EpiTech: Developing Epilepsy Care with Implantable device

Background

Epilepsy is a long-term neurological condition marked by frequent, spontaneous seizures. Almost 50 million individuals globally are impacted by it. If a seizure occurs suddenly in public, it may result in bodily harm and painful circumstances. The goal of this research is to create a tiny implantable device that can automatically identify seizures and notify medical professionals and caregivers so they can administer care and treatment on time.

Objectives

- Create a tiny implantable device that can track brain activity all the time.
- Real-time seizure event detection that is automatic based on an on-device machine learning algorithm.
- During a seizure, the device send location information and notifications to caregivers and medical professionals.
- Providing long-term security of an implanted medical device.

Scope

An implanted seizure alarm system prototype will be produced as a result of this study. An implantable hardware device and machine learning software will be designed and engineered, tested in an animal model, and clinical feasibility studies on the system's performance and safety will be carried out.

Timeframe

	Description of Work	Start and End Dates
Phase One	Research and concept validation: •Conduct literature review to understand current state of seizure detection and alert technologies •Interview neurologists and patients to gather requirements for the implantable device system •Define essential product specifications based on key medical, functional and usage needs	Feb 2rd 2024-feb 29th 2024

	•Develop initial concept prototypes and architectures •Evaluate technical and clinical feasibility of identified concepts	
Phase Two	System and algorithm design: •Design overall system components including implant hardware, algorithms. •Design implantable hardware devices by size, power and biocompatibility needs •Develop customized machine learning algorithms for patient-specific seizure detection based on neurological data patterns	March 1st 2024-march 31st 2024
Phase Three	Prototype development and lab testing: •Build proof of concept prototype implementing phase two specifications •Test on experimental models to validate product requirements are met •Demonstrate seizure detection capability on EEG datasets	April 1st 2024- april 30th 2024

Project Budget

	Description of Work	Anticipated Costs
Phase One	Research and concept design	Researcher team of 5 - Salaries: $15,000 Stakeholder Involvement: $5,000 Project Manager: $8,000 Materials: $5,000 Concept Prototyping and Analysis Tools: $10,000 Incidental outgoings: $5,000 Total= $48,000

Phase Two	System design	Team of 5- Salaries: $15,000 Project Manager: $8,000 Simulation Software: $5,000 Algorithm Development Tools: $10,000 Incidental outgoings: $5,000 Total= $43,000
Phase Three	Prototype development and testing	Team of 5- Salaries: $15,000 Project Manager: $8,000 Prototype Creation: $18,000 Test Equipment: $10,000 Incidental outgoings: $7,000 Total= $58,000
	Total	**$ 150,000.00**

Key Stakeholders

Client	IUPUI
Sponsor	Indiana university- under Dr. Zeyana Hamid
Project manager	Mariam Khan

Monitoring and Evaluation

MONITORING:

- Budget Monitoring:

Every two weeks, compare actual phase expenses to the allocated budget.

Notice differences >10%, and approve spending if necessary

Report the current consolidated budget status in monthly steering sessions.

- Meetings:

Initiate a moderation meeting at the beginning of each stage in order to come into an agreement on delivery listings.

Hold bi-weekly project team sync-ups for progress discussions.

Organize monthly governance updates in steering committee meetings.

- Progress Monitoring:

Weekly generated progress status dashboard/report to be up

Completion rate of capture across activities such as design, and testing.

Qualitatively evaluate progress for factors such as complexity, and quality.

Review the schedule and dates.

Evaluations:

Evaluate the phase goals such as requirements and final assurance etc.

Lab-tested prototype performance metrics vs.

Give evidence like models, photos, and metric reports to show progress.

Include the impact of project deliverables and the future reach.

Approval Signatures

[IUPUI], Project Client	[Dr. Zeyana Hamid], Project Sponsor	[Mariam Khan], Project Manager

REFERENCES :

Jeppesen, J., Christensen, J., Mølgaard, H., & Beniczky, S. (2023). Automated detection of focal seizures using subcutaneously implanted electrocardiographic device: A proof-of-concept study. *Epilepsia*, *64*, S59-S64. https://doi.org/10.1111/epi.17612

Stacey, W. C., & Litt, B. (2008). Technology Insight: neuroengineering and epilepsy—designing devices for seizure control. *Nature Clinical Practice. Neurology*, *4*(4), 190–201. https://doi.org/10.1038/ncpneuro0750