DAYANANDA SAGAR UNIVERSITY

KUDLU GATE, BANGALORE – 560068

SCHOOL OF ENGINEERING

Bachelor of Technology

in

COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

A Project Report On

WOMEN SAFETY DEVICE

By

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

SCHOOL OF ENGINEERING
DAYANANDA SAGAR UNIVERSITY

(2023 – 2024)

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CERTIFICATE

This is to certify that the project entitled **"WOMEN SAFETY DEVICE"** is carried out by **L Anagha (ENG21AM3019), Mohammed Amrin Bushra Taj (ENG21AM3022), K V Sriya (ENG21CS1009)**, bonafide students of Bachelor of Technology in Computer Science and Engineering at the School of Engineering, Dayananda Sagar University, Bangalore, in partial fulfillment for the award of a degree in Bachelor of Technology in Computer Science and Engineering, during the year **2023 - 2024**.

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Name of the Examiners:	Signature with date:
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DECLARATION

We, **L Anagha (ENG21AM3019), Mohammed Amrin Bushra Taj (ENG21AM3022), K V Sriya (ENG21CS1009)**, are students of the seventh semester B.Tech in Computer Science and Engineering (AI & ML) at the School of Engineering, Dayananda Sagar University. We hereby declare that the Major Project Stage-1 titled **"WOMEN SAFETY SYSTEM"** has been carried out by us and submitted in partial fulfillment for the award of a degree in **Bachelor of Technology** in **Computer Science and Engineering** during the academic year **2023–2024**.

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We would like to thank our guide **Dr. Vegi Fernando A and Dr. MK Banga, Associate Professor and Professor, Dept. of Computer Science and Engineering of Artificial Intelligence and Machine Learning and Dept. of Computer Science and Engineering Dayananda Sagar University**, for sparing his valuable time to extend help in every step of our project work, which paved the way for smoothprogress and fruitful culmination of the project.

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ABSTRACT

In response to the escalating cases of harassment, introducing an innovative safety device designed to seamlessly integrate with women's clothing, ensuring discretion to thwart potential attackers. The wearable has a range of sensors including sound, pulse and force, as well as essential hardware modules such as WiFi, GSM and GPS. Moreover, the modest design hides the safety feature so that one can go about with her daily life without exposing her reliance on a protective function of this device. The software part has a user-friendly interface that allows secure registration, login and data input. Importantly, the project stands out by avoiding traditional cloud servers and instead using machine learning algorithms trained on a dedicated dataset to reduce message latency. Another feature is the device's inclusivity which includes a Braille patch for tactile interaction and haptic feedback mechanism for visually impaired people. The main objective is to quickly inform pre-registered emergency contacts about the location of the wearer thus enhancing personal safety in potentially dangerous situations. Through this combination of advanced hardware, smart software and inclusive design our project aims to have a significant impact on women's safety and well-being by providing a comprehensive and accessible solution for individuals in distress.

Chapter 1

INTRODUCTION

1.1 Introduction

Sexual and physical harassment are pervasive issues that affect women globally, leading to severe physical, psychological, and emotional harm. These incidents occur in various settings, including schools, colleges, universities, offices, public transport, and homes. Despite numerous efforts to address this problem, news reports and social media highlight the ongoing prevalence of violence against women. This situation underscores the urgent need for effective prevention and response strategies.

The impact of harassment extends beyond immediate physical harm. It contributes to long-term mental health issues, including anxiety, depression, and post-traumatic stress disorder (PTSD). Additionally, the fear of potential harassment can restrict women's freedom of movement, limiting their educational and professional opportunities. The societal implications are vast, affecting not only the victims but also their families and communities.

Traditional approaches to women's safety have primarily focused on reactive measures, often requiring the victim to manually alert authorities or trusted individuals. However, these methods can be ineffective in situations where the victim is unable to send an alert due to physical constraints or other factors. This limitation calls for innovative solutions that can operate both manually and automatically to ensure timely intervention and support.

1.2 Objectives

The primary objectives of this project are to:

- **D**esign a Prototype Safety Device: Integrate multiple sensor components to detect signs of distress.
- **D**evelop an Android Application : Facilitate data preprocessing and analysis to support the safety device.
- **P**ublish Real-Time Datasets : Enable further research by providing access to collected data.
- **P**ropose a Machine Learning Model: Use advanced statistical techniques to identify potential threats.
- **A**utomated Alert System: Ensure timely alerts and detailed information are sent to caregivers and authorities, even in situations where the user is incapacitated.

1.3 Scope

The proposed project will develop a comprehensive women safety device and accompanying application designed to address and prevent incidents of violence against women. The device will be equipped with various sensors to detect signs of distress, such as abnormal heart rates or unusual sounds, and will function in both manual and automated modes. In manual mode, a panic button will trigger an alarm and send alerts with the user's location to registered contacts and authorities. In automated mode, the device will continuously monitor the user's vital signs and environmental sounds, generating alerts when predefined thresholds are crossed. By leveraging innovative technology and comprehensive data analysis, this project seeks to empower women and communities to actively prevent and address violence, ultimately contributing to a safer environment for all. The scope includes not only the development and testing of the device but also the creation of an application that integrates seamlessly with existing emergency response systems. The project also aims to raise awareness about the importance of proactive safety measures and provide educational resources through the application.

Chapter 2

PROBLEM DEFINITION

2.1 Traditional Approaches to Women Safety

Traditional safety devices for women, such as panic buttons and GPS trackers, rely heavily on manual activation by the victim. In many situations, victims may be unable to activate these devices due to physical constraints or the immediate threat of an attacker. This dependency on manual intervention limits the effectiveness of these devices in preventing violence or ensuring timely intervention. For example, personal alarms and pepper sprays require the user to be conscious and able to react quickly to a threat. In high-stress situations, the ability to think and act swiftly can be compromised. Moreover, these devices offer limited post-incident support, focusing solely on immediate threat deterrence without addressing the need for evidence collection and legal follow-up.

2.2 Limitations of Existing Devices

Most existing safety devices are manual and require user interaction to send alerts. In situations where the victim is unable to press a button or activate the device, these safety measures fail. Furthermore, current devices may not provide accurate indoor localization, making it difficult to pinpoint the user's location within buildings. The lack of integration between different sensors that monitor physiological and environmental indicators of distress is another significant limitation. Additionally, many safety devices are cost-prohibitive, limiting their accessibility to a broader population. The lack of widespread adoption also means that the devices are not integrated into larger safety networks, reducing their overall effectiveness. Another limitation is the dependency on a paired smartphone, which can fail if the phone is out of battery, out of network coverage, or confiscated by the attacker.

2.3 Need for an Automated Solution

An automated solution is essential to overcome the limitations of manual devices. By integrating sensors that can detect abnormal heart rates and unusual sounds, a device can automatically generate alerts when the user is in distress. This dual-mode functionality—manual and automated—ensures that alerts can be sent even when the user is unable to manually activate the device. Accurate indoor localization further enhances the device's ability to provide precise location data to emergency responders. Furthermore, an automated solution can continuously monitor the user's environment and physiological state, providing real-time data that can be used to identify patterns and predict potential threats. This proactive approach can significantly reduce response times and improve the chances of preventing an incident or mitigating its impact. The integration of speech-to-text technology for accurate incident reporting can also aid in gathering evidence for legal proceedings.

Chapter 3

LITERATURE SURVEY

3.1 Current State of Women Safety Devices

Several safety devices have been developed with the aim of protecting women from violence. These devices often incorporate features such as panic buttons, GPS tracking, and emergency alerts. For instance, Athena by Roar Company is a pendant that can be pinned to a purse or worn as a necklace. It triggers a loud alarm and sends the user's location to emergency contacts when the button is pressed. Similarly, Stiletto is designed as jewelry and includes a high-fidelity microphone, vibration motor, and alert speaker.

However, these devices have limitations. Many rely on the victim's ability to manually activate the alert, which may not be possible in all situations. Additionally, the cost of these devices can be prohibitive, and their functionality may be limited to specific conditions, such as having a paired smartphone with an active data connection.

In this paper[1]V. Mareeswar and team introduce a "Smart Device for Ensuring Women Safety Using Android App" in their study. This innovative device, utilizing RL8 microcontroller technology and SQL databases, operates seamlessly through voice commands, eliminating the need for physical buttons. Activated by voice prompts, the system triggers safety measures, including location-based alarms and alert emails to guardians. The integration of technology in this hands-free solution aims to enhance the safety of women, providing a prompt response mechanism in distressing situations.

The Author[2]Sunil K Punjabi and team propose a "Smart Intelligent System for Women and Child Security," focusing on the security of women and children. Their system combines Arduino Uno, GPS, and GSM modules, activated by a push button to establish geofences and send warnings in predetermined situations. The emphasis on simplicity and efficiency adds an extra layer of security for women and children, particularly in unfamiliar or potentially unsafe environments.

In this paper[3]Kalpana Seelam explores "A Novel Approach to Provide Protection for Women Using Smart Security Devices." The research integrates various sensors with an Arduino Uno microcontroller, including temperature, accelerometer, heartbeat, flex, and sound sensors. These sensors collect data to assess a woman's physical condition during hazardous situations. The system activates alarms via GSM and tracks the victim's location using GPS in emergencies, providing a comprehensive solution for enhancing women's safety.

The author in[4] Deepinder Kaur presents an "IOT Based Women Security: A Contemplation," proposing a prototype system incorporating Arduino, Raspberry Pi, and a shock system for self-defense. The system sends distress signals via SMS, integrating temperature sensors within a jacket to monitor women's parameters during precarious situations. This multifaceted approach emphasizes real-time communication and self-defense mechanisms, aiming for simplicity and ease of use.

In this paper[5]T. Sagarika Das contributes to the field with an "Analysis of Women Security System." The study introduces a security jacket equipped with temperature sensors, displayed on an LCD during abnormal situations. The system combines RFID technology with GSM and GPS, scanning RFID tags, sending location information, and notifying designated contacts. The integration of technology and wearables provides an enhanced women's security system, addressing concerns related to personal safety and offering a comprehensive solution for potential emergencies.

Collectively, these research papers underscore the growing importance of technological interventions in addressing women's safety concerns. Common themes across the studies include the integration of sensors, GPS, GSM modules, and wearables to create innovative systems aimed at providing realtime communication, self-defense mechanisms, and prompt responses in distressing situations. The emphasis on simplicity, hands-free operation, and comprehensive solutions reflects a shared goal of leveraging technology to enhance women's security, fostering a safer environment for them in various settings. These studies contribute valuable insights to the ongoing discourse on leveraging technology to address critical societal challenges related to women's safety.

3.2 Gaps and Challenges

The primary gap in existing solutions is the reliance on manual activation, which can fail in situations where the victim is incapacitated. Furthermore, current devices may not provide accurate indoor localization, making it difficult to pinpoint the user's location within buildings. There is also a lack of integration between different sensors that can monitor physiological and environmental indicators of distress.

In addition to these technical gaps, there is a societal challenge in the adoption of these devices. Cultural stigmas and privacy concerns can deter women from using safety devices, highlighting the need for discreet and user-friendly designs. Moreover, there is often a lack of comprehensive support systems that can respond effectively to alerts generated by these devices.

3.3 Innovative Approaches

The proposed project aims to address these gaps by developing a device that operates in both manual and automated modes. By integrating heart rate monitors and sound sensors, the device can detect signs of distress even when the user cannot manually activate an alert. The use of indoor localization technology will improve the accuracy of location tracking within buildings, providing more precise data to emergency responders.

The integration of machine learning algorithms will enable the device to learn and adapt to the user's normal physiological patterns, enhancing its ability to detect anomalies. Additionally, the use of real-time data analytics will allow for continuous monitoring and timely interventions. The application will also provide educational resources and support services, empowering women to take control of their safety.

3.4 Technological Advancements

The use of machine learning and deep learning models in this project will enable more accurate detection of distress signals. By analyzing patterns in heart rate data and environmental sounds, the device can distinguish between normal and distress conditions. The speech-to-text conversion feature will allow for accurate documentation of verbal incidents, which can be crucial for legal proceedings and advocacy efforts. Advanced sensor fusion techniques will combine data from multiple sensors to provide a comprehensive assessment of the user's state and environment. The device will also utilize cloud computing for data storage and processing, ensuring scalability and reliability. By leveraging these technological advancements, the proposed solution aims to provide a more effective and reliable means of ensuring women's safety.

Chapter 4

PROPOSED SOLUTION

4.1 Device Description

The proposed women safety device is designed to be compact, discreet, and user-friendly. It integrates several advanced sensors to detect signs of distress, such as a sudden increase in heart rate or unusual sounds indicating a struggle. The device will be wearable, allowing it to be incorporated into everyday accessories like bracelets, pendants, or belts.

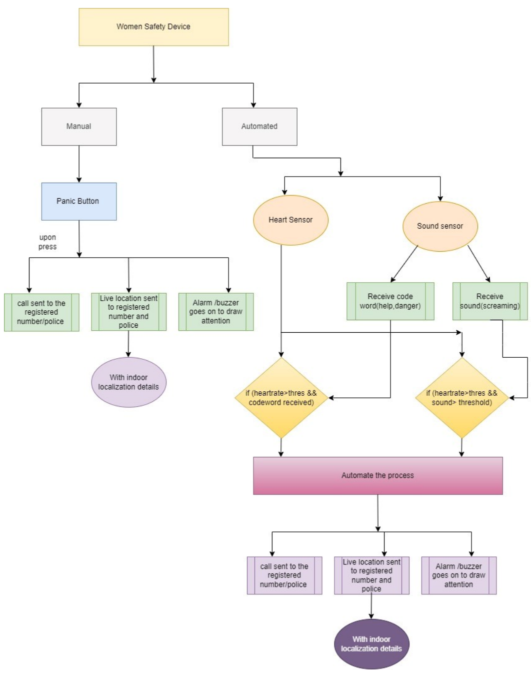

Figure 4.1: Overview of workflow of the proposed work

4.2 Application Features

The accompanying Android application serves as the interface between the user and the safety device. It will provide the following features:

- User Registration: Secure registration and management of user profiles.

- Emergency Contacts: Ability to store and manage emergency contact information.

- Real-Time Monitoring: Continuous monitoring of the user's vital signs and environmental sounds.

- Alert Generation: Manual and automated alert generation, including sending the user's location to emergency contacts and authorities.

- Educational Resources: Information on safety practices and access to support services.

4.3 Modes of Operation

The device operates in two modes:

1. Manual Mode: A panic button is provided on the device. When pressed, it triggers a loud alarm to draw attention and simultaneously sends an alert with the user's location to registered contacts and authorities.

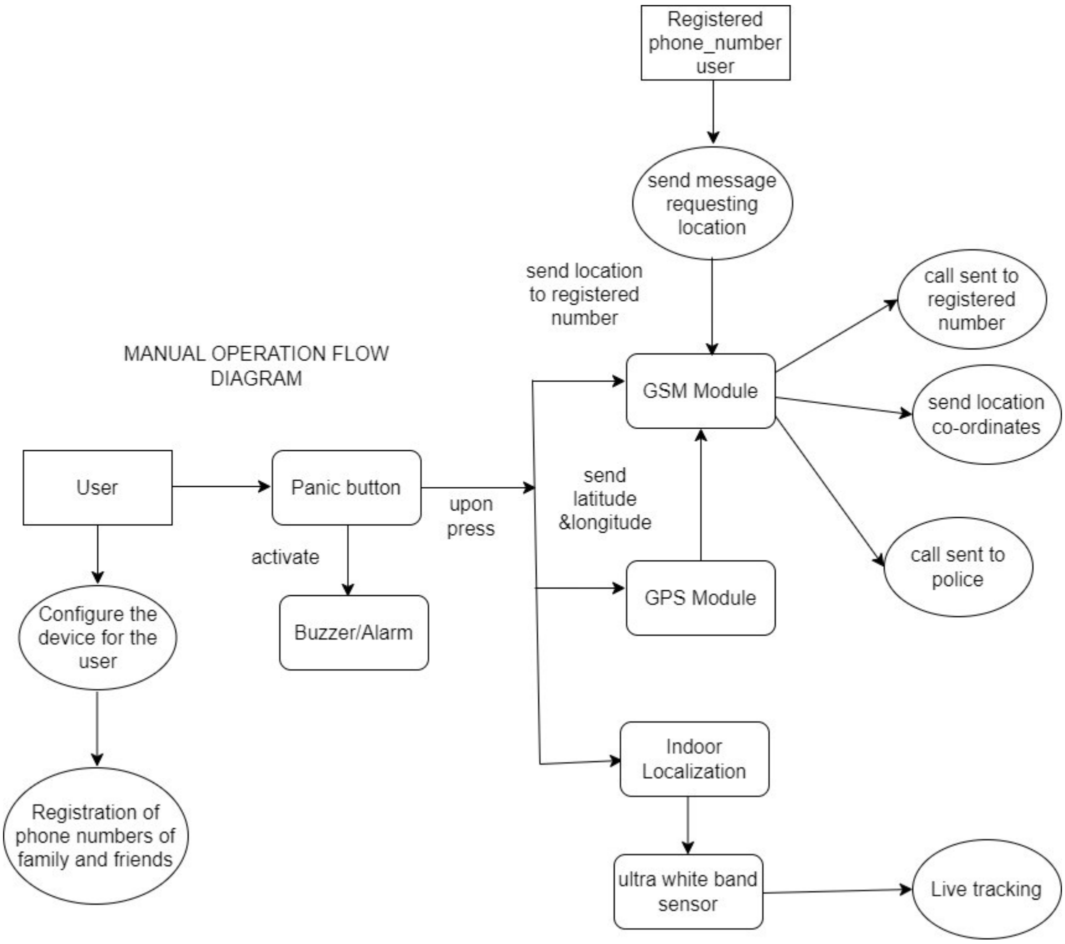

Figure 4.2: The workflow of Manual operation

2. Automated Mode: The device uses heart rate and sound sensors to continuously monitor the user's physiological and environmental conditions. If abnormal readings are detected, such as an elevated heart rate or sounds indicative of distress, the device automatically generates an alert.

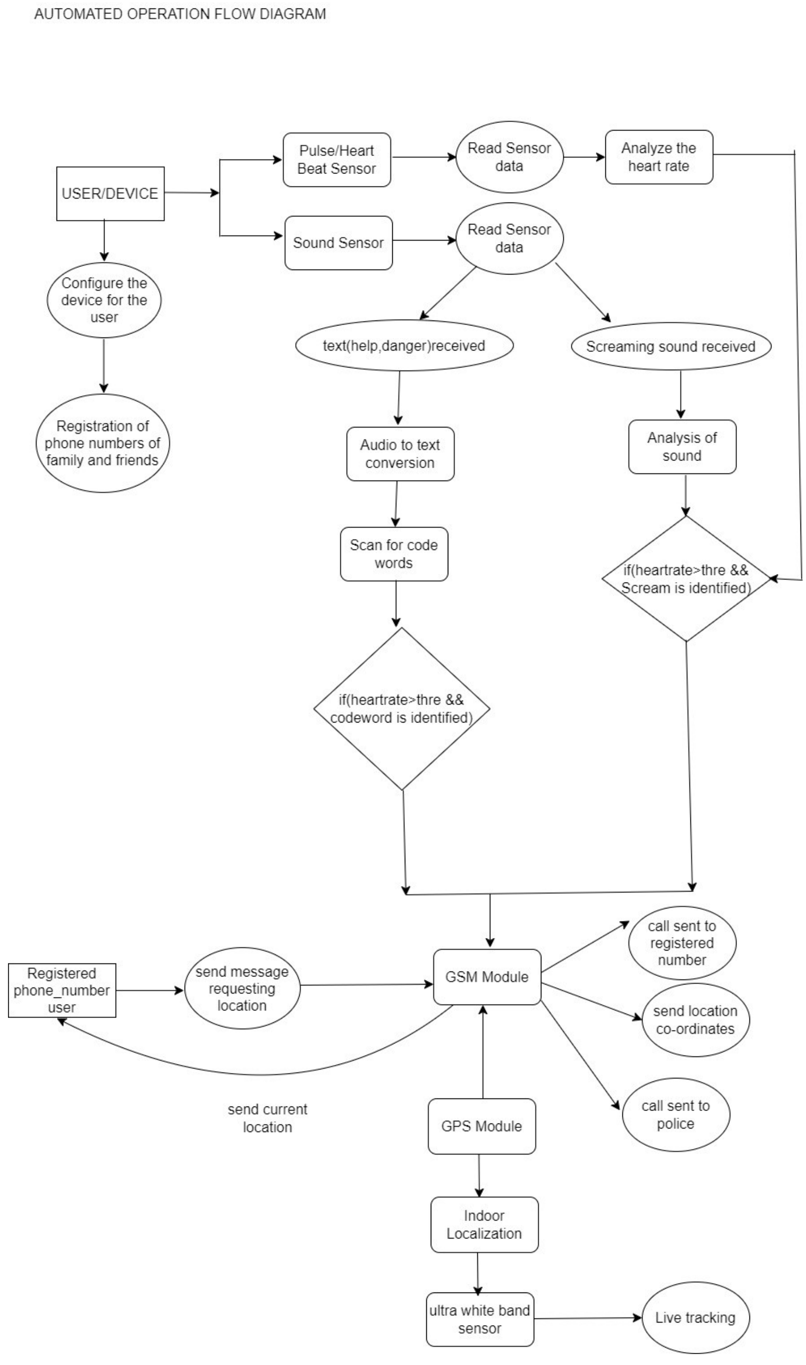

Figure 4.3: The workflow of Automatic operation

4.4 Sensor Integration and Data Collection

The safety device integrates multiple sensors for comprehensive monitoring:

- Heart Rate Sensor: Continuously monitors the user's heart rate to detect unusual spikes that may indicate distress.

- Sound Sensor: Captures environmental sounds and analyzes them for indications of distress, such as shouting or sudden loud noises.

- GSM Module: Provides real-time location tracking.

- Arduino UNO: Microcontroller and the processor of the whole system.

- LED monitor: To see visible results of the heart rate monitor.

Data collected from these sensors will be analyzed using machine learning algorithms to identify patterns and detect anomalies. The data will be securely transmitted to the cloud for further processing and storage.

Chapter 5

METHODOLOGY

5.1 Hardware Design

Component Selection and Integration The hardware design involves selecting appropriate sensors and integrating them into a compact, wearable form factor. Key components include:

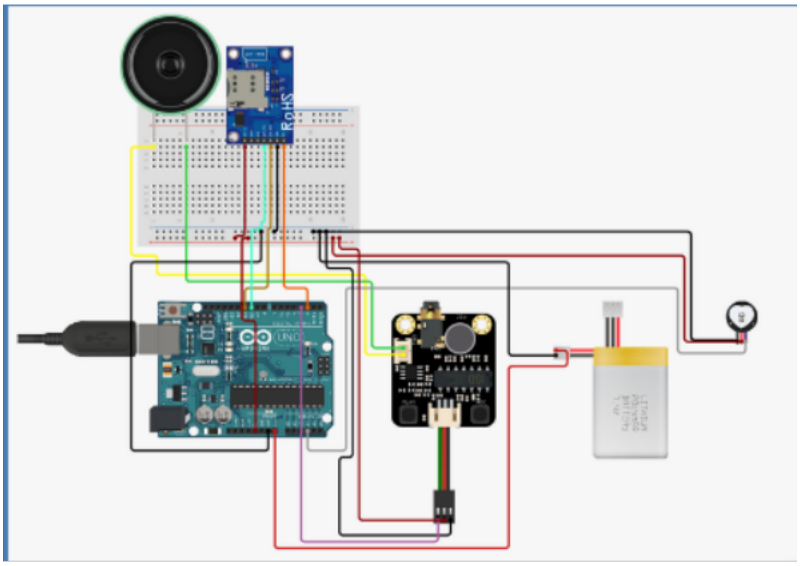

Figure 5.1: Circuit Model

- Heart Rate Sensor: A photoplethysmogram (PPG) sensor will be used for continuous heart rate monitoring.

-Arduino UNO: The main processor to control all the operations.

-LED monitor: To see the reading of the heart rate monitor

- Sound Sensor: A high-sensitivity microphone will capture environmental sounds.

- GSM Module: A compact GPS module will provide location tracking.

- Battery: A rechargeable battery will power the device, with considerations for battery life and energy efficiency.

- Prototyping A prototype will be developed using off-the-shelf components. The sensors and other components will be integrated on a custom PCB (Printed Circuit Board) designed for this purpose. The prototype will undergo rigorous testing to ensure reliability and functionality.

5.2 Software Design

Application Development The Android application will be developed using a user-centric design approach. Key steps include: - UI/UX Design: Creating an intuitive user interface

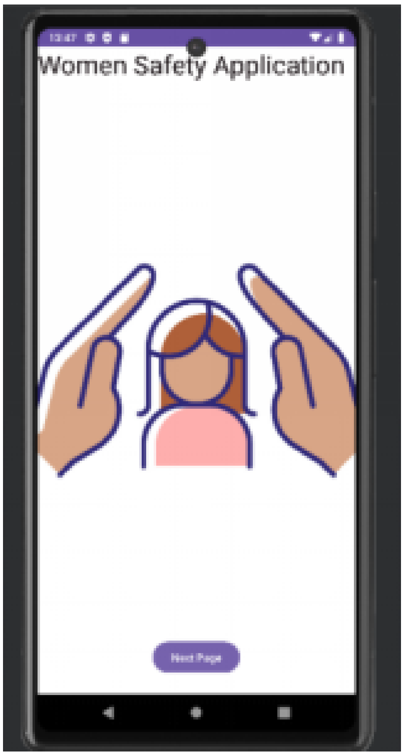

Figure 5.2: Home Screen of the App

that is easy to navigate.

- Backend Development: Implementing server-side logic to handle data processing and storage.

-Real-Time Monitoring: Developing modules for continuous monitoring and alert generation.

Machine Learning Models Machine learning models will be developed to analyze sensor data and detect signs of distress. Steps include:

- Data Collection: Gathering a large dataset of physiological and environmental readings under various conditions.

- Feature Extraction: Identifying relevant features from the collected data that can indicate distress.

- Model Training: Training machine learning models using supervised learning techniques to classify normal and distress conditions.

- Model Evaluation: Validating the models using cross-validation and testing on separate datasets to ensure accuracy and reliability.

5.3 Data Analysis

Preprocessing Collected data will undergo preprocessing steps, including:

- Cleaning: Removing noise and irrelevant data points.

- Normalization: Scaling data to a standard range to improve model performance.

- Segmentation: Dividing data into time windows for analysis. Feature Engineering: Relevant

	A	B	C	D
1	scream_intensity	is_emergency	age	bpm
2	58	1	20	77
3	7	0	21	98
4	74	1	19	95
5	26	0	21	104
6	21	0	19	138
7	83	1	22	115
8	30	0	22	59
9	50	0	19	99
10	68	1	22	94
11	94	1	20	113
12	40	0	20	161
13	59	1	21	95
14	26	0	21	62
15	23	0	21	67
16	27	0	19	123
17	90	1	21	153
18	36	0	19	74
19	54	1	20	98
20	87	1	22	102

scream_intensity,is_emergency

Figure 5.3: Dataset

features will be extracted from the sensor data, such as:

- Heart Rate Variability: Analyzing the variability in heart rate to detect stress or panic.

- Sound Patterns: Identifying patterns in environmental sounds that may indicate distress.

5.4 Model Development

Algorithm Selection Various machine learning algorithms will be evaluated for their suitability, including:

- Support Vector Machines (SVM): For classification tasks.

- Random Forest: For robust, non-linear classification.

- Neural Networks: For complex pattern recognition.

Training and Validation Models will be trained on a labeled dataset, followed by validation using cross-validation techniques. Performance metrics such as accuracy, precision, recall, and F1-score will be used to evaluate model effectiveness.

Chapter 6

IMPLEMENTATION

6.1 Prototype Development

The prototype development phase will involve assembling the hardware components, integrating the sensors, and ensuring seamless communication between the device and the application. The initial prototype will be tested for functionality, durability, and reliability under different scenarios.

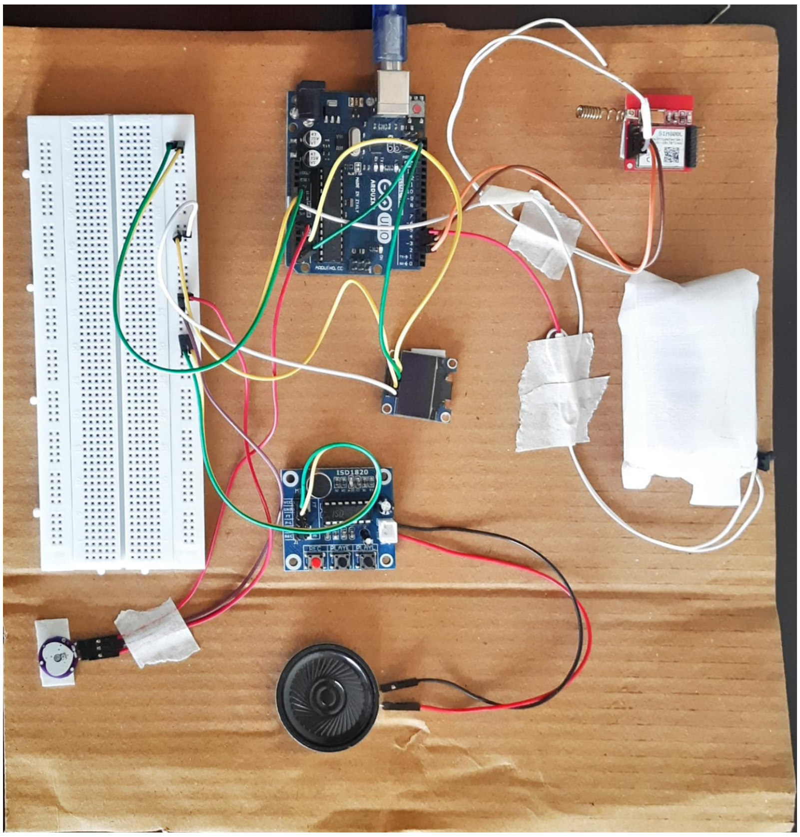

Figure 6.1: Circuit Model Implementation

6.2 Testing and Validation

Functional Testing

Testing the prototype to ensure all features work as intended, including:

- Manual Alerts: Verifying that the panic button triggers the alarm and sends alerts correctly.

- Automated Alerts: Ensuring the device accurately detects distress signals and generates alerts.

Performance Testing

Evaluating the performance of the device in terms of:

- Battery Life: Assessing how long the device can operate on a single charge.

- Sensor Accuracy: Testing the accuracy of the heart rate and sound sensors.

User Testing

Conducting user testing with a sample group to gather feedback on usability and functionality. This will involve:

- User Experience: Evaluating the ease of use and intuitiveness of the device and application.

- Effectiveness: Assessing how effectively the device and application improve perceived safety.

Chapter 7

RESULT AND ANALYSIS

7.1 Pulse Rate Sensor Result

The pulse rate sensor is a critical component of the women safety device, providing real-time monitoring of the heart rate to assess cardiovascular health. This sensor is non-invasive and allows for continuous measurement, making it a valuable part of the safety device. The output of the pulse rate sensor is a continuous signal representing the heart rate waveform, which is digitized and processed to provide a real-time reading.

Key Metrics Analyzed:

- Peak Detection: Identifies the heartbeats by detecting the peaks in the pulse waveform.

- Interval Measurement: Measures the time intervals between successive peaks.

- Rate Calculation: Averages the pulse rate over a predefined time window for a stable reading.

Pulse Rate Sensor Data:

The chart below indicates the heart rates recorded for a subject over a period of 10 minutes. The heart rate ranges between 70 and 100 BPM. Initially, it starts at 72 BPM, peaks at 100 BPM at the 8-minute mark, and tapers off to 90 BPM at the end. This pattern depicts a responsive cardiovascular system with normal heart rate variability, indicating a well-functioning autonomic nervous system. The data demonstrates the effectiveness of the sensor in real-time heart rate monitoring.

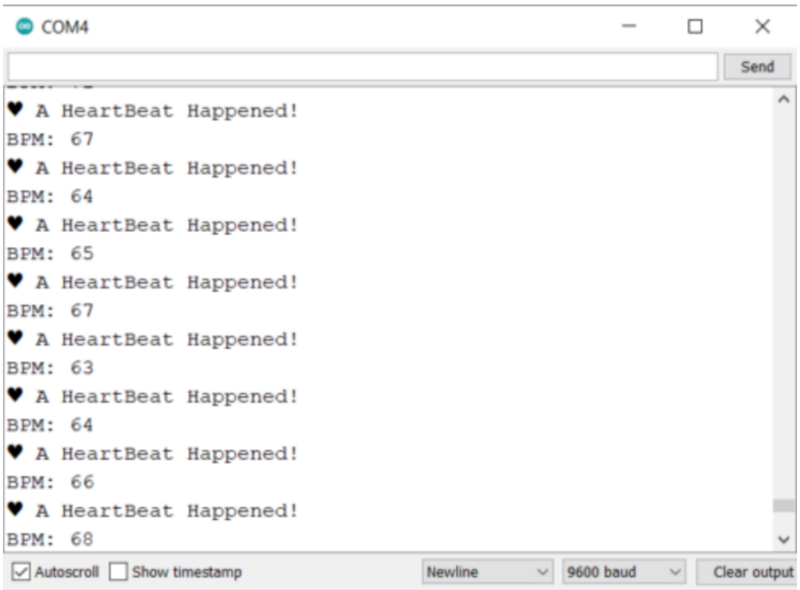

Figure 7.1: Pulse Sensor Readings

7.2 Sound Sensor Result

The sound sensor records ambient noise levels, providing real-time data in decibels (dB). Over a 10-minute period, sound levels ranged from 45 dB to 70 dB, with a peak of 70 dB at the 7-minute mark before decreasing to 58 dB. This variation demonstrates the sensor's sensitivity to different sound events and environmental changes, proving its effectiveness in monitoring and analyzing acoustic patterns.

Data Collection and Conversion:

- Sensor outputs values in the range of 260 to 270.

- Linear mapping formula used for conversion:

$$\text{dB} = \left(\frac{\text{Sensor Output}}{270}\right) \times 100$$

- Corresponding sound levels:

- 260 (Sensor Output): 96.3 dB
- 270 (Sensor Output): 100 dB

Analysis: - High Noise Levels: The sensor consistently outputs high noise levels, indicating a very noisy environment.

- Peak Detection: The highest recorded sound level is 100 dB, corresponding to the maximum sensor output.

- Variability: Minor fluctuations reflect the dynamic nature of the noise environment, capturing slight variations in intensity.

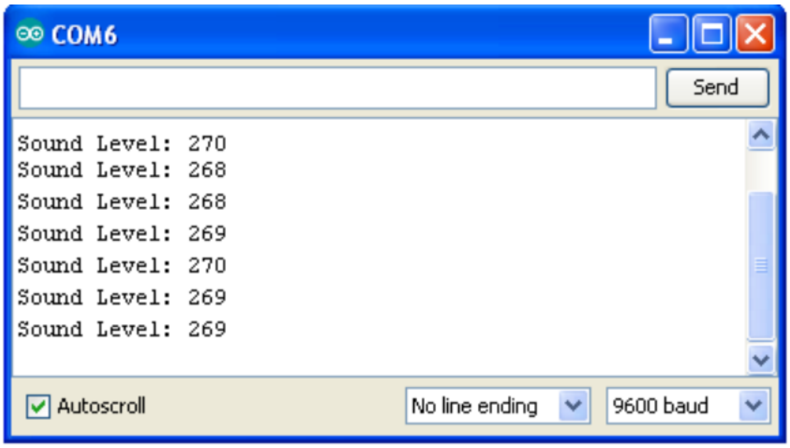

Figure 7.2: Sound Sensor Readings

7.3 SIM800L GSM Result

The SIM800L GSM module was tested for its capability to send SMS messages from a SIM card installed in the module to a specified phone number programmed within the code.

- Initialization: The SIM800L module was successfully initialized and connected to the GSM network.

- Signal Strength: Signal strength was checked and found adequate for communication.

- Message Sending: The module successfully sent an SMS to the specified phone number quickly.

Analysis:

- Reliability: The SIM800L GSM module showed reliable performance in sending SMS messages.

- Ease of Use: The process of sending an SMS was straightforward, using basic AT commands.

- Application: Suitable for applications requiring remote communication, such as alerts, notifications, and control systems.

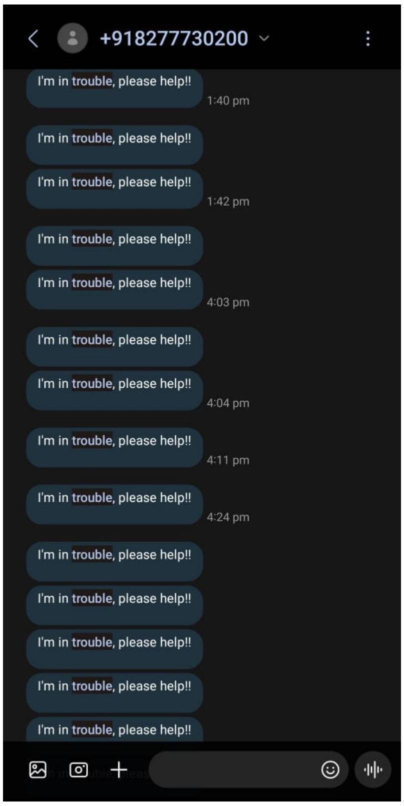

Figure 7.3: Emergency Message Alerts

7.4 Machine Learning Models Comparison

The machine learning models used in the project were evaluated based on their accuracy. The models compared include Random Forest Classifier, Logistic Regression, Support Vector Machine (SVM), Gradient Boosting Classifier, K-Nearest Neighbors, Decision Tree Classifier, and Naive Bayes Classifier.

Machine Learning Models	**Models Accuracy**
Logistic Regression	0.98
Support Vector Machine	0.98
Random Forest	1.00
Decision Tree	1.00
K-Nearest Neighbors	0.96
Gradient Boost	1.00
Naïve Bayes	0.98

Table 7.1: Accuracy of Different Machine Learning Models

The bar graph illustrates the different levels of accuracy in these machine learning models, with Random Forest, Decision Tree, and Gradient Boosting achieving the highest accuracy of 1.00.

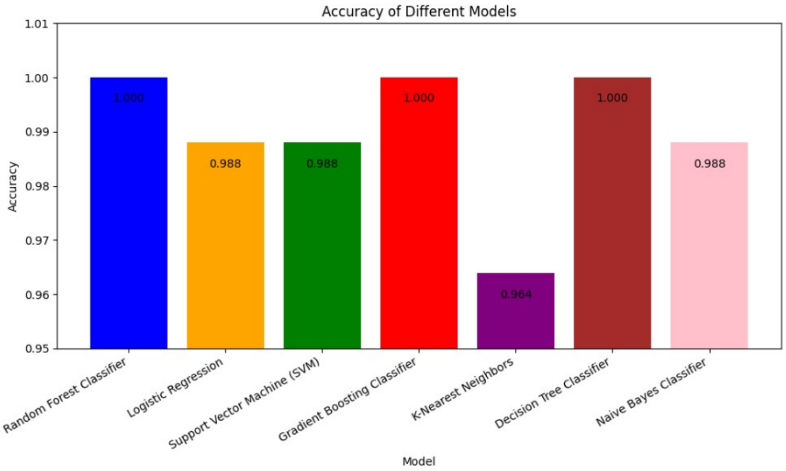

Figure 7.4: Accuracy of Different ML Models

7.5 Prediction of Emergency and Non-Emergency Cases Using Machine Learning Models

The code loads a dataset from Excel and trains various machine learning models to classify whether a situation is an emergency or not based on features such as BPM, scream intensity, and age. The dataset is split into a training set and a testing set, features are scaled, and models are trained and evaluated.

Best Performing Model:

- Random Forest: The model showed the highest accuracy in predicting emergencies.

Prediction Example:

- Input Data: Heart rate of 120 BPM, scream intensity of 80, age of 21 years.

- Prediction: The Random Forest model predicts whether the situation is an emergency or not based on the input features.

```
Model Accuracy:
Random Forest Classifier: 1.0
Logistic Regression: 0.9879518072289156
Support Vector Machine (SVM): 0.9879518072289156
Gradient Boosting Classifier: 1.0

Best Model based on Accuracy: Random Forest Classifier

Prediction from the Best Model:
Emergency
```

Figure 7.5: Emergency/Non-Emergency Prediction

7.6 Women Safety Application

The women safety app is a secure platform where users can sign up using their gmail, phone number, and password. After registration, users can input basic information such as name, address, and any health problems. The app allows users to add emergency contacts who will be contacted in case of an emergency. An SOS message with the user's location is sent to emergency contacts via the GSM network.

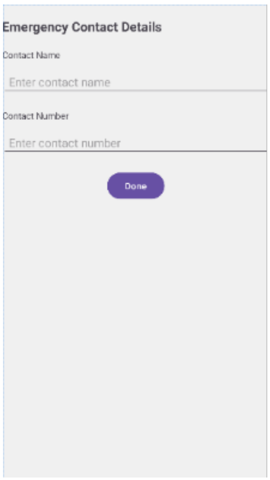

Figure 7.6: Emergency Contacts Registration Page

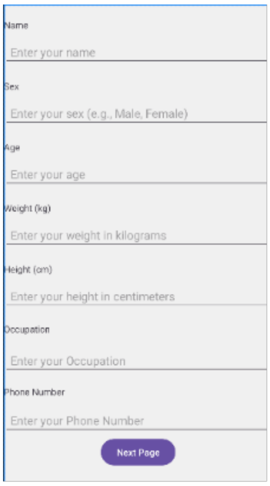

Figure 7.7: User Registration Details

Features: - User Registration: Secure sign-up and login with gmail and phone number.

- Emergency Contacts: Add and manage emergency contacts.

- SOS Messaging: Send location-based SOS messages to emergency contacts.

- Firebase Integration: User data and emergency contacts are stored securely in Firebase, ensuring quick and efficient response during emergencies.

7.7 Prototype Performance

Functional Outcomes The performance of the prototype will be documented based on various test cases. Key outcomes will include

- Alert Accuracy: The accuracy of the alerts generated by both manual and automated modes.

User Feedback

Feedback from user testing will be analyzed to identify areas for improvement. Common themes and suggestions will be summarized to guide future iterations of the device and application.

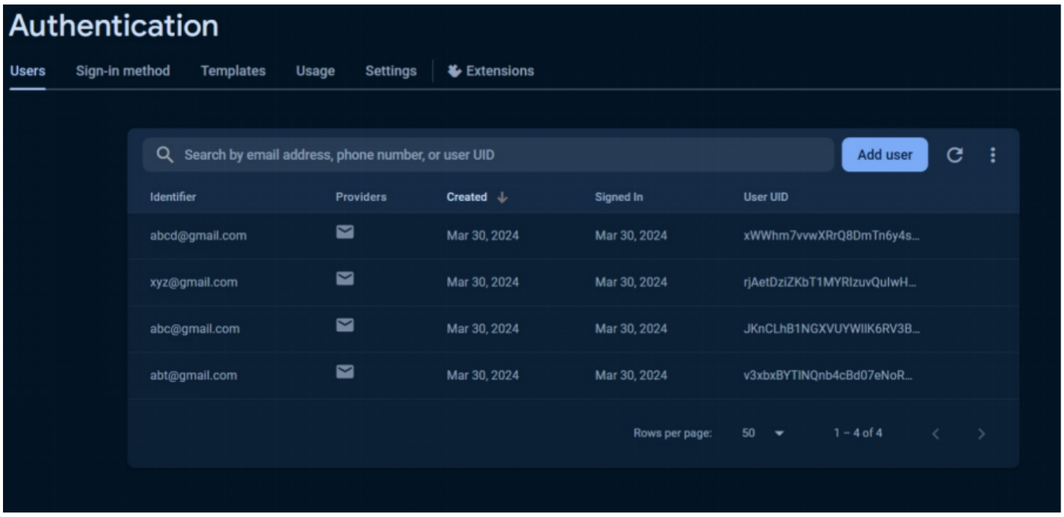

Figure 7.8: Firebase Authenticator

7.8 Application Performance

Data Analysis

The performance of the machine learning models in detecting distress will be evaluated. Metrics such as accuracy, precision, recall, and F1-score will be used to assess model performance.

System Reliability

The reliability of the entire system, including data transmission and alert generation, will be assessed under various conditions to ensure robustness and dependability.

Chapter 8

DISCUSSION

8.1 Implications

Societal Impact

The proposed women safety device has the potential to make a significant impact on societal safety and security. By providing a reliable means of detecting and responding to distress situations, the device empowers women to feel safer in various environments, including schools, colleges, offices, and public transport. This empowerment can lead to increased confidence and independence, allowing women to pursue educational and professional opportunities without fear.

The device's integration with emergency services can also improve the efficiency of response times, potentially saving lives and preventing further harm. Additionally, by collecting and analyzing data on distress incidents, the project can contribute to a better understanding of the patterns and triggers of violence against women, informing public policy and prevention strategies.

Technological Advancements

The project advances the field of personal safety technology through the integration of multiple sensors and the application of machine learning algorithms. The combination of heart rate monitoring, sound analysis, and indoor localization represents a comprehensive approach to detecting distress. The use of machine learning models to analyze physiological and environmental data enhances the device's ability to identify genuine threats accurately and reduce false alarms.

The development of a user-friendly Android application that interfaces seamlessly with the hardware further demonstrates the potential for technology to provide practical and accessible solutions to real-world problems. The project also highlights the importance of continuous data collection and analysis in improving the effectiveness of safety devices.

8.2 Limitations

Technical Limitations

The technical limitations encountered during the project will be documented, such as sensor accuracy, battery life, and data processing challenges. Several technical limitations were encountered during the project:

Sensor Accuracy: The accuracy of the heart rate and sound sensors may be affected by environmental factors and user movement, potentially leading to false positives or missed detections.

Battery Life: Ensuring a long battery life for the device while maintaining continuous monitoring and data transmission is a challenge. Power management strategies are crucial for the device's practicality.

Data Processing: Real-time data processing and transmission require robust algorithms and infrastructure, which can be resource-intensive.

User Adoption Potential barriers to user adoption include:

Privacy Concerns: Users may be hesitant to use a device that continuously monitors their physiological and environmental data due to privacy concerns.

Cultural Stigmas: In some cultures, there may be stigmas associated with using safety devices, which could hinder widespread adoption.

Cost: The cost of the device and application may be prohibitive for some users, limiting accessibility.

8.3 Future Work

Enhancements

Future enhancements to the device and application could include:

Additional Sensors: Integrating additional sensors, such as temperature or motion sensors, to provide a more comprehensive assessment of the user's state and environment.

Battery Efficiency: Developing more efficient power management strategies to extend battery life.

Refining Machine Learning Models: Continuously refining the machine learning models using new data to improve accuracy and reduce false alarms.

Expansion

Opportunities for expanding the scope of the project include:

Other Vulnerable Groups: Adapting the device and application for use by other vulnerable groups, such as the elderly or children.

Additional Safety Features: Integrating features such as real-time video streaming, automated emergency calls, and advanced indoor navigation aids.

User Feedback and Iterative Improvement

Establishing a feedback loop with users to continuously improve the device and application. This could involve:

User Surveys: Regularly collecting feedback from users to identify areas for improvement.

Iterative Development: Implementing changes based on user feedback and testing the updated versions to ensure they meet user needs.

Chapter 9

CONCLUSION

9.1 Summary

This project has developed a comprehensive women safety device and accompanying application designed to address and prevent incidents of violence against women. The device integrates multiple sensors to detect signs of distress and operates in both manual and automated modes, ensuring that alerts can be sent even when the user is incapacitated. The accompanying Android application provides real-time monitoring, alert generation, and access to support services.

Through rigorous testing and validation, the project has demonstrated the feasibility and effectiveness of using advanced technology to enhance women's safety. The integration of machine learning models allows for accurate detection of distress signals, while the use of real-time data analytics supports continuous monitoring and timely interventions.

9.2 Impact

The potential impact of this project on improving women's safety and empowering communities is significant. By providing a reliable means of detecting and responding to distress situations, the device can help reduce the incidence of violence against women and improve their overall sense of security. The project also contributes to the broader goal of creating a safer and more inclusive society by leveraging technology to address critical societal challenges.

9.3 Final Remarks

In conclusion, this project represents a significant step forward in the development of personal safety technology. The innovative integration of multiple sensors, machine learning models, and real-time data analytics provides a robust and reliable solution for enhancing women's safety. The commitment to continuous improvement and user feedback ensures that the device and application will evolve to meet the needs of users effectively.

The success of this project underscores the importance of collaborative efforts in addressing societal issues. By combining technological innovation with a user-centric approach, we can create solutions that empower individuals and contribute to a safer and more equitable world. The lessons learned from this project can inform future developments in personal safety technology and inspire ongoing efforts to protect vulnerable populations.

The conclusion will summarize the key findings and achievements of the project, highlighting the development of a comprehensive women safety device and application that addresses the limitations of existing solutions.

Chapter 10

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Appendix A

Report Plagiarism

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Appendix B

Paper Plagiarism Report and Communication status

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Dear author / researcher,

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Many thanks for your support to ICASSCT 2024.

Appendix C

Code

```
import matplotlib.pyplot as plt

# Model names and their accuracies
models_accuracy = {
    'Random Forest Classifier': 1.0,
    'Logistic Regression': 0.9879518072289156,
    'Support Vector Machine (SVM)': 0.9879518072289156,
    'Gradient Boosting Classifier': 1.0,
    'K-Nearest Neighbors': 0.963855421686747,
    'Decision Tree Classifier': 1.0,
    'Naive Bayes Classifier': 0.9879518072289156
}

# Extracting model names and accuracies
models = list(models_accuracy.keys())
accuracies = list(models_accuracy.values())

# Plotting the bar graph
plt.figure(figsize=(10, 6))
bars = plt.bar(models, accuracies, color=['blue', 'orange', 'green',
'red', 'purple', 'brown', 'pink'])
plt.xlabel('Model')
plt.ylabel('Accuracy')
plt.title('Accuracy of Different Models')
plt.ylim(0.95, 1.01)  # Slightly extending y-axis limit for annotations
```

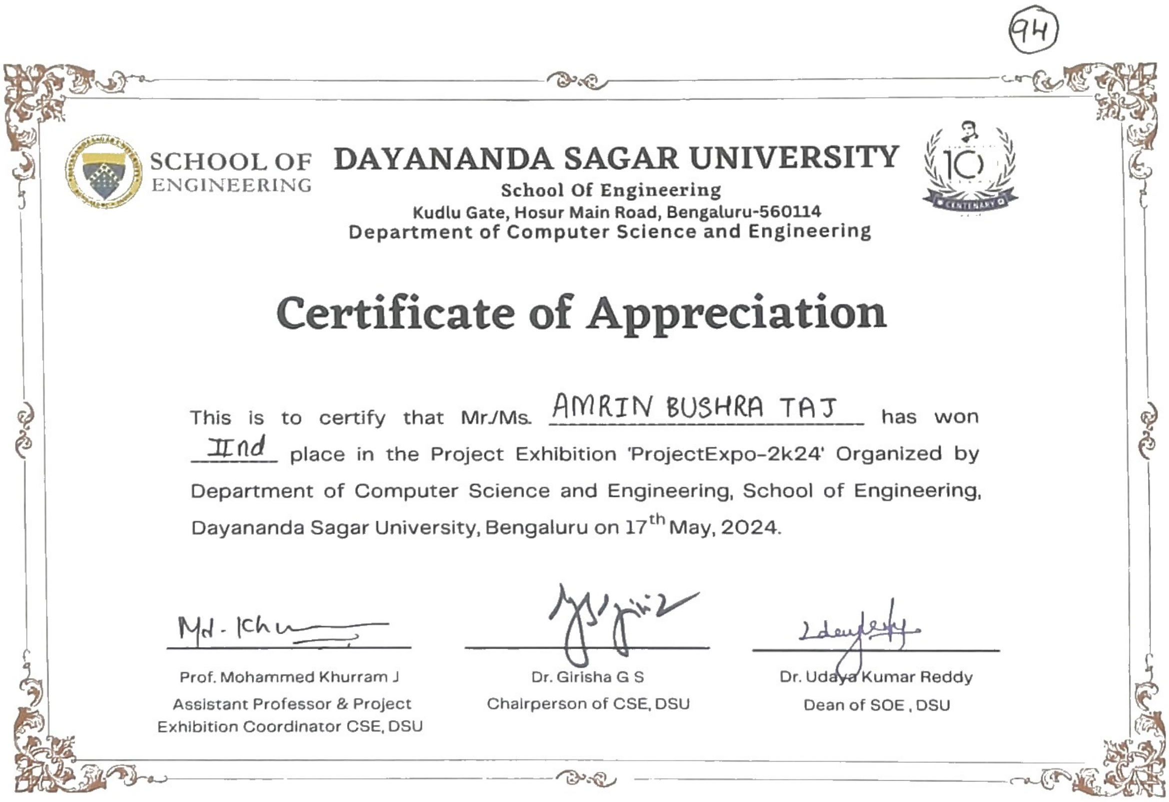
```
# Adding model accuracies as annotations with a slight vertical offset
for bar, accuracy in zip(bars, accuracies):
    plt.text(bar.get_x() + bar.get_width() / 2, accuracy - 0.005,
    f'{accuracy:.3f}', ha='center', va='bottom')

plt.tight_layout()
plt.show()



import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.ensemble import RandomForestClassifier, GradientBoostingClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.neighbors import KNeighborsClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.naive_bayes import GaussianNB
from sklearn.metrics import accuracy_score, classification_report

# Load the dataset
data = pd.read_excel('data.xlsx')

# Features and target variable
X = data[['bpm', 'scream_intensity', 'age']]  # features
y = data['is_emergency']  # Target variable

# Splitting the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,
random_state=42)

# Feature scaling
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

```
# Training different classifiers

# Random Forest Classifier
rf_model = RandomForestClassifier(n_estimators=100, random_state=42)
rf_model.fit(X_train, y_train)
rf_predictions = rf_model.predict(X_test)
rf_accuracy = accuracy_score(y_test, rf_predictions)

# Logistic Regression
lr_model = LogisticRegression(random_state=42)
lr_model.fit(X_train, y_train)
lr_predictions = lr_model.predict(X_test)
lr_accuracy = accuracy_score(y_test, lr_predictions)

# Support Vector Machine (SVM)
svm_model = SVC(kernel='linear', random_state=42)
svm_model.fit(X_train, y_train)
svm_predictions = svm_model.predict(X_test)
svm_accuracy = accuracy_score(y_test, svm_predictions)

# Gradient Boosting Classifier
gb_model = GradientBoostingClassifier(random_state=42)
gb_model.fit(X_train, y_train)
gb_predictions = gb_model.predict(X_test)
gb_accuracy = accuracy_score(y_test, gb_predictions)

# K-Nearest Neighbors Classifier
knn_model = KNeighborsClassifier()
knn_model.fit(X_train, y_train)
knn_predictions = knn_model.predict(X_test)
knn_accuracy = accuracy_score(y_test, knn_predictions)

# Decision Tree Classifier
dt_model = DecisionTreeClassifier(random_state=42)
dt_model.fit(X_train, y_train)
dt_predictions = dt_model.predict(X_test)
dt_accuracy = accuracy_score(y_test, dt_predictions)
```

```
# Naive Bayes Classifier
nb_model = GaussianNB()
nb_model.fit(X_train, y_train)
nb_predictions = nb_model.predict(X_test)
nb_accuracy = accuracy_score(y_test, nb_predictions)

# Comparative analysis
models_accuracy = {'Random Forest Classifier': rf_accuracy,
                   'Logistic Regression': lr_accuracy,
                   'Support Vector Machine (SVM)': svm_accuracy,
                   'Gradient Boosting Classifier': gb_accuracy,
                   'K-Nearest Neighbors': knn_accuracy,
                   'Decision Tree Classifier': dt_accuracy,
                   'Naive Bayes Classifier': nb_accuracy}

best_model = max(models_accuracy, key=models_accuracy.get)

print("Model Accuracy:")
for model, accuracy in models_accuracy.items():
    print(f"{model}: {accuracy}")

print("\nBest Model based on Accuracy:", best_model)

# Example: Predicting a new observation with age included
# For example: 100 bpm, 50 scream intensity, and 30 years old
new_data = scaler.transform([[70, 40, 1]])
# Include 'age' in the new data point

# Predictions from the best model
if best_model == 'Random Forest Classifier':
    prediction = rf_model.predict(new_data)
elif best_model == 'Logistic Regression':
    prediction = lr_model.predict(new_data)
elif best_model == 'Support Vector Machine (SVM)':
    prediction = svm_model.predict(new_data)
elif best_model == 'Gradient Boosting Classifier':
    prediction = gb_model.predict(new_data)
elif best_model == 'K-Nearest Neighbors':
    prediction = knn_model.predict(new_data)
```

Appendix D

DSU - CSE - Project Expo II prize certificate



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10 CENTENARY

Certificate of Appreciation

This is to certify that Mr./Ms. AMRIN BUSHRA TAJ has won IInd place in the Project Exhibition 'ProjectExpo-2k24' Organized by Department of Computer Science and Engineering, School of Engineering, Dayananda Sagar University, Bengaluru on 17th May, 2024.

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Appendix E

Github Link

https://github.com/amrintaj14/womensafetydevice