

PROPOSAL FOR THE GRANT

*of*

**STUDENT PROJECT SCHEME 2023-2024**

*on*

**“SAFEBOT- Small Hand-held Safety Monitoring & Alert System for Sewage Workers in Tamil Language”**

*Submitted to*

**TAMILNADU STATE COUNCIL FOR SCIENCE AND TECHNOLOGY**

**DOTE CAMPUS,**

**CHENNAI – 600 025.**

Submitted by

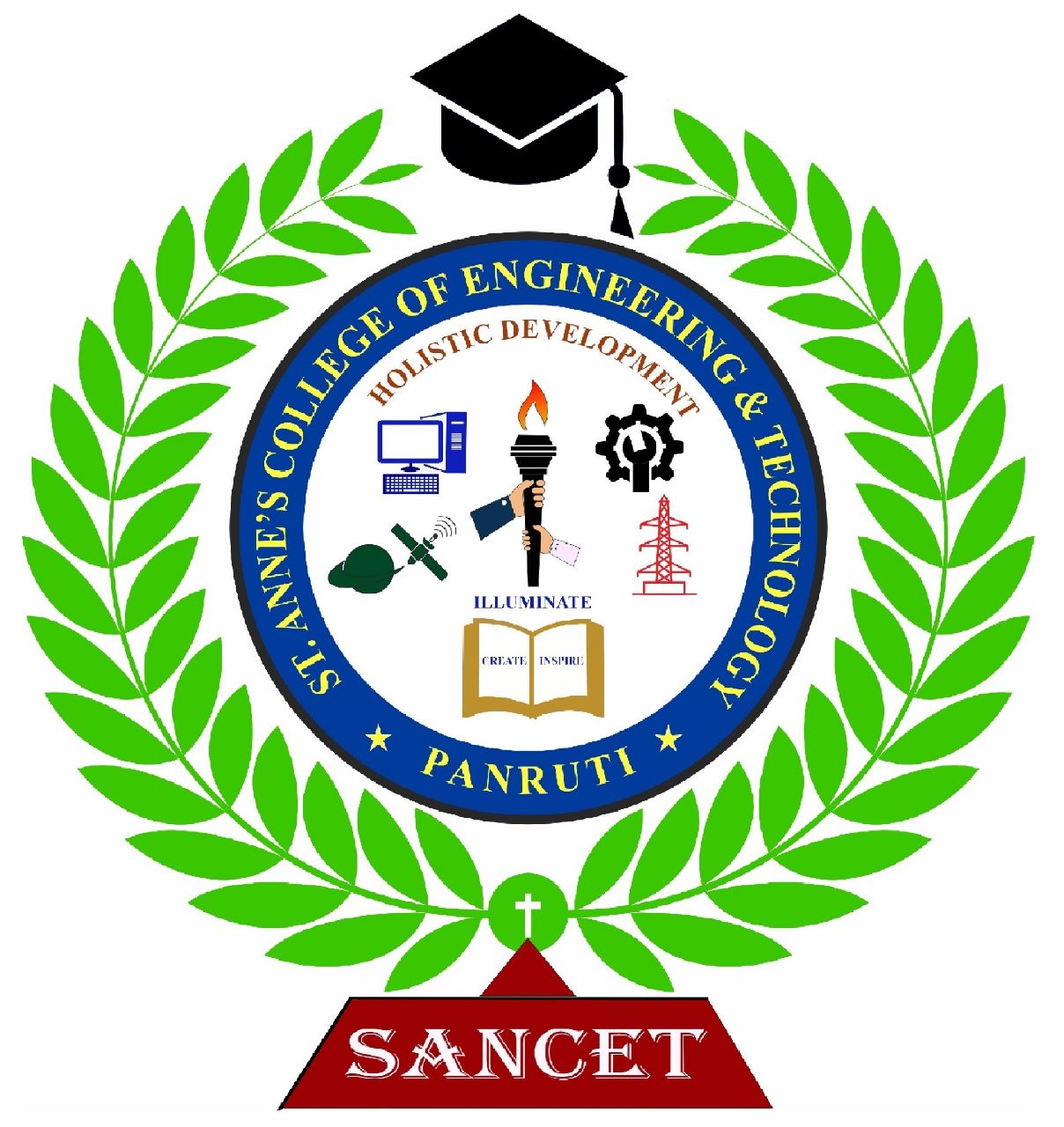
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Approved by AICTE New Delhi & Affiliated to Anna University Chennai

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**STUDENT PROJECT PROPOSAL**

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| --- | --- | --- | --- |
| 1 | Name of the Student(s)  One valid e-mail id | **:** | RAJASRI S,  KAYALVIZHI M,  NIVETHA U,  SHANMUGAPRIYA N **(**[**ece@stannescet.ac.in**](mailto:ece@stannescet.ac.in)**)** |
| 2 | Name of the Guide Department/Designation  Institutional Address  Phone No. & Mobile No. | **:** | Mr. S. BALABASKER  Assistant Professor,  St. Anne’s College of Engineering and Technology,  Anguchettypalayam,  Panruti Taluk, Cuddalore District,  Pincode – 607 106.  Ph: 9944374993 |
| 3 | Project Title | **:** | SAFEBOT- A Small Hand-held Safety Monitoring & Alert System for Sewage Workers in Tamil Language |
| 4 | Sector in which your Project Proposal is to be considered | : | Engineering & Technology |
| 5 | Project Details | : | Attached separately with this form |
| 6 | Has a similar project been carried out in your college/elsewhere? If so, furnish details of the previous project and highlight the improvements suggested in the present one. | **:** | No |

**CERTIFICATE**

This is to certify that **RAJASRI S, KAYALVIZHI M, NIVETHA U, SHANMUGAPRIYA N** is a bonafide final year student of U.G. Engineering courses of our college and it is also certified that two copies of utilization certificate and final report along with seminar paper will be sent to the Council after completion of the project by the end of April 2024.

Signature of the Guide Signature of the HOD Signature of the Principal

**Project Details**

**1.1 INTRODUCTION**

A significant number of sanitation workers tragically lose their lives every year due to the hazardous nature of sewage cleaning work, characterized by unpredictability, lack of adequate safety measures, and exposure to harmful toxic gases. In response to this critical issue, a real-time health monitoring system has been developed to safeguard the lives of these workers.

In our project, we introduce a pioneering device **“SAFEBOT”** designed to continuously monitor the vital signs and toxic gases to sanitation workers as they navigate the challenges of sewage cleaning. Our device incorporates cutting-edge technology, including a Carbon Monoxide, Hydrogen sulphide sensors and one Heart Beat sensor to accurately track the worker's pulse rate. Furthermore, it measures the concentration of methane, a highly flammable and hazardous gas commonly found in sewage, and monitors atmospheric oxygen levels.

The primary objective of SAFEBOT is to provide proactive alerts in their own regional language (Ex. Tamil) to both the worker wearing it and an external monitoring unit. These alerts are triggered whenever any of the monitored parameters deviate from the established safe ranges. By delivering real-time data and warnings, this system empowers sanitation workers to make informed decisions about their safety and swiftly respond to potential threats, such as toxic gas exposure.

In essence, this real-time health monitoring device is a crucial advancement in the quest to protect the lives and well-being of sanitation workers, enabling them to work more safely and effectively in sewage environments by detecting toxic gases before harm can occur.

**1.2 OBJECTIVES**

The main objectives of our work are,

1. **Develop SAFEBOT Prototype:** Design and create a functional prototype of the SAFEBOT device that integrates vital sign monitoring (pulse rate) and sensors for detecting toxic gases (Carbon Monoxide, Hydrogen sulphide, and methane).
2. **Real-time Data Monitoring:** Implement real-time data monitoring capabilities within SAFEBOT to continuously track vital signs and toxic gas concentrations while sanitation workers perform sewage cleaning tasks.
3. **Alert System in Regional Language**: Develop an alert system that can provide timely warnings to sanitation workers in their regional language (Tamil) when monitored parameters, such as vital signs or gas concentrations, deviate from established safe ranges.
4. **External Monitoring Unit Integration**: Establish connectivity between SAFEBOT and an external monitoring unit to ensure that supervisors or safety personnel can receive alerts and monitor the status of sanitation workers in real time.
5. **Field Testing and Validation:** Conduct extensive field tests and validation exercises to assess the effectiveness and reliability of SAFEBOT in real sewage cleaning scenarios. Gather user feedback and make necessary improvements based on the results.

These objectives encompass the development, implementation, and testing phases of the project, with the ultimate aim of enhancing the safety and well-being of sanitation workers in sewage cleaning environments.

**1.3 METHODOLOGY**

**1. Needs Assessment and Requirements Gathering:**

* Conduct interviews, surveys, and field observations to understand the specific needs and challenges faced by sanitation workers in sewage cleaning.
* Identify the vital parameters to monitor (pulse rate, gas concentrations) and the safe ranges for these parameters.

**2. SAFEBOT Hardware Design and Assembly:**

* Select appropriate sensors for measuring vital signs (Heart Beat sensor) and detecting toxic gases (Carbon Monoxide, Hydrogen sulphide, methane).
* Design the SAFEBOT hardware, including sensor integration, power source (e.g., battery), microcontroller (e.g., Raspberry Pi), and communication modules.
* Assemble the SAFEBOT prototype, ensuring that it is rugged and suitable for use in challenging sewage environments.

**3. Sensor Calibration and Testing:**

* Calibrate the sensors to ensure accurate measurements of vital signs and gas concentrations.
* Conduct laboratory tests to verify the performance and accuracy of sensor readings under controlled conditions.

**4. Real-time Data Acquisition and Processing:**

* Develop software to continuously acquire data from sensors in real time.
* Implement algorithms for processing and interpreting sensor data.
* Set up thresholds for safe parameter ranges and establish criteria for triggering alerts.

**5. Alert System Development:**

* Create an alert system that can deliver notifications in the regional language (Tamil) to the sanitation worker through a display or audio interface.
* Design the alert system to also transmit alerts to an external monitoring unit, such as a supervisor's device.

**6. Connectivity and Communication:**

* Establish communication protocols (e.g., Wi-Fi, Bluetooth, Zigbee) between SAFEBOT and the external monitoring unit.
* Ensure that data transmission is reliable and secure.

**7. User Interface Design:**

* Develop a user-friendly interface on SAFEBOT for sanitation workers to view their vital signs and receive alerts.
* Create a simple interface on the external monitoring unit for supervisors to track worker status.

**8. Field Testing and Validation:**

* Conduct field tests in actual sewage cleaning environments with sanitation workers.
* Evaluate the performance of SAFEBOT in detecting unsafe conditions and providing timely alerts.
* Gather feedback from sanitation workers and make any necessary improvements to the device and software.

**9. Data Analysis and Reporting:**

* Analyze the data collected during field tests to assess the device's effectiveness in enhancing worker safety.
* Generate reports summarizing the results and highlighting any insights for future improvements.

**10. Documentation and Training:**

* Prepare user manuals and training materials for sanitation workers and supervisors on SAFEBOT usage and maintenance.
* Ensure that all project documentation is comprehensive and accessible.

**11. Deployment and Scaling:**

* Deploy SAFEBOT devices to sanitation workers in sewage cleaning operations.
* Monitor device performance in real-world scenarios and provide ongoing support.
* Consider opportunities for scaling the project to benefit a larger population of sanitation workers.

Throughout the project, maintain a strong focus on safety, user-friendliness, and the cultural and linguistic preferences of the sanitation workers to ensure the success of the SAFEBOT system in safeguarding their lives and well-being.

**1.4 FLOW CHART:**

**Start SAFEBOT**

**Load Sensor value**

No

**If**

**Carbon Monoxide > threshold**

**If**

**Hydrogen Sulfide > threshold**

**If**

**Methane > threshold**

No

No

Yes

Yes

Yes

Show Level in LCD/OLED Display & Voice Alert in Speaker (Tamil)

No

**If**

**Pulse Rate > threshold**

**Stop**

Yes

**Alert to External person outside Sewage tank**

**1.5 WORK PLAN**

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Timeline** | **Work Plan** |
| 1. | Dec. 1st – 15th, 2023 | **Project Initiation**   * Project Kick-off Meeting * Needs Assessment and Requirements |
| 2. | Dec. 16th – 31st, 2023 | **Design and Hardware Development**   * Sensor Selection and Procurement * SAFEBOT Hardware Design |
| 3. | Jan. 1st – 15th, 2024 | **Sensor Calibration and Testing**   * Sensor Calibration * Laboratory Testing |
| 4. | Jan. 16th – 31st, 2024 | **Software Development**   * Real-time Data Acquisition * Alert System Development |
| 5. | Feb. 1st – 15th, 2024 | **Connectivity and User Interface**   * Communication Setup * User Interface Design |
| 6. | Feb. 16th – 29th, 2024 | **Field Testing and Validation**   * Field Testing Planning * Field Testing * Data Collection and Analysis |
| 7. | Mar. 1st – 10th, 2024 | **Documentation and Training**   * Documentation Preparation * Training Materials |
| 8. | Mar. 11th – 20th, 2024 | **Deployment and Scaling**   * Deployment * Ongoing Support |
| 9. | Mar. 21th – 31st, 2024 | **Project Conclusion and Reporting**   * Project Review * Final Reporting |
| 10. | Apr. 1st – 10th, 2024 | **Project Closure and Handover to TNSCST** |

**1.6 BUDGET**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S. No.** | **Component Name** | **Quantity** | **Unit Cost** | **Cost** |
| 1 | Raspberry Pi Pico W with cable | 2 | 750 | 1500 |
| 2 | Audio Playback Device | 1 | 1000 | 1000 |
| 3 | 50W speaker | 2 | 250 | 500 |
| 4 | Rechargeable Battery | 2 | 500 | 1000 |
| 5 | Adaptor(12V/1A) | 1 | 200 | 200 |
| 6 | Breadboard | 2 | 250 | 500 |
| 7 | Jumper Wires | 150 | 5 | 750 |
| 8 | OLED/LCD Display | 300 | 2 | 600 |
| 9 | 3D parts Printing | 1 | 2500 | 2500 |
| 10 | Methane Sensor Module(MQ5) | 2 | 250 | 500 |
| 11 | Carbon Monoxide Sensor Module (MQ7) | 2 | 250 | 500 |
| 12 | Hydrogen Sulfide Sensor Module (MQ136) | 1 | 1600 | 1600 |
| 13 | Pulse Sensor | 1 | 200 | 200 |
| 14 | Consumables | - | - | 1000 |
| **Total Cost** | | | | **12350** |

**1.7 BENEFITS OF PROPOSED SYSTEM:**

* To provide safety for sewage workers
* To avoid deaths of sewage workers due to toxic gasses.
* To develop a cost friendly system.
* To alert the worker if any parameters exceed.
* Alerts in Regional Languages (Ex. Tamil)

**1.8 FUTURE SCOPE**

The project described, which involves the development of the SAFEBOT device has significant potential for future expansion and improvement. Here are several avenues for future scope:

* Enhanced Sensor Capabilities
* Machine Learning Integration
* Integration with GIS Technology
* Smartphone Applications
* Cloud-Based Data Storage and Analysis
* Cross-Industry Adaptation
* Regulatory Compliance
* Cost Optimization
* Community Awareness
* Data Privacy and Security
* Feedback Loops

It is not limited to technical enhancements but also includes its potential impact on worker safety, environmental protection, and public health. It may evolve into a comprehensive safety ecosystem, contributing to the well-being of sanitation workers and the communities they serve.