensure the expected results with the adoption of these technologies.

With the Internet of Things (IoT), connected devices collect vital signs and other health information from real-time individuals, generating a large mass of data. This collaborates for the continuity of treatment, since the monitoring of the patient's vital signs can be done remotely, 24 hours a day, seven days a week. This provides the health professional accurate information, which allow the distance care and monitoring of the individual's health status in real time. In addition, technology assists and guides the patient about simple actions, which must be made outside the hospital environment.

2. Purpose

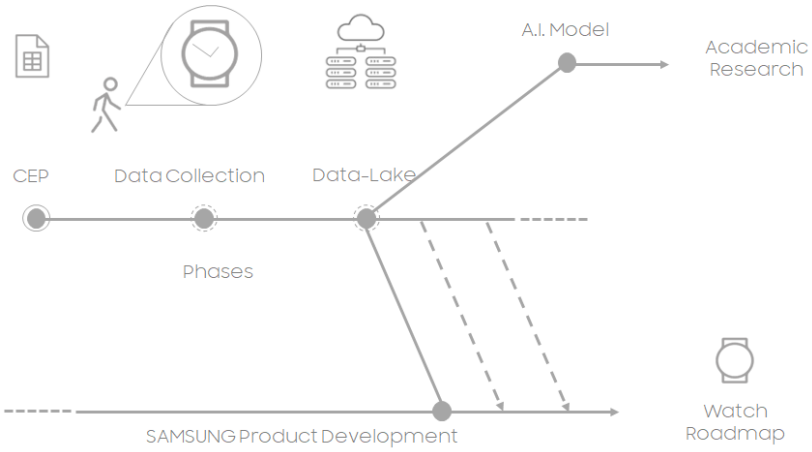
SRBR intends to receive formal proposals of Innovative Software Development project proposal applying Artificial Intelligence techniques to implement, or at least develop proof-of-concept models for human digital-bio-markers monitoring and identify trends on health conditions.

3. Confidentiality

The contents of the present RFP is fully confidential and should be handled with maximum care by all bid participants.

4. Objectives:

The diagram below represents a simplified Innovative Software Development project main phases. You are invited to present a development proposal to turn them into high-quality, robust, and fully functional software development research and development project. The commercial software solution is not mandatory to be part of the project scope proposal. It can be considered as a potential evolvement of the concepts developed as of the research scope; but it is an exclusive decision of Samsung according to its product lineup.



5. Deliverables

- Anonymous data-set of digital-bio-markers and any proper additional related information (like gold-standard exams and diagnostics) of volunteers enough to describe its health conditions;
- Computational AI models, algorithms and software modules to process digital-bio-markers to generate insights, recommendations and/or health trend conditions,
- And Academic publications to document and share the academic relevant achievements

6. PROJETO SCOPE

- XXXXX
- XXXXX

7. EXPECTED RESULTS

a) XXXXXXXXXXXXXXXXXX

b) XXXXXXXXXXXXXXXXXX

8. ASSUMPTIONS

The following assumptions are requirements to the success of this project:

- XXXXXXXXXXXXXXXX
- XXXXXXXXXXXXXXXX

9. PROJECT DEVELOPMENT

The execution plan shows the main necessary activities to conclude all the goals of this project. These activities are preliminaries, thus, they may change during the development of project. Any change of the content must be in common agreement between the parts.

10. ACTIVITIES

- Name of the activity: Explanation of the activity itself.
- Name of the activity: Explanation of the activity itself
- XXX

11. SCHEDULE OF ACTIVITIES

<Please, insert a simple table (or GANT GRAPHIC) showing the activities during the 18 months of the project. >:

Activity	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12

Activity	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24

12. MILESTONES

<A set of activities must complete a Milestone>. Please, include the milestones and explain the deliverable (surveys, reports, demos, proof of concepts, etc):

- Milestone 1 at M3: XXX
- Milestone 2 at M5: XXX
- Milestone 3…

13. RESOURCES

The estimated budget to implement this project is **R$ XXXXXXX (XXXXXXXXXXXXXXXXXXXX)**. See the detailed description of each item in the table in Section 6.

Items	**Total (R$)**	**%**
Equipments		
Human Resources		
Books		
Materials		
Trips		
Training		
Technical Services		

TOTAL Expenses		
Admin tax		
TOTAL		

14. DETAILS OF NEEDED RESOURCES

A) EQUIPMENTS

A1) HARDWARE

XXXXXX

XXXXXX

Total Cost **of R$ XXXXXXXXXXXXX**

A2) SOFTWARE

XXXXXX

XXXXXX

Total Cost of **R$ XXXXXXXXXXXXX**

B) HUMAN RESOURCES

<Estimate the number of researchers that must participate in the project and include their roles and responsibilities>

B1) DIRECT RH

- Professors: <up to 02>
  - Main Researcher: <explain main role>
- Undergraduates (iniciação científica)
  - <role in the project>
  - <role in the project>
- Master Students
  - Role in the project>
  - Role in the project>
- PhD Students

    - Role in the project>
    - Role in the project>
- Post Doctorate Students
    - Role in the project

C) BOOKS & JOURNALS

As instruments of research and capacitating will be acquired books in the research field of the project with an estimated cost of **R$ XXXXXXXX.**

D) MATERIALS

To support the research activities will be acquired desk materials and other informatics goods (tonner for printers, pencils & pens etc) with an estimated cost of **R$ XXXXXXXX**.

E) TRIPS

Resources needed to participate in national and international conferences with an estimated cost of **R$ XXXXXXXX.**

F) TRAINING

Cost related with training and capacitating, (conference fees, for instance), with an estimated cost of **R$ XXXXX.**

G) TECHNICAL SERVICES

It is expected a consultant to support technically the project team in specific research area <explain role and responsibilities> with an estimated cost of **R$ XXXXX** (up to 20% of the human resources cost).

H) ADMIN TAX

Cost related to University, Institute/Faculty (up to 20% of the project cost).

Request for Proposal*

* This document presents the idea of what the future project will be and its main objectives. However, we will refine it as we align with Samsung Brazil, adapting it to the partner company's demands.

Project Name	Helix - DNA Data Storage for High Density and Durability	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	Jose Cambeiro da Cunha Junior
Project Duration	36 months	Document Date	September/2024
Summary/ Goal	Develop an innovative data storage technology using DNA molecules, combining biotechnology and computer science to create a high-density, durable, and sustainable storage solution, capable of meeting the growing global demand for storage capacity.		
Research Scope	- Develop an innovative digital storage solution based on DNA molecules, leveraging their ability to encode vast amounts of data in an extremely compact and efficient manner; - Integrate cutting-edge knowledge in biotechnology and computer science, applying DNA synthesis, sequencing, and encoding techniques to create a robust data storage architecture; - Create a data storage system with ultra-high density, virtually unlimited durability, and sustainability, enabling long-term data preservation and surpassing the limitations of traditional methods		
Output/ Specifications	- Advanced digital storage solution utilizing DNA molecules, enabling unprecedented data density and efficiency; - Sophisticated data storage architecture that integrates cutting-edge biotechnology and computer science to ensure reliability and scalability; - High-density data storage system designed to be compact, exceptionally durable, and energetically sustainable, addressing both current and future storage needs.		
Requests	Project in partnership with university team (Professors, Phd, Msc and Undergraduates Students)		
Comments	Technical Proposals must be submitted until **September/2024**		

1. Motivation

The motivation for IT companies to invest in DNA data storage is based on the growing need for highly efficient and durable storage solutions. With the exponential increase in data generation and the demand for long-term storage, traditional methods such as hard drives and SSDs face limitations in capacity and durability. DNA offers unmatched storage density, allowing large volumes of data to be stored in an extremely small space. This efficiency could revolutionize the way data is stored,

reducing the cost and space required for storing large amounts of information.

Furthermore, DNA storage is appealing due to its exceptional durability. DNA can preserve information for thousands of years, which is significantly longer than the lifespan of conventional storage devices. For companies dealing with large volumes of valuable data, the ability to ensure data integrity and accessibility over such long periods is a major asset. Investing in DNA storage technologies not only promises to overcome the limitations of current methods but also positions companies at the forefront of innovation in data storage, providing a sustainable and long-term solution for the future of technology.

2. Purpose

The purpose of DNA data storage is to provide a highly efficient and durable solution for storing large volumes of information. By utilizing the extraordinary density of DNA, it is possible to store data in very small spaces with energy efficiency, as well as with a durability that can extend for thousands of years, surpassing the limitations of traditional storage methods.

3. Confidentiality

The contents of the present RFP is fully confidential and should be handled with maximum care by all bid participants.

4. Objectives:

- Design a groundbreaking digital storage approach using DNA molecules, capitalizing on their capability to encode large quantities of data in a highly compact and efficient format;
- Combine state-of-the-art expertise in biotechnology and computer science, employing techniques such as DNA synthesis, sequencing, and encoding to develop a resilient data storage framework;
- Develop a proof of concept for a data storage solution that provides exceptional density, nearly limitless longevity, and environmental sustainability. This solution should facilitate long-term data retention and overcome the limitations of conventional storage methods.

5. Deliverables

- Research a high-density data storage system engineered to be compact, exceptionally durable, and energy-efficient, addressing both current and future storage needs.
- Design a sophisticated data storage architecture that seamlessly integrates cutting-edge biotechnology with computer science, ensuring both reliability and scalability.
- Develop a proof of concept for an advanced digital storage solution that utilizes DNA molecules, enabling unprecedented data density and efficiency.

6. PROJECT SCOPE

- Develop a proof of concept for a revolutionary digital storage solution based on DNA molecules, harnessing their capability to encode vast amounts of data in an extremely compact and efficient manner;
- Integrate cutting-edge knowledge in biotechnology and computer science, applying DNA synthesis, sequencing, and encoding techniques to create a robust data

storage architecture;

- Create a data storage system with ultra-high density, virtually unlimited durability, and sustainability, enabling long-term data preservation and surpassing the limitations of traditional methods

7. EXPECTED RESULTS

a) A pioneering system using DNA molecules for unprecedented data density in a compact format.

b) Combining biotechnology and computer science to create a reliable, scalable storage framework with DNA synthesis, sequencing, and encoding.

c) High-density, long-lasting, and energy-efficient storage, offering a sustainable alternative to traditional methods.

8. ASSUMPTIONS

The following assumptions are requirements to the success of this project:

- Investments in equipment and materials, and human resources.
- A multidisciplinary team consisting of Molecular Biologists, Computer Scientists, Biotechnologists, Project Managers, Market and Regulatory Consultants.
- Integration between the Samsung Brazil team and the State University of Amazonas team.
- Periodic reviews to monitor the technical and administrative execution of the project.
- Establishment of a clear and effective communication system among all stakeholders, ensuring transparency, alignment of expectations, and prompt resolution of issues that may arise during the project execution.

9. PROJECT DEVELOPMENT

The execution plan highlights the key activities needed to achieve the project's objectives. These activities may be subject to changes during the course of the project. Any modifications to the content must be agreed upon consensually by the involved parties

10. ACTIVITIES

- **1**. **Research and Literature Review**

  • Objective: Understand the state of the art and progress of DNA storage technologies.

  • Tasks:

  - Survey scientific articles on DNA data storage.
  - Analyze the methods of encoding and decoding information in DNA.
  - Study the capabilities and challenges of using DNA as a storage medium.

- **2. Project Scope Definition**

  • Objective: Define the project objectives, expected results, and success metrics.

• Tasks:

- Define what types of data will be stored (text, images, videos, etc.).
- Determine the volume of data to be encoded and stored in DNA.
- Establish technical and cost requirements.

- **3**. **Data Encoding**
  • Objective: Transform digital data into DNA sequences.
  • Tasks:
  -Study data encoding algorithms in nucleotide sequences (A, T, C, G).
  - Implementation of encoding algorithms that minimize errors and maximize efficiency.
  - Perform computer simulations to validate the integrity of the encoded data.
- **4**. **DNA Synthesis**
  • Objective: Physically create the DNA sequences that represent the data.
  • Tasks:
  - Identify suppliers or laboratories capable of synthesizing DNA sequences.
  - Analyze the costs and time required to synthesize the data into DNA.
  - Request and validate the synthesis of DNA samples.
- **5**. **Physical Storage of DNA**
  • Objective: Evaluate ways to physically store DNA.
  • Tasks:
  -Research the ideal conditions for preserving DNA (temperature, environment, etc.).
  - Test different storage methods (microtubes, silicon wafers, etc.).
  - Evaluate the durability and economic viability of large-scale storage.
- **6**. **Data Decoding**
  • Objective: Recover digital data from DNA sequences. • Tasks:
  -Develop or use DNA sequencing tools to read the information.
  - Decode the nucleotide sequences back into binary data.
  - Test the integrity and accuracy of the retrieved data.
- **7**. **Validation and Testing**
  • Objective: Verify the fidelity of the data storage and retrieval process.
  • Tasks:
  -Compare the stored data with the retrieved data to check for possible errors.
  - Analyze the error rate during the reading and writing process.
  - Develop error correction methods to improve accuracy.
- **8**. **Cost and Time Optimization**
  • Objective: Reduce the costs involved in the DNA storage process.
  • Tasks:
  - Analyze the costs of DNA synthesis, storage and reading.
  - Identify areas where the process can be optimized (algorithms, synthesis technology, etc.).
  - Explore emerging methods of more efficient and affordable DNA synthesis and sequencing.

- **9**. **Documentation and Publication of Results**
  • Objective: Document the project and share the results with the scientific community.
  • Tasks:

- Create technical reports and scientific articles detailing the project's findings.

- Participate in conferences or workshops in the area of data storage.

- Publish the results in relevant journals in the area of bioinformatics and biotechnology.

- **10**. **Proposal for Future Improvements**

  • Objective: Identify the limitations of the project and suggest improvements for future research.

  • Tasks:

  -Evaluate the strengths and weaknesses of the project.

  - Explore new technologies or methods to improve efficiency and reduce errors.

  - Suggest collaborations or partnerships with other laboratories or companies to expand the project.

11. SCHEDULE OF ACTIVITIES

Activity	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
1	X	X	X	X								
2	X	X	X									
3			X	X	X	X	X	X				
4								X	X	X	X	X
5												
6											X	X
7												
8												
9												
10												

Activity	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24
1												
2												
3												
4												
5	X	X										
6		X	X	X	X	X	X					
7					X	X	X	X	X			
8							X	X	X	X		
9									X	X	X	
10										X	X	X

12. MILESTONES

- Milestone 1 at M8: Data encoding and initial validation
- Milestone 2 at M14: DNA Synthesis and Storage testing
- Milestone 3 at M21: Data decoding and comprehensive validation
- Milestone 4 at M24: Final reporting and proposal for future research

13. RESOURCES

The estimated budget to implement this project is **R$ 14.073.350 (Fourteen million, seventy-three thousand, three hundred and fifty Reais)**. See the detailed description of each item in the table in Section 14.

Items	Total (R$)	%
Equipments	4.182.580,00	29,72
Human Resources	5.027.600,00	35,72
Infrastructure	1.000.000,00	7,11
Books	50.000,00	0,36
Materials	788.500,00	5,60
Trips	80.000,00	0,57
Training	30.000,00	0,21
Technical Services	100.000,00	0,71
TOTAL Expenses	**11.258.680,00**	**80,00**
Admin tax	2.814.670,00	20,00
TOTAL	**14.073.350,00**	**100,00**

14. DETAILS OF NEEDED RESOURCES

A) EQUIPMENTS

A1) HARDWARE

Equipment	Quantity	Estimated Price (in R$)	Description/Note
Next-Generation DNA Sequencer (NGS)	1	R$ 1.200.000,00	Core equipment for NGS; prices vary according to capacity and manufacturer
Library Preparation Machine	1	R$ 560.000,00	Automates sample preparation for sequencing
DNA Fragment Analyzer	1	R$ 250.000,00	For analyzing the size and quantity of DNA fragments before sequencing

Real-Time Thermocycler (qPCR)	1	R$ 220.000,00	Used for nucleic acid quantification, essential in library preparation
Bioinformatics Workstation	2	R$ 120.000,00	High-performance computers for sequencing data analysis
Data Storage Server	1	R$ 112.000,00	Dedicated server for storing and processing large volumes of data
-80°C Freezer	1	R$ 60.000,00	Storage for biological samples and reagent
Ultracentrifuge	1	R$ 100.000,00	For the separation and purification of DNA/RNA samples
Benchtop Centrifuge	1	R$ 40.000,00	With rotor for 1.5-2 mL microtubes
Thermocycler (PCR)	1	R$ 80.000,00	For DNA amplification
Analytical Balance	1	R$ 5.580,00	Precision of 0.1 mg
Gel Electrophoresis Chamber	2	R$ 20.000,00	For separation of DNA/RNA fragments
UV Transilluminator	1	R$ 15.000,00	For visualization of agarose gels
Autoclave	1	R$ 40.000,00	Sterilization of materials
Water Purification System	1	R$ 45.000,00	To produce laboratory-grade water
Laminar Flow Hood	1	R$ 60.000,00	For sterile handling of samples
Gel Documentation	1	R$ 40.000,00	Captures images of

System			electrophoresis gels
Computers	15	R$ 75.000,00	
Printers	5	R$ 50.000,00	

Total Cost **of R$ 3.092.580,00**

A2) SOFTWARE

Software	**Quantity**	**Estimated Price (in R$)**	**Description/Note**
Software de Análise de Dados de Sequenciamento	1	R$ 500.000,00	Software licenses for bioinformatics analysis (such as CLC Genomics, BaseSpace)
Banco de Dados de Referência	3	R$ 90.000,00	Subscriptions to genomic databases (NCBI, Ensembl)
Outros (Tecnologia chip)		R$ 500.000,00	

Total Cost of **R$ 1.090.000,00**

B) HUMAN RESOURCES

B1) DIRECT RH

- Professors:
  - 01 General Coordinator;
  - 01 Technical Coordinator in Molecular Biology;
  - 03 Senior Researchers in Molecular Biology;
  - 02 Senior Researchers in IT

- Undergraduates (iniciação científica)
  - 06 Junior Researchers
  - 06 Junior Researchers in IT

- PhD Students
  - 06 Mid-level Researchers;
  - 01 Mid-level Researchers in IT

Total Cost of R$ 3.477.600,00

B2) INDIRECT RH

- 02 Project Management Support Staff
- 03 Project Analyst
- 03 Project Assistant

Total Cost of R$ 1.550.000,00

C) BOOKS & JOURNALS

As instruments of research and capacitating will be acquired books in the research field of the project with an estimated cost of **R$ 50.000,00.**

D) MATERIALS

To support the research activities, consumables and reagents will be acquired (e.g., micropipette tips, library preparation kits, microcentrifuge tubes, PCR reagents, DNA/RNA extraction kits, among others) with an estimated cost of **R$ 788.500,00.**

E) TRIPS

Resources allocated for participation in international conferences to present the achieved results, respecting the confidentiality agreed upon between the parties wih an estimated cost of R$ 80.000,00

F) TRAINING

In synthetic biology in the construction of microorganisms, metabolic engineering and adaptive evolution, Tools for process optimization and scaling;
Training and practices in Bioinformatics, focusing on
Genomics and Transcriptomics;
TAdvanced DNA Sequencing. estimated cost of **R$ 30.000,00**

G) TECHNICAL SERVICES

Considering the high level of specificity of the equipment used in this project, it is anticipated that specialized technical services will be required for their maintenance over the 36-month execution period. The estimated cost for these services is **R$ 100,000.00**, ensuring the full functionality of the equipment and the continuity of the activities outlined in the schedule.

H) ADMIN TAX

Cost related to University, Institute/Faculty: **R$ 2.814.670,00**.

Request for Proposal

* This document presents the idea of what the future project will be and its main objectives. However, we will refine it as we align with Samsung Brazil, adapting it to the partner company's demands.

Project Name	**Mellitus: Revolutionizing diabetes monitoring with wearables and AI**	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	18 months	Document Date	Ago/2024
Summary/ Goal	The main objective of this project is to improve diabetes monitoring through the use of wearable devices and AI technology that can analyze vital signs and predict health risks, offering personalized health insights for diabetes management.		
Research Scope	- Correlate risk factors related to diabetes through the monitoring of vital signs; - Use wearables devices (such as smartwatch and smart ring) to continuously collect patient data; - Apply artificial intelligence to analyze data and predict diabetic risks; - Develop models that provide personalized healths alerts; - Explore new applications for wearables in healthcare, particularly for diabetes monitoring.		
Output/ Specifications	- Creating of AI models that correlate various health parameters and predict risks; - Wearable technology integration for real-time monitoring and diabetes management; - Development of personalized insights and alerts based on AI analysis.		
Requests	Project in partnership with University of the State of Amazonas team (Professors, Post-docs, Phd and Msc students)		
Comments	Technical Proposals must be submitted until **September/2024**		

1. Motivation

Diabetes is a chronic condition that affects millions globally, requiring constant monitoring to avoid complications. Patients often struggle with managing the disease due to a lack of continuous, precise data on their glucose levels and other vital signs. This can lead to severe outcomes, such as diabetic comas.

The increasing availability of wearable devices offers a new frontier in healthcare by providing a way to continuously monitor vital signs. These devices, paired with AI, can generate large amounts of data that can be analyzed to provide critical insights. This technology can be leveraged to create a system that assists diabetic patients in better managing their health.

The use of AI allows for the correlation of various internal and external parameters, identifying patterns that are difficult for humans to detect. The ultimate goal is to create a comprehensive monitoring and alert system that helps prevent emergencies and improve overall health management.

Given the rising costs and challenges associated with diabetes management, innovative solutions are critical. This project aims to address these challenges by creating a system that not only monitors but also predicts risks, potentially reducing the need for costly medical interventions.

2. Purpose

To develop an AI-driven system for continuous diabetes monitoring using wearable technology, aiming to improve patient outcomes by providing personalized health insights.

3. Confidentiality

The contents of the present RFP is fully confidential and should be handled with maximum care by all bid participants.

4. Objectives:

- Develop AI models that correlate multiple health parameters;
- Use wearable devices to collect real-time data from diabetic patients;
- Create a system that provides personalized health alerts to users;
- Explore new applications for wearables in healthcare;
- Innovate diabetes management methods to reduce the risk of diabetic comas.

5. Deliverables

- AI models for predicting diabetic risks based on real-time data;
- Integration of wearable devices for continuous health monitoring;
- Development of personalized health alerts and insights;
- Reports on the efficacy of the system in managing diabetes;
- New applications for wearable technology in the healthcare sector.

6. PROJECT SCOPE

- Develop AI models for health data analysis;
- Integrate wearable technology for diabetes monitoring;
- Collect and process real-time data;
- Develop a system for health alerts and risk prediction;
- Collaborate with healthcare professionals for system validation.

7. EXPECTED RESULTS

a) Accurate prediction of diabetic risks through AI analysis;
b) Improved diabetes management through personalized health alerts;
c) Reduction in diabetic emergencies (e.g., comas);
d) Enhanced patient compliance with health monitoring routines;
e) Greater market potential for wearables in healthcare applications;
f) Positive impact on the healthcare industry, especially in diabetes care;

g) Validation of the AI system's effectiveness in real-world scenarios.

8. ASSUMPTIONS

The following assumptions are requirements to the success of this project:

- Wearable devices will provide accurate and reliable data;
- AI models will successfully correlate health parameters with diabetic risks;
- Patients will consistently use the wearable devices for data collection;
- The will be collaboration from healthcare professionals for system validation;
- Communication between the teams of the investing company and the executing ICT will be agile and efficient.

9. PROJECT DEVELOPMENT

The execution plan shows the main necessary activities to conclude all the goals of this project. These activities are preliminaries, thus, they may change during the development of the project. Any change of the content must be in common agreement between the parts.

10. ACTIVITIES

1. **Literature Review and Initial Problem Analysis:** This stage involves reviewing existing literature to understand the main advancements in the field and facilitate the start of activities by preliminarily modeling the problem.
2. **Data Extraction and Storage:** This includes the extraction and monitoring of data collected by wearable devices used in the research. It also involves creating a specific database that will be referenced throughout the project.
3. **Data Preparation:** This involves developing systems and models that transform the data to make it applicable for Machine Learning algorithms.
4. **Model Creation and Pattern Analysis:** This is one of the most crucial phases of the research, where we analyze emerging patterns from the data and develop models to predict risks associated with diabetes.
5. **Model Deployment:** After completing the models, a Proof of Concept (PoC) will be created to test the solution's validity with a specific target audience.

11. SCHEDULE OF ACTIVITIES

Act 01 - Literature Review and Initial Problem Analysis
Act 02 - Data Extraction and Storage
Act 03 - Data Preparation
Act 04 - Model Creation and Pattern Analysis
Act 05 - Model Deployment

Activity	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
Act 01	X	X	X									
Act 02		X	X	X	X	X	X	X	X			
Act 03			X	X	X	X	X	X	X	X	X	
Act 04						X	X	X	X	X	X	X
Act 05												

Activity	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24
Act 04	X	X	X									
Act 05	X	X	X	X	X	X						

12. MILESTONES

- Milestone 1 at M9: Data collection and model development
- Milestone 2 at M12: System integration and testing
- Milestone 3 at M15: Validation and reporting;
- Milestone 4 at M17: Market exploration

13. RESOURCES

This section of the project requires more time for study and negotiation with the investors to determine all investment values.

14. DETAILS OF NEEDED RESOURCES

This section of the project requires more time for study and negotiation with the investors to determine all investment values.

A) EQUIPMENTS

A1) HARDWARE

Total Cost **of R$**

A2) SOFTWARE

Total Cost of **R$**

B) HUMAN RESOURCES

This part of the project will be more clearly defined as the type and size of the available investment are determined in future rounds of discussions about the project.

<Estimate the number of researchers that must participate in the project and include their roles and responsibilities>

B1) DIRECT RH

- Professors: <up to 02>
    - Main Researcher: <explain main role>
- Undergraduates (iniciação científica)
    - <role in the project>
    - <role in the project>
- Master Students
    - Role in the project>
    - Role in the project>
- PhD Students
    - Role in the project>
    - Role in the project>
- Post Doctorate Students
    - Role in the project

Total Cost of R$

B2) INDIRECT RH

- 01 Project Management Support Staff
- 02 Project Analyst
- 03 Project Assistant

Total Cost of R$

C) BOOKS & JOURNALS

D) MATERIALS
Not applicable.

E) TRIPS

Not applicable.

F) TRAINING

Not applicable.

G) TECHNICAL SERVICES

Not applicable.

H) ADMIN TAX

Cost related to University: **R$**

Request for Proposal*

* This document presents the idea of what the future project will be and its main objectives. However, we will refine it as we align with Samsung Brazil, adapting it to the partner company's demands.

Project Name	Psiquê: Detection and Support in Anxiety Crises and Neurodegenerative Diseases Using Wearables	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	Jose Cambeiro da Cunha Junior
Project Duration	24 months	Document Date	Set/2024
Summary/ Goal	Development and implement an innovative system for early detection and support in anxiety crises and panic attacks using wearable technology, aiming to improve users' quality of life and mental well-being.		
Research Scope	- Develop algorithms for early detection of anxiety crises using wearable technology; - Implement continuous biometric data analysis systems for real-time monitoring; - Integrate personalized intervention techniques into the wearable platform; - Design a machine learning framework for adapting interventions based on user data; - Build an interactive app or platform that communicates with wearable devices.		
Output/ Specifications	- Functional system for early detection and support in anxiety crises and panic attacks; - Implementation of detection algorithms based on biometric data; - Development of an app or platform integrated with wearables.		
Requests	Project in partnership with University of the State of Amazonas (UEA) (Professors, Post-docs, PhD and MSc students, specialists in areas such as Biology, Pharmacy, Psychiatry, Software and Hardware Engineering, IT, AI and Market)		
Comments	Technical Proposals must be submitted until **September/2024**		

1. Motivation

Anxiety and panic disorders are growing concerns in modern society, affecting millions of people worldwide. Many individuals struggle to identify early symptoms and manage these crises effectively, leading to worsened mental health outcomes. Early intervention can significantly improve how people handle these situations, but current tools for real-time support are limited, leaving a gap in accessible, proactive mental health solutions.

Wearable technology presents an opportunity to bridge this gap. By continuously monitoring biometric data such as heart rate, skin temperature, and movement patterns, wearables can provide early detection of anxiety symptoms. These devices can offer immediate, personalized support to users through techniques like guided breathing exercises, helping to manage symptoms before they

escalate into a full-blown crisis.

This project aims to harness the potential of wearable technology in mental health care. Through the development of advanced detection algorithms and personalized interventions, we can create a system that not only detects anxiety crises in real time but also provides tailored support based on individual user data, enhancing overall well-being and quality of life.

2. Purpose

Psiquê project aims to improve the early detection and intervention for anxiety crises and panic attacks through wearable technology.

3. Confidentiality

The contents of the present RFP is fully confidential and should be handled with maximum care by all bid participants.

4. Objectives:

The objectives of this project are to develop an innovative system for the early detection of anxiety crises and panic attacks using wearable technology, to implement machine learning algorithms that personalize interventions based on individual users' biometric patterns, and to create an accessible platform that integrates these devices, allowing for continuous mental health monitoring.

5. Deliverables

- Early detection algorithms for anxiety crises;
- Wearable-integrated app or platform;
- Personalized intervention techniques embedded in the system;
- Data analysis framework for continuous mental health monitoring;
- User-friendly interface with real-time support features.

6. PROJECT SCOPE

- Development of wearable-integrated system for mental health monitoring;
- Algorithm design for biometric data analysis;
- Research into the effectiveness of wearable-based interventions for anxiety and neurodegenerative diseases;
- Collaboration across fields including bioinformatics, artificial intelligence, and psychology.

7. EXPECTED RESULTS

a) Early detection of anxiety and panic attacks through wearable technology;
b) Functional system reaching TRL 6 (technology demonstrated in a relevant environment) by the end of the project;
c) Integration of wearables and machine learning algorithms for personalized mental health interventions;
d) Successful deployment of the platform for continuous monitoring and user support;
e) Improvement in user well-being through real time interventions;
f) Expansion of technological applications in mental health care.

8. ASSUMPTIONS

The following assumptions are requirements to the success of this project:

- Biometric data collected will be sufficient for accurate anxiety detection;
- Collaboration between mental health experts and tech developers will be effective;
- Adequate resources and funding will be available throughout the project duration;
- Communication between the teams of the investing company and the executing ICT will be agile and efficient.

9. PROJECT DEVELOPMENT

The execution plan shows the main necessary activities to conclude all the goals of this project. These activities are preliminaries, thus, they may change during the development of the project. Any change of the content must be in common agreement between the parts.

10. ACTIVITIES

1. **Literature Review and Initial Problem Analysis:** This stage involves reviewing existing literature to understand the main advancements in the field and facilitate the start of activities by preliminarily modeling the problem.
2. **Data Extraction and Storage:** This includes the extraction and monitoring of data collected by wearable devices used in the research. It also involves creating a specific database that will be referenced throughout the project.
3. **Data Preparation:** This involves developing systems and models that transform the data to make it applicable for Machine Learning algorithms.
4. **Model Creation and Pattern Analysis:** This is one of the most crucial phases of the research, where we analyze emerging patterns from the data and develop models to predict risks associated with diabetes.
5. **Model Deployment:** After completing the models, a Proof of Concept (PoC) will be created to test the solution's validity with a specific target audience.

10.

11. SHEDULE OF ACTIVITIES

Act 01 - Literature Review and Initial Problem Analysis
Act 02 - Data Extraction and Storage
Act 03 - Data Preparation
Act 04 - Model Creation and Pattern Analysis
Act 05 - Model Deployment

Activity	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
Act 01	X	X	X									
Act 02		X	X	X	X	X	X	X	X			

Act 03			X	X	X	X	X	X	X	X	X	
Act 04						X	X	X	X	X	X	X
Act 05												

Activity	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24
Act 04	X	X	X									
Act 05	X	X	X	X	X	X	X	X	X	X	X	X

10.

11.

12. MILESTONES

- Milestone 1 at M6:Initial detection algorithms
- Milestone 2 at M12: Integration of wearable technology with platform
- Milestone at M18: Completion of machine learning models
- Milestone at M24: Final testing of the system

13. RESOURCES

The estimated budget to implement this project is **R$ 4.460.408,13 (Four million, four hundred sixty thousand, four hundred eight reais and thirteen centavos)**. See the detailed description of each item in the table in Section 14.

Items	Total (R$)	%
Equipments	244.326,50	5,48
Infrastructure	400.000,00	8,97
Human Resources	2.924.000,00	65,55
Books	0,00	0,00
Materials	0,00	0,00
Trips	0,00	0,00
Training	0,00	0,00
Technical Services	0,00	0,00
TOTAL Expenses		
Admin tax	892.081,63	20,00%
TOTAL	**4.460.408,13**	

14. DETAILS OF NEEDED RESOURCES

A) EQUIPMENTS

A1) HARDWARE

- 7 Notebook Samsung Galaxy Book4 Intel i7, 16GB RAM, 512 GB SSD, NVIDEA GeForce MX570 for the software development team
- 1 Notebook Samsung Galaxy Book4 Intel i5, 8GB RAM, 512 GB SSD, Intel UHD for the technical support team

- 15 Samsung Galaxy Watch 7, for tests and development
- 7 Samsung Galaxy S24 Ultra 256GB, 12GB RAM, for tests and development
- 15 Samsung Galaxy Ring, for tests and development

Total Cost **of R$ 194.326,50**

A2) SOFTWARE
Total Cost of **R$ 50.000,00**

B) HUMAN RESOURCES

<Estimate the number of researchers that must participate in the project and include their roles and responsibilities>

B1) DIRECT RH

- Professors:
  - 01 General Coordinator;
  - 01 Assistant Coordinator
  - 07 Senior researchers.
- Undergraduates
  - 01 Undergraduate
- PhD Students
  - 04 PhD students

Total Cost of R$ 2.424.000,00

B2) INDIRECT RH

- 01 Project Management Support Staff
- 02 Project Analyst
- 03 Project Assistant

Total Cost of R$ 500.000,00

C) BOOKS & JOURNALS

Not applicable.

D) MATERIALS
Not applicable.

E) TRIPS

Not applicable.

F) TRAINING

Not applicable.

G) TECHNICAL SERVICES

Not applicable.

H) ADMIN TAX

Cost related to University: **R$ 892.081,63**

Request for Proposal

Project Name	**BE-FAST STROKE**	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	TBD	Contact Point (Local)	
Project Duration	36 meses	Document Date	SET/2024
Summary/ Goal	O acidente vascular cerebral (AVC) é definido pela interrupção do suprimento sanguíneo para o cérebro, causado por ruptura ou obstrução de um vaso. O AVC é a segunda causa de morte no mundo, sendo responsável por 11,6% de todas as mortes.Ao redor do mundo existem mais de 12.2 milhôes de AVCs por ano. Ocorre 1 AVC a cada 3 segundos. Várias ferramentas de rastreio foram desenvolvidas para ajudar o público a identificar pessoas que sofreram um AVC agudo, facilitando o rápido acesso a serviços de emergência. O mnemônico BE-FAST (Balance, Eyes, Face, Arm, Speech, Time) tem sido uma das ferramentas mais utilizadas. Modelos de Inteligência Artificial vem sendo usada para identificação de sinais precoces de AVC. O propósito desse trabalho é identificar padrões do BE–FAST (Balance, Eyes, Face, Arm, Speech) que possam alarmar como sinais precoces de AVC, a partir dos biosensores dos dispositivos vestíveis (Samsung Ring e Samsung Watch).		
Research Scope	- Calibração de biosensores capazes de coletar dados de *Balance, Eyes, Face, Arm e Speech*. - Pré-processar os dados para permitir a criação de um banco de dados de alta qualidade, de uma população brasileira, contendo dados anônimos coletados durante a pesquisa. - Implementar algoritmos de aprendizado de máquina para detectar de forma precoce sintomas que indique a ocorrência de AVC e gerar alertas para usuários e médicos.		

	- Correlacionar, se durante as alterações BE-FAST STROKE ocorrem mudanças na pressão arterial, saturação de oxigênio, frequência cardíaca e arritmias, a partir dos biosensores dos dispositivos vestíveis. - A pesquisa clínica será realizada em Rede Pública e Privada da cidade de Manaus, com 200 indivíduos saudáveis (grupo controle) e 200 indivíduos com diagnóstico de AVC que tenham acima de 18 anos de idade.
Output/ Specifications	- Banco de Dados: Calibração de biosensores capazes de coletar dados de *Balance, Eyes, Face, Arm e Speech* e pré-processar os mesmos para permitir a criação de um banco de dados de alta qualidade de uma população da região Norte do Brasil. Os dados coletados poderão ser usados para esta e futuras pesquisas em AVC e outras condições relacionadas. - Algoritmos de aprendizado de máquinas: Implementação, validação e teste de algoritmos de aprendizado de máquina capazes de prever de forma eficiente a ocorrência de AVC com base nos dados coletados pelos dispositivos vestíveis. - Programas de Treinamento: Desenvolvimento de programas de treinamento para médicos e profissionais de saúde sobre o uso de dispositivos vestíveis e interpretação dos dados coletados.
Requests	Project in partnership with university team (Professors, Post-docs, Phd and Msc students)
Comments	Technical Proposals must be submitted until **September/2024** **Valor do Projeto: R$ 10 milhões**

Request for Proposal

Project Name	Wearable device for pregnant women (with and without high risk	Requesting Team	Samsung Research, Samsung Research Brazil
Contact Point (HQ)	Maria Riselda Vinhote da Silva Cleto Leal	Contact Point (Local)	mrvsilva@uea.edu.br
Project Duration	24 months	Document Date	set/2024
Summary/ Goal	Submission of a Project Proposal for the development of innovative software for maternal-fetal health, which will be used to assess the vitality of the fetus during pregnancy and labor. It can be used intra- and extra-hospital. This software will empower the pregnant woman to know about her baby's well-being. It will indicate possible changes, where the pregnant woman receives alerts on her wearable device when available, which are transmitted to her prenatal doctor. Every year, 140 million women become pregnant around the world. The expected average consumption will be 14 million women per year. Purchasing Potential: Demand for wearables with advanced features like CTG could be significant, especially in developed and developing countries with a growing middle class. A pilot project will be developed with 20 pregnant women: 10 monitored in Manaus (University of the State of Amazonas-UEA) and 10 in São Paulo (Federal University of São Paulo-UNIFESP).		
Research Scope	- definition and competencies of the research team, made up of teachers, students and other professionals. - management and monitoring in all phases of project execution, respecting and following current legislation. - monitoring and evaluation of the product in all phases of the application (softwares and hardwares). - monitoring and evaluation of collected data (processing logistics).		
Output/ Specifications	- Improved Monitoring and Early Intervention. - Reduction of Hospitalization and Cost. - Empowerment and Autonomy of Pregnant Women. - Access to Data for Research and Continuous Improvement.		
Requests	Project in partnership with university team (Professors, Post-docs, PhD and MsC students) and Federal University São Paulo.		
Comments	Technical Proposals must be submitted until **September/2024**		

1. Motivation

The adoption of a cardiotocograph in a wearable device represents a promising advance for the health of pregnant women with and without comorbidities, promoting early detection of complications, reducing hospital costs, empowering pregnant women and contributing to the advancement of research.

The development of a wearable device with cardiotocography (CTG) aims to face the challenge of efficiently and continuously monitoring maternal-fetal health, in pregnant women with and without comorbidities.

The primary objective is to create a device that enables the continuous and accurate collection of vital data, such as fetal heart rate and uterine contraction patterns, outside of the clinical environment. This will allow:
Early Detection and Intervention: Continuous monitoring facilitates early identification of pathological changes or signs of fetal distress, allowing rapid response and implementation of appropriate interventions to improve health outcomes for both mother and baby.
Clinical Validation and Reliability: Clinical validation of the device will ensure that the data collected is accurate and reliable, comparable to traditional monitoring methods used in hospital settings. This is essential to ensure the device can be confidently adopted in healthcare settings.
Improved Pregnancy Management: The ability to continuously monitor maternal and fetal health allows for more efficient management, potentially reducing the incidence of serious complications and improving the quality of prenatal care.
Economic Efficiency: Comparing the cost of the device with the costs of hospitalizations and frequent visits can demonstrate the potential savings for the healthcare system and patients, justifying the investment in the device.
Impact on Quality of Care: Fewer hospital visits can mean less stress and discomfort for pregnant women, improving the overall care experience and enabling more comfortable and less invasive management.
Design and Usability: Identify areas for improvement in device design and functionality to ensure it is comfortable and easy to use, increasing the likelihood of continued adoption.
Psychological and Behavioral Impact: Understanding how the device affects pregnant women's perception of health and their engagement with prenatal care can provide insights into how to optimize communication and support during pregnancy, contributing to a better overall care experience.

2. Purpose

The Project Proposal for the development of innovative software for maternal-fetal health used to assess the vitality of the fetus during pregnancy and labor will be forwarded to SRBR for evaluation and joint projection of the construction of the Project.

3. Confidentiality

All content of this proposal is confidential and cannot be shared or worked on outside of this purpose and without the authorization of the participants.

4. Objectives:

Primary Objective: Develop and validate a wearable device with cardiotocography integration for continuous and remote monitoring of maternal-fetal health in pregnant women with and without comorbidities, aiming to improve the early detection of complications and optimize clinical results.

Secondary Objective 1: Evaluate the effectiveness of the wearable device in reducing the need for hospitalizations and frequent consultations for monitoring in pregnant women with and without comorbidities, comparing costs and the use of health resources before and after implementing the device.

Secondary Objective 2: validate the wearable device, including aspects such as comfort, ease of use and, mainly, impact on the perception of one's own health and engagement with prenatal care.

Figure 1 – Wearable device model (without the device proposed in this Project)

Image created with AI (ChatGPT)

5. Deliverables

Monitoring pregnant women tends to reduce possible complications, which in its absence can contribute to a significant increase in the use of health services at different levels in the care of pregnant women. Our proposal is also to investigate how much the use of wearable devices can reduce the need for hospitalizations and frequent clinical visits. Reducing these factors can bring substantial economic benefits to both the healthcare system and pregnant women.

6. Estimated value
   R$ 4.000.000,00

ALINHAMENTO DE PROPOSTAS SAMSUNG

BIOFARMACOLOGIA & IMUNOLOGIA & VIROLOGIA & INTELIGÊNCIA ARTIFICIAL & INOVAÇÃO.

UM UNIVERSO DE POSSIBILIDADES

LABORATÓRIO IMUNOFARMACOLOGIA CELULAR

UEA UNIVERSIDADE DO ESTADO DO AMAZONAS

lab data
Laboratório de Pesquisas em Ciência de Dados e Inteligência Artificial

PESQUISADORES PROPONENTES

Dra. Gladys Corrêa

Dra. Rosilene Gomes Ferreira

Dr. Raimundo S. Lima-Júnior

Dra. Ieda Batista

Dr. Rodrigo Tavares

Dra. Elizângela Leão

Dra. Elizângela Farias

PROJETO MELLITUS

Revolucionando o Monitoramento da Diabetes com Wearables e IA

OBJETIVO PRINCIPAL

Correlacionar fatores de risco relacionados à diabetes através do monitoramento de sinais vitais captados por dispositivos wearables, como Smart Watch e Smart Ring.

PROBLEMA

A diabetes é uma doença crônica que requer monitoramento constante dos níveis de glicose no sangue. Muitos pacientes enfrentam dificuldades em gerenciar a doença devido à falta de dados contínuos e precisos sobre seus sinais vitais e níveis de glicose, que podem levar ao coma diabético.

SOLUÇÃO

Utilizar dados coletados através de wearables para monitorar sinais vitais, batimentos cardíacos, e outros dados de pacientes que tenham quadro ou propenção à diabetes. Esses dados serão cruzados com diferentes parâmetros internos e externos para a criação de padrões, e enfim analisados por modelos de Inteligência Artificial para prever riscos e fornecer insights personalizados para o gerenciamento da diabetes.

DIFERENCIAL

Criação de IAs que relacionam diversos parâmetros da saude humana, com o propósito de fornecer ao usuário alertas sobre sua saúde e possíveis riscos.

ENTREGÁVEL

- Criação de IAs que relacionam diversos parâmetros da saude humana, com o propósito de fornecer ao usuário alertas sobre sua saúde e possíveis riscos.
- Desenvolvimento de novas aplicações do uso de wearebles para o monitoramento da diabétes.

PRAZO ESTIMADO

18 meses

INVESTIMENTO

Em elaboração.

EQUIPE NECESSÁRIA:

Biólogos, Farmacêuticos, Endocrinologista, Engenheiros de Software e hardware, profissionais de TI, IA, gerente de projeto e alunos de graduação e pós-graduação

Mercado

Segundo relatório da Mordor Intelligence, o tamanho do mercado latino-americano de medicamentos para cuidados com diabetes é estimado em US$ 4,71 bilhões em 2024, e deverá atingir US$ 5,58 bilhões até 2029, crescendo a um CAGR (taxa de crescimento anual composto) de 3,48% durante o período de previsão (2024 a 2029).

PROJETO PSIQUÊ

Detecção e Suporte em Crises de Ansiedade e em Doenças Neurodegenerativas com Wearables

OBJETIVO PRINCIPAL

Desenvolver e implementar um sistema inovador de detecção precoce e suporte para crises de ansiedade e ataques de pânico utilizando tecnologia de wearables, visando melhorar a qualidade de vida e promover o bem-estar mental dos usuários.

PROBLEMA

Muitas pessoas enfrentam dificuldades em identificar e lidar com crises de ansiedade e ataques de pânico de forma precoce e eficaz.

SOLUÇÃO

Desenvolver um sistema baseado em tecnologia wearable que possa detectar sinais precoces de ansiedade e ataques de pânico através da análise contínua de dados biométricos.

DIFERENCIAL

O projeto visa integrar funcionalidades de intervenção direta, como técnicas de respiração guiada, exercícios de relaxamento e notificações personalizadas baseadas nos dados coletados.

ENTREGÁVEL

Sistema funcional de detecção precoce e suporte para crises de ansiedade e ataques de pânico, baseado em tecnologia de wearables:

- Implementação de algoritmos de detecção precoce com base nos dados coletados.
- Desenvolvimento de um aplicativo ou plataforma que se comunique com os wearables.
- Algoritmos de aprendizado de máquina para personalizar as intervenções com base nos padrões individuais do usuário.

PRAZO ESTIMADO

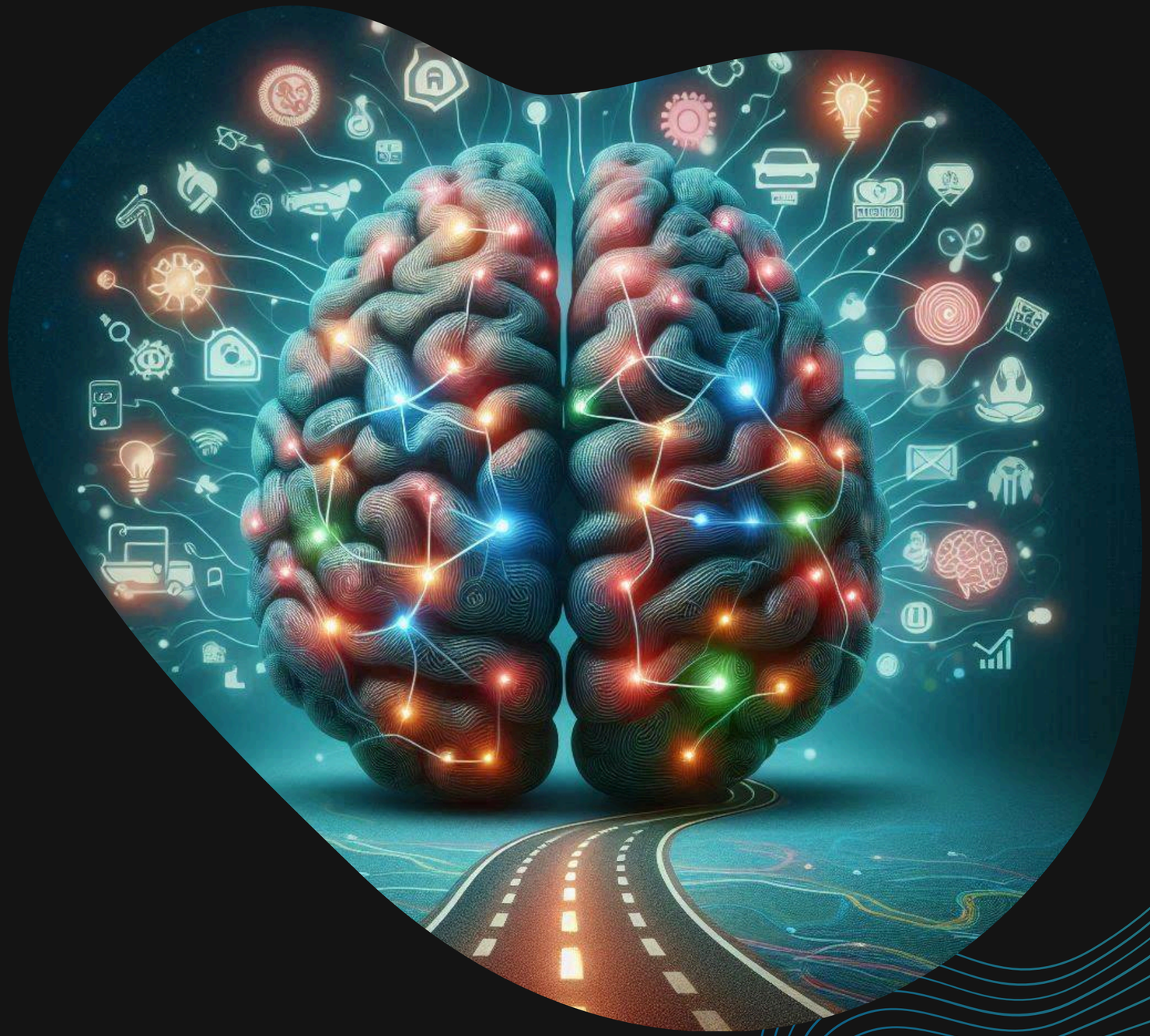
24 meses

INVESTIMENTO

- Notebooks (7), Notebook (apoio tercnico)(1), Galaxy Watch7 (15), Galaxy S24 ultra (7), Galaxy Ring (15).
- Softwares
- Recursos humanos: a definir
- Estrutural: Ampliação de Laboratório (Infraestrutura de rede e iluminação), climatização e audio visual.

EQUIPE NECESSÁRIA:

Biólogos, Farmacêuticos, Psicólogos, Psiquiatras, Engenheiros de Software e hardware, profissionais de TI, IA, gerente de projeto, alunos de graduação e pós-graduação, especialista em mercado.



Mercado

"O mercado de tratamento de transtornos de ansiedade atingiu um valor de US$ 11,49 bilhões em 2023 e deverá atingir US$ 15,90 bilhões até 2032. As projeções sugerem uma taxa composta de crescimento anual (CAGR) de 3,6% de 2024 a 2032."

PROJETO HELIX

DNA STORAGE: Armazenamento de Dados em DNA para Alta Densidade e Durabilidade

OBJETIVO PRINCIPAL

Desenvolver uma tecnologia inovadora de armazenamento de dados utilizando moléculas de DNA, combinando biotecnologia e ciência da computação para criar uma solução de armazenamento de alta densidade, durável e sustentável, capaz de atender à crescente demanda global por capacidade de armazenamento.

PROBLEMA

A quantidade de dados digitais gerados globalmente está crescendo exponencialmente, mas a capacidade dos meios de armazenamento tradicionais, como mídias magnéticas e ópticas, não está conseguindo acompanhar essa demanda.

SOLUÇÃO

Desenvolver uma solução inovadora para armazenamento de dados digitais em moléculas de DNA, combinando conhecimentos avançados de biotecnologia e ciência da computação para criar um meio de armazenamento de alta densidade, durável e sustentável

DIFERENCIAL

O projeto integra avanços biotecnológicos com inovações na engenharia de armazenamento de dados, resultando em uma solução híbrida que maximiza a eficiência e a sustentabilidade

ENTREGÁVEL

Tecnologia de armazenamento de dados digitais em moléculas de DNA sintéticas

PRAZO ESTIMADO

24 meses

INVESTIMENTO

- Ampliação de infra estrutura de laboratório/ equipamentos e materiais
- Recursos humanos
- computadores / software/ impressoras e scanners

EQUIPE NECESSÁRIA:

Biólogos Moleculares, Cientistas da Computação, Biotecnologistas, Gestores de Projeto, Consultores de Mercado e Regulamentação.

Mercado

"O tamanho do mercado de armazenamento de dados de DNA foi avaliado em US$ 70 milhões em 2023 e estima-se que registre um CAGR de mais de 80% entre 2024 e 2032. Os crescentes investimentos e iniciativas em P&D estão impulsionando o crescimento do mercado."

Vamos Inovar Juntos e Destacar a Amazônia?

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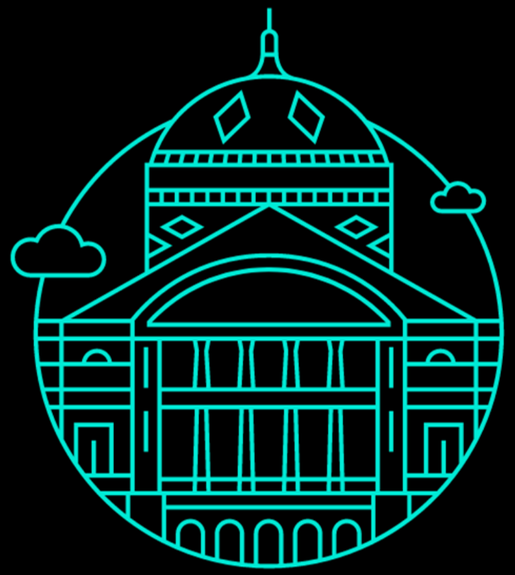
ENDEREÇO

Universidade do Estado do Amazonas
Escola Normal Superior - ENS
Escola Superior de Tecnologia - EST
Manaus-AM
NES Tabatinga - AM
NES Boca do Acre - AM

PROJETOS P,D&I LIFCEL E LADATA

SBC JOINT CONFERENCES



30.09 a 03.10
Manaus
AMAZONAS 2024

SBGAMES 2024 | XXIII Simpósio Brasileiro de Jogos e Entretenimento Digital

SVR 2024
37th Conference on Graphics, Patterns and Images

SIBGRAPI 2024 | 37th Conference on Graphics, Patterns and Images

INTERNATIONAL CONFERENCE ON ENTERTAINMENT COMPUTING

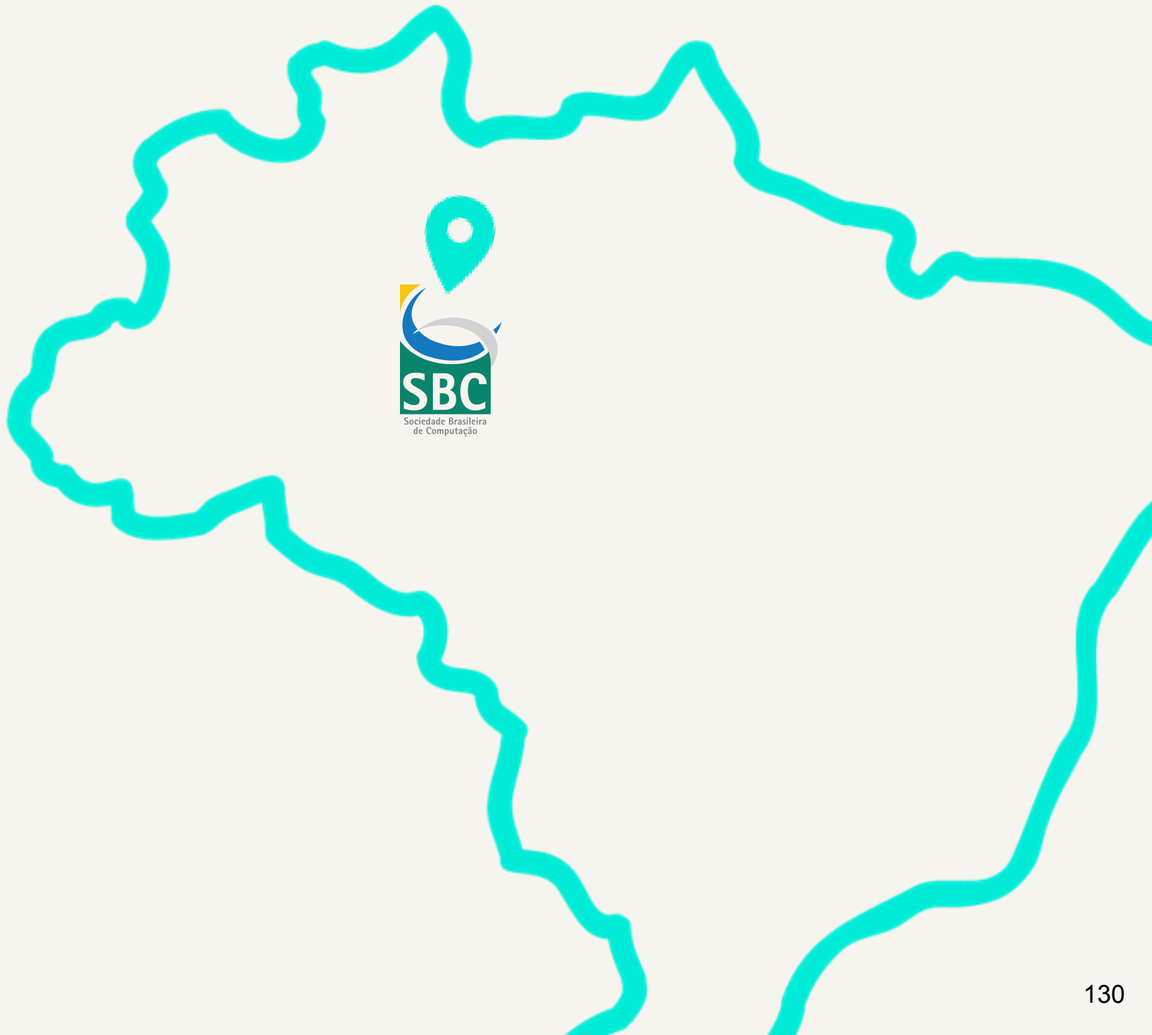
Em 2024 **Manaus será a capital da tecnologia e entretenimentos digital**

EST
ESCOLA SUPERIOR DE TECNOLOGIA

UEA
UNIVERSIDADE DO ESTADO DO AMAZONAS

Escola Superior de Tecnologia **EST/UEA**

Esses eventos são itinerantes, ocorrendo a cada ano em uma cidade diferente do Brasil, visando atingir todas as regiões do país e possibilitar a participação de um maior número de pesquisadores e estudantes.



- Maior evento acadêmico da América Latina nestas áreas;
- Organizado pela Sociedade Brasileira de Computação (SBC);
- Divulga o estado-da-arte e congrega pesquisadores, estudantes da educação básica, graduação e pós-graduação e membros da indústria.
- Veículo para divulgação de pesquisas e o estabelecimento de colaborações em projetos de pesquisa, desenvolvimento e inovação

PROGRAMA

Exposição e
Arena Gamer

Seis trilhas técnicas permanentes:

Artes e Design
Computação
Cultura
Educação
Saúde
Industria

- **O promovido há mais de 25 anos pela Comissão Especial de Realidade Virtual (CERV/SBC), Principal evento científico nas áreas de RV/RA do país.**

- **Frequente participação internacional e de empresas do setor, o SVR:**

  Estreita laços entre pesquisadores e profissionais da indústria, promove troca de experiências

  Melhora as condições para o surgimento de novos grupos de pesquisa interinstitucionais

  Motiva o ingresso na área e mostra aos participantes os avanços no Brasil e no mundo.

PROGRAMA

Workshop de Teses e Dissertações (WTD)

Oficina de Trabalhos de Graduação (WUW)

CERV Destaque no Prêmio XR 2024

SIBGRAPI 2024 | 37th Conference on Graphics, Patterns and Images

CONFERENCE ON GRAPHICS, PATTERNS AND IMAGES

- Evento consolidado internacionalmente
- Congrega renomados pesquisadores brasileiros e estrangeiros
- Tradição, consistência, qualidade e alto impacto dos trabalhos apresentados no evento lhe conferem a nona posição entre todos os eventos internacionais na categoria Graphics (Google Metrics 2022)
- Considerada a principal conferência nesta área do conhecimento na América Latina

PROGRAMA

- Trilha Principal
- Oficina de Teses e Dissertações
- Workshop de Obras em Andamento
- Oficina de Trabalhos de Graduação

ATORES ENVOLVIDOS

- GOVERNOS
- UNIVERSIDADES
- EMPRESAS
- SOCIEDADE

Edição

2023

Rio Grande - RS

506
participantes

06/11 a 09/11

Edição

2024

Manaus - AM

PÚBLICO PRESENCIAL

600

Participantes das atividades acadêmicas e de Inovação

2500

Visitantes

ALCANCE POR

MÍDIA

PARCERIAS EM PROCESSO

Realização:

SBC
Sociedade Brasileira de Computação

INSTITUTO FEDERAL
Amazonas

SBGAMES 2024 | XXIII Simpósio Brasileiro de Jogos e Entretenimento Digital

SEDECTI

UNIVERSIDADE FEDERAL DO AMAZONAS
IN UNIVERSA SCIENTIA VERITAS
UFAM

SUFRAMA

FAMETRO

FAESP
FEDERAÇÃO AMAZONENSE DE E-SPORTS

QUOTAS DE PATROCÍNIO

	BRONZE	PRATA	OURO	DIAMANTE
INSCRIÇÕES CORTESIA NOS EVENTOS	3	5	10	15
LOGO NOS MATERIAIS DE DIVULGAÇÃO	✓	✓	✓	✓
LOGO NOS WEBSITES DOS EVENTOS	✓	✓	✓	✓
DIVULGAÇÃO NA IMPRENSA/MÍDIA SOCIAL	✓	✓	✓	✓
DIVULGAÇÃO CERIMÔNIA ABERTURA	✓	✓	✓	✓
CITAÇÃO E-MAILS PARTICIPANTES	✓	✓	✓	✓
DIVULGAÇÃO DO LOGOTIPO NAS SESSÕES TÉCNICAS	✓	✓	✓	✓
PARTICIPAÇÃO DE FALA NO PAINEL INDUSTRIAL		✓	✓	✓
ESTANDE PARA DIVULGAÇÃO/ RECRUTAMENTO (APROX. 6M²)			✓	✓
BENEFÍCIOS ADICIONAIS NEGOCIÁVEIS				✓
VALOR DO PATROCÍNIO	R$ 20k	R$ 30k	R$ 50k	R$ 100k

Outras opções de pacotes com diferentes configurações de termos e benefícios são negociáveis, na categoria Custom.

Jucimar Maia Jr.

COORDENADOR GERAL DO EVENTO

Engenheiro de Software formado pela Universidade Federal do Amazonas em 1995. Mestre em Engenharia Elétrica pela Universidade Federal de Pernambuco (UFPE). Doutor em Engenharia Elétrica pela UFPE.

É coordenador do curso de Pós-Graduação em Desenvolvimento de Jogos Eletrônicos e Coordenador e criador do curso de Bacharelado em Sistemas de Informação da UEA.

CONTATO

jjunior@uea.edu.br

(92) 98106-0204 / Jucimar Maia

SBC JOINT CONFERENCES

30.09 a 03.10 Manaus AMAZONAS 2024


VENHA FAZER PARTE
DESTA AÇÃO !


TEKOHÁ

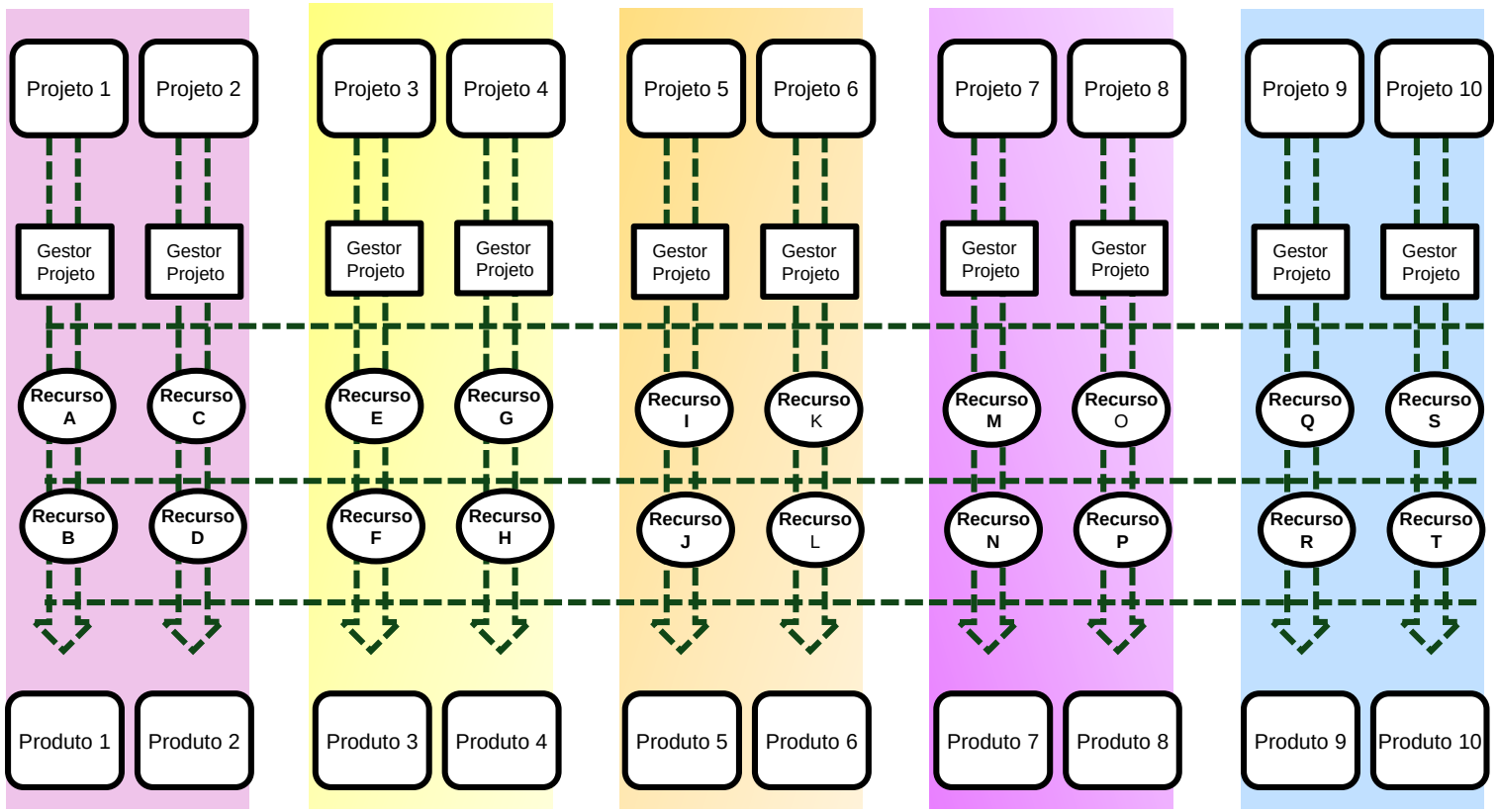
SIGNIFICADO

TEKOHÁ

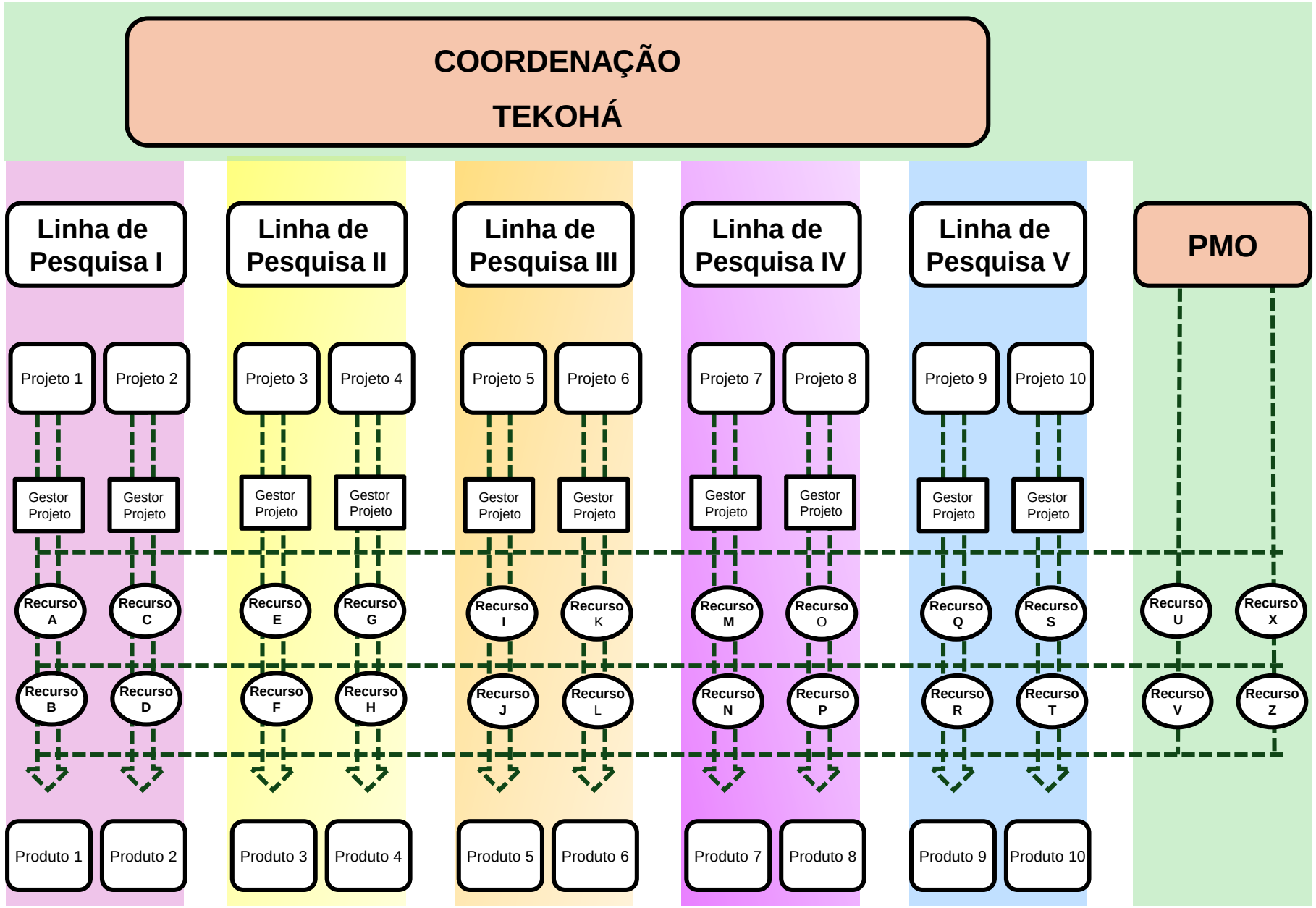
“o lugar onde somos o que somos” em guarani

MODELO ATUAL

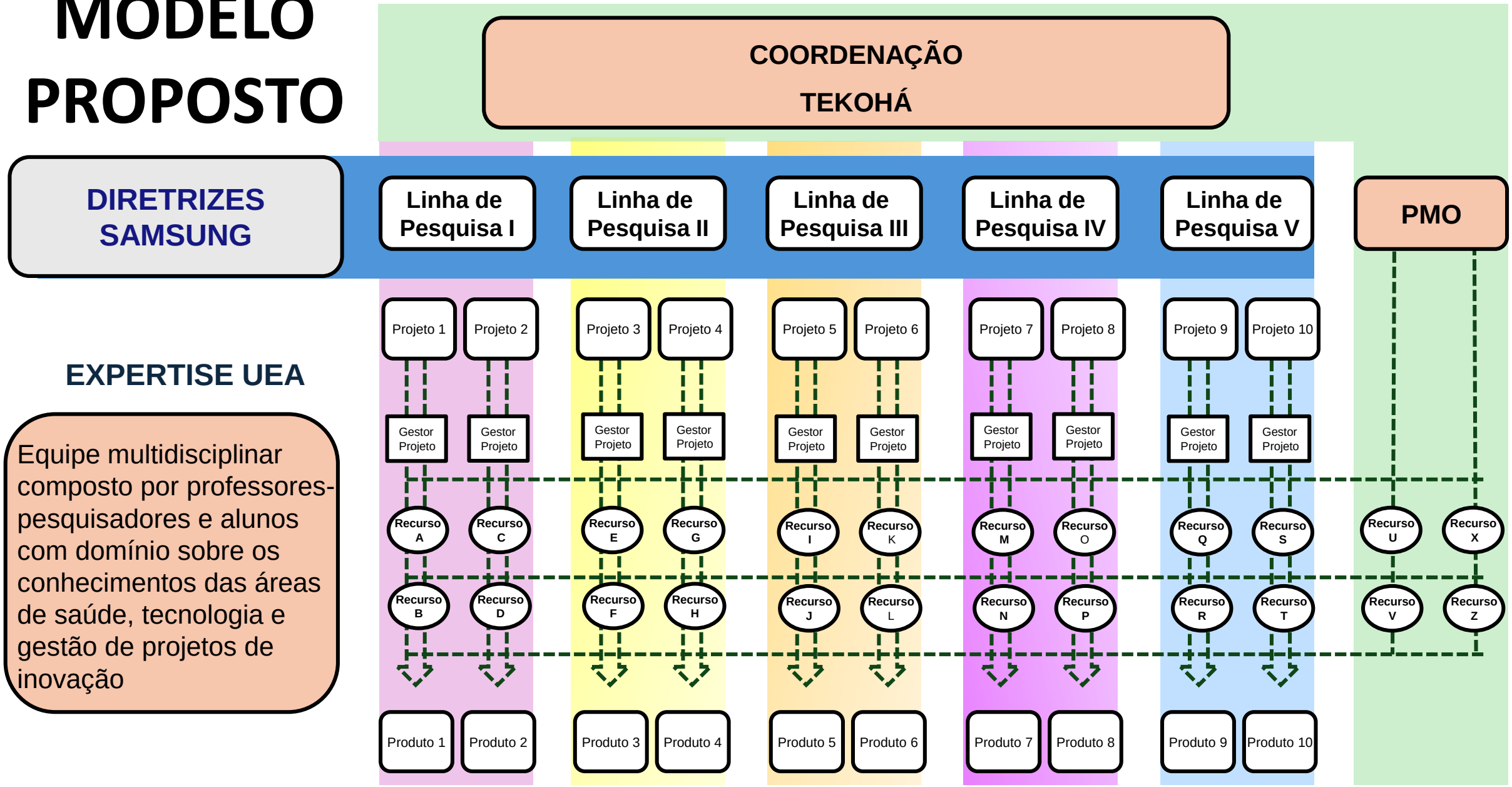
O gerenciamento e acompanhamento dos projetos são realizados separadamente por cada equipe sem que haja a adoção de uma metodologia de Gestão de Projetos que potencialize a otimização dos recursos tampouco o compartilhamento de lições aprendidas



MODELO PROPOSTO



MODELO PROPOSTO



MODELO PROPOSTO

PMO

ESCRITÓRIO DE PROJETOS

EXPERTISE UEA

Formado por especialistas em gestão de projetos com experiência comprovada na estruturação, gestão e acompanhamento de projeto de P&D e com a gestão de equipes e temas multidisciplinares.

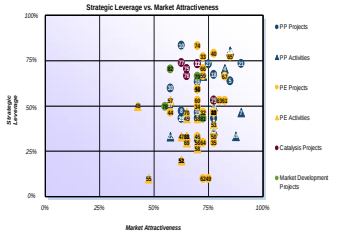
Identificação de Oportunidades

Contempla, de forma compartilhada com a empresa investidora e professores-pesquisadores a identificação de oportunidades para proposição de novos projetos e aplicações tecnológicas de maneira alinhada as linhas de pesquisa prioritárias e novas potenciais do mercado.

Estruturação de Projetos

Ação em conjunto com equipe de projeto na orçamentação, planejamento e estruturação do projeto de acordo com modelo de gestão de projeto adotado, cabendo ao PMO o papel de capitanear a Análise de Risco

Priorização de Projetos



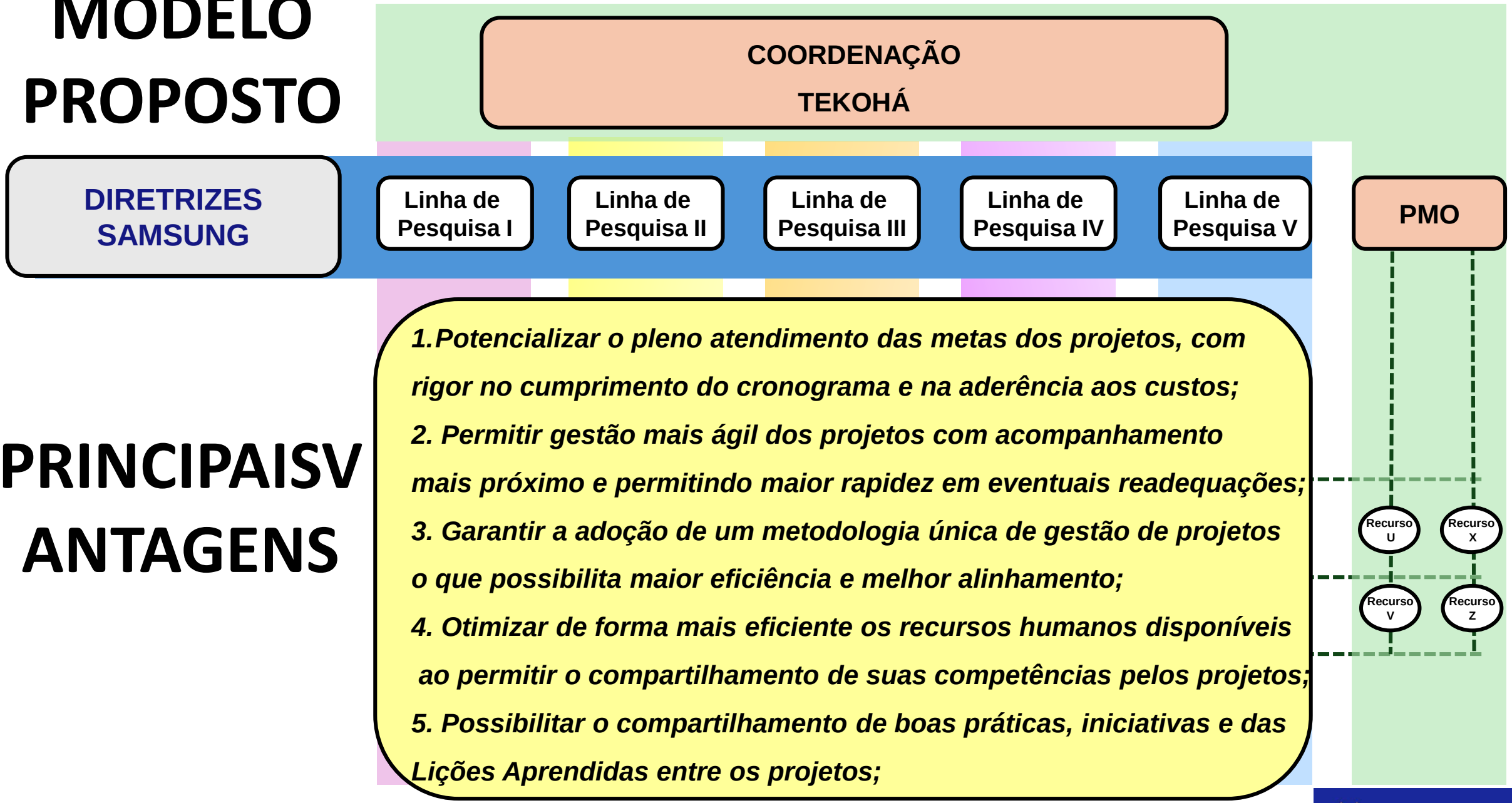
Análise de Critérios (Indicadores de Desempenho):

- Compulsoriedade
- Alinhamento Estratégico
- Viabilidade Econômica
- Análise Risco / Sucesso

Acompanhamento dos Projetos

Acompanhamento dos projetos tendo como referência os indicadores assumidos pela empresa investidora e os demais que permitam atender aos requisitos do EPA (Elegibilidade, Pertinência e Adequação) Eventuais realinhamento e gestão de processo de Lições Aprendidas

MODELO PROPOSTO



PRINCIPAISV ANTAGENS

1.Potencializar o pleno atendimento das metas dos projetos, com rigor no cumprimento do cronograma e na aderência aos custos;

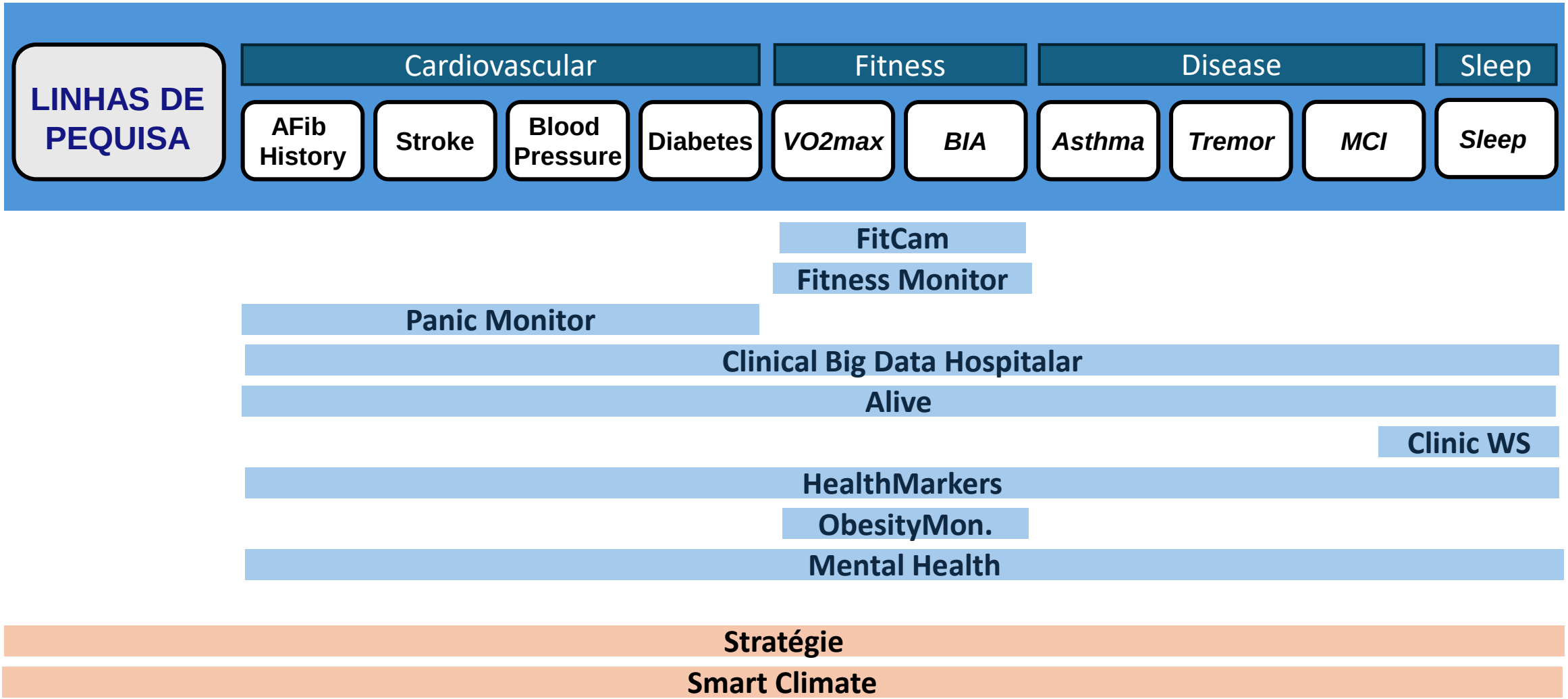
2. Permitir gestão mais ágil dos projetos com acompanhamento mais próximo e permitindo maior rapidez em eventuais readequações;

3. Garantir a adoção de um metodologia única de gestão de projetos o que possibilita maior eficiência e melhor alinhamento;

4. Otimizar de forma mais eficiente os recursos humanos disponíveis ao permitir o compartilhamento de suas competências pelos projetos;

5. Possibilitar o compartilhamento de boas práticas, iniciativas e das Lições Aprendidas entre os projetos;

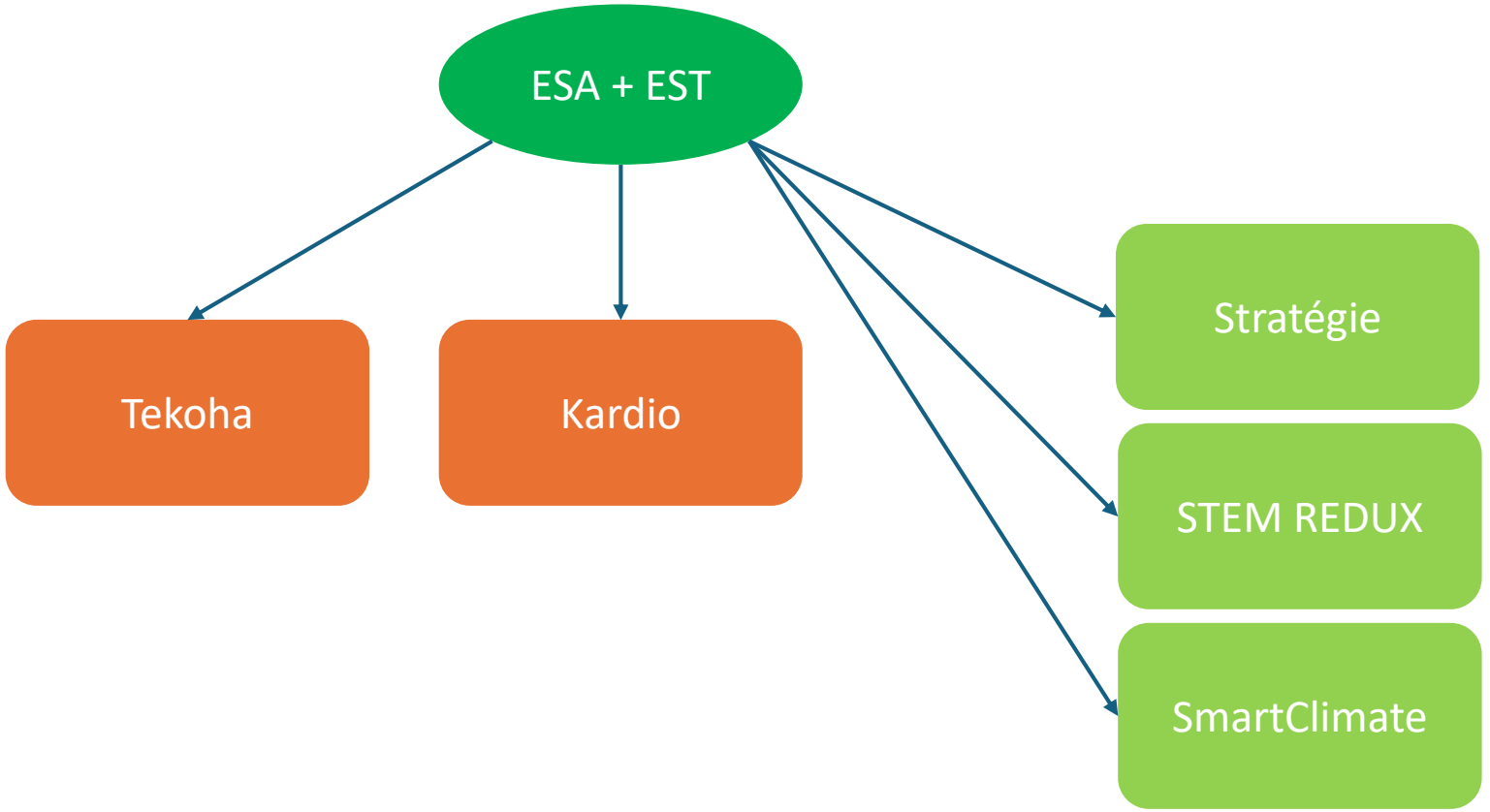
PLANO DE AÇÃO



PROJETOS TEKOHÁ

Propostas de Projetos	Duração (Meses)	Valor (R$ Milhão)
Fit Cam	36	10
Fitness Monitor	24	8
Clinical Big Data	26	16
Panic Monitor	24	8
Alive	24	8
Clinic WS	24	7
Health Markers	36	10
Obesity Monitoring	24	8
Mental Health	36	12
Stratégie	24	4
Smart Climate	24	5
Stem Redux	36	24
TOTAL		120

PROPOSTAS DE PROJETOS



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6.	DOCKAGEM	Deolinda Luciane Ferreira Garcia dlferreira@uea.edu.br
7.	ECG AMAZON	Katia do Nacimento Couceiro kcouceiro@uea.edu.br
8.	ECG NOW	Jucimar Maia da Silva Junior jjunior@uea.edu.br
9.	E-OBESIDADE	Jucimar Maia da Silva Junior jjunior@uea.edu.br
10.	FITCAM	Jucimar Maia da Silva Junior jjunior@uea.edu.br
11.	FITNESS MONITOR	Jucimar Maia da Silva Junior jjunior@uea.edu.br
12.	PANIC MONITOR	Jucimar Maia da Silva Junior jjunior@uea.edu.br
13.	CLINICAL BIG DATA	Jucimar Maia da Silva Junior jjunior@uea.edu.br
14.	ALIVE	Jucimar Maia da Silva Junior jjunior@uea.edu.br
15.	REVEDUA	Jucimar Maia da Silva Junior jjunior@uea.edu.br
16.	ClinicWS - *Intelligent support for assessment of sudden illness and sleep quality*	Jucimar Maia da Silva Junior jjunior@uea.edu.br
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23.	STROKE	Jucimar Maia da Silva Junior jjunior@uea.edu.br
24.	WEARABLE	Maria Riselda Vinhote da Silva mrvsilva@uea.edu.br