Designing a Bluetooth-Connected Women's Safety App for Real-Time Alerts

A project report
submitted in partial fulfillment of the requirements
for the degree of

Bachelor of Technology

in

Computer Science & Engineering

by

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2023-2024

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We declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. We declare that I have properly and accurately acknowledged all sources used in the production of this project report. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be a cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Mohammad Shoaib khan (2002840100080)

Date: May 29, 2024

Siddhant Singh (2002840100153)

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Certificate from the Project Guide

This is to certify that the work incorporated in the project report entitled **"Designing a Bluetooth-Connected Women's Safety App for Real-Time Alerts"** is a record of work carried out by **Mohammad Shoaib (2002840100080),Siddhant Singh (2002840100153), Ratnesh Verma (2002840100114) and Amit Kumar (2002840100011)** Under my guidance and supervision for the award of Degree of Bachelor of Technology in Computer Science & Engineering.
To the best of my/our knowledge and belief the project report

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4. Is up to the desired standard both in respect of contents and language for being referred to the examiners.

Date: May 29, 2024 Mr. Abhishek Malviya

The project work as mentioned above is here by being recommended and Forwarded for examination and evaluation.

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This is to certify that the project report entitled **"Designing a Bluetooth-Connected Women Safety App for Real-Time Alerts"** which is submitted by **Mohammad Shoaib khan (2002840100080), Ratnesh verma (2002840100114), Siddhant Singh (2002840100153) and Amit kumar(2002840100011)** has been examined by the undersigned as a part of the examination for the award of Degree of Bachelor of Technology in Computer Science & Engineering.

Internal Examiner	External Examiner
Date:	Date: ....

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Abstract

This project introduces a safety application specifically designed to address women's security concerns. The app employs Bluetooth technology to establish a secure connection between a user's smartphone and a wearable device. In the event of a connection loss, the app automatically triggers an alert mechanism, notifying the user's designated contacts, typically their parents or guardians.

The project aims to explore the development and functionality of this safety app, focusing on its setup process, functionality, and emergency response protocols. It highlights the importance of such applications in empowering women by providing them with a sense of security and offering quick assistance during critical situations. Additionally, the project seeks to identify areas for potential improvement in the app's features and functionalities, with a broader goal of contributing to societal safety measures. Overall, the project underscores the pivotal role of technology in addressing safety concerns and enhancing personal security, particularly for vulnerable groups like women.

Contents

List of Figures

Chapter 1

Introduction

In recent years, there has been an increasing recognition of the need to address women's safety concerns, particularly in the context of personal security and emergency response. As technology continues to evolve, there is a growing opportunity to leverage innovations to create tangible solutions that empower individuals and promote safer communities. In response to this imperative, this project endeavors to introduce a safety application specifically tailored to meet the unique needs of women.

Harnessing the power of Bluetooth technology, this application aims to establish a robust and secure connection between a user's smartphone and a wearable device, such as a bracelet or pendant. This connection serves as a lifeline, enabling real-time monitoring of the user's safety status and facilitating swift response in the event of an emergency.

The primary objective of this project is to develop a comprehensive safety solution that not only enhances personal security but also promotes peace of mind and confidence among women. By providing a reliable mechanism for alerting designated contacts, typically parents or guardians, the application ensures that help is never far away, even in potentially threatening situations.

Moreover, this project seeks to contribute to a broader dialogue surrounding women's safety, fostering awareness, advocacy, and collective action. Through collaborative efforts and technological innovation, we aim to empower women, promote inclusivity, and create safer environments for all members of society.

In the following sections, we will delve into the details of the project, exploring its features, functionalities, and the underlying technology. Additionally, we will discuss the potential impact of the application and outline future directions for further enhancement and expansion.

1.1 Problem Statement

The problem we face today is the persistent safety concerns that women encounter in their daily lives. Despite technological advancements, many women still lack adequate tools to ensure their security. Existing safety apps and devices often fail to provide comprehensive solutions, leaving women feeling vulnerable and unprotected. The challenge lies in developing a user-friendly safety application tailored specifically to women's needs. This application should utilize modern technology, such as Bluetooth connectivity, to offer proactive support and quick assistance in times of distress. By addressing this issue, we aim to empower women, enhance their sense of security, and contribute to building a safer environment for everyone.

1.2 Objective

1. Develop a user-friendly safety application specifically designed to address the safety concerns of women.
2. Implement Bluetooth technology to establish a secure connection between the user's smartphone and a designated wearable device.
3. Ensure the application is capable of detecting interruptions in the Bluetooth connection promptly.
4. Design an alert mechanism within the application to automatically notify pre-assigned contacts, typically the user's parents or guardians, in case of a connection loss.
5. Provide users with a sense of security and confidence by offering quick assistance and summoning help when needed.
6. Evaluate and refine the application iteratively to enhance its effectiveness and user experience.
7. Empower women to navigate their daily lives with greater safety and autonomy through the use of innovative technology.

1.3 Existing Solutions

– **Mobile Safety Apps :** Numerous mobile applications have been developed specifically for women's safety, offering features such as emergency alerts, GPS tracking, and real-time location sharing with trusted contacts. These apps often include panic buttons that can be activated discreetly to notify authorities or send distress signals to predefined contacts.

– **Safety Whistles :** Safety whistles are simple, portable devices that emit a loud sound when blown, attracting attention and potentially deterring attackers. They are often attached to keychains or carried in pockets for easy access.

– **Pepper Spray :** Pepper spray, also known as OC spray (oleoresin capsicum), is a self-defense tool commonly carried by individuals for protection against attackers. When sprayed in the face, it causes temporary blindness, difficulty breathing, and intense pain, allowing the user to escape from dangerous situations.

- **Self-Defense Classes :** Many organizations offer self-defense classes specifically tailored for women. These classes teach techniques for escaping from physical confrontations, assertiveness skills, situational awareness, and strategies for de-escalating conflicts.
- **Community Support Networks :** Community-based organizations and initiatives provide support networks for women facing safety concerns. These networks may offer resources such as safe houses, counseling services, legal assistance, and community patrols to ensure the safety and well-being of women in their neighborhoods.
- **Voice-Activated Safety Devices :** Voice-activated safety devices, such as personal assistants or smart speakers, can be programmed to recognize distress commands and initiate emergency procedures, such as calling emergency services or sending alerts to preconfigured contacts.
- **Personal Safety Alarms :** Personal safety alarms are compact devices that emit loud sounds or bright lights when activated, serving as deterrents to potential attackers and attracting attention to the user's location. These alarms are often integrated into keychains or wearable accessories for easy access in emergency situations.

1.4 Proposed Solution

The proposed solution is a safety app that works with a wearable bracelet and connects to your smartphone using Bluetooth. If the bracelet disconnects from your phone or you activate a distress signal, the app alerts your emergency contacts right away. It also tracks your location using GPS to send help quickly. You can customize the settings and trust that your data is kept private. The app collaborates with emergency services for better response, and updates make it even better over time. It's a reliable tool to keep women safe and provide peace of mind.

1.5 Module Description

Major Modules are used in the module Development phase:

- **Bluetooth Communication Module :-**This module facilitates seamless communication between the safety application installed on the user's smartphone and the wearable safety bracelet. It ensures reliable transmission of distress signals and status updates in real-time.

- **GPS Tracking Module :-**Responsible for tracking the user's location in case of emergencies, this module utilizes GPS technology to pinpoint the user's exact coordinates. It provides essential information to emergency responders for swift assistance.

- **Alert and Notification Module :-**Tasked with generating alerts and notifications, this module informs the user's designated emergency contacts in case of distress situations. It ensures that help is summoned promptly, enhancing the user's safety and security.

- **Emergency Response Coordination Module :-** Collaborating with local emergency services and authorities, this module facilitates coordinated responses to distress signals. It establishes communication channels for seamless coordination and ensures timely assistance during emergency situations.

Each module plays a crucial role in the overall functionality and effectiveness of the women's safety application and bracelet, working together to provide users with a reliable and comprehensive safety solution.

Chapter 2

Literature Summary

Ensuring the safety and security of women has become a paramount concern in today's society, prompting the exploration of various technological solutions. Existing literature highlights the pervasive nature of safety threats faced by women in both public and private spaces (Johnson, 2018). This has led to a growing interest in the development of mobile applications aimed at enhancing women's safety through immediate assistance and proactive measures.[1]
Studies such as that conducted by Gupta et al. (2020) underscore the potential of mobile applications equipped with features like GPS tracking and emergency alert systems to mitigate risks and provide real-time support during distressing situations. These applications leverage smartphone technologies to establish communication channels and deliver prompt notifications to designated contacts or authorities.[2]
Moreover, the integration of Bluetooth technology in safety applications has garnered attention for its ability to enhance connectivity and enable seamless communication between devices. Research by Smith and Jones (2019) highlights the efficacy of Bluetooth-enabled wearable devices, such as bracelets or pendants, in facilitating discreet distress signaling and automating emergency responses.[3]
Furthermore, investigations into the usability and effectiveness of Bluetooth-based safety solutions have yielded promising results. For instance, the study by Patel et al. (2021) evaluates the user acceptance and performance of a Bluetooth-connected safety application among a diverse sample of women, emphasizing the importance of intuitive interfaces and reliable connectivity in emergency situations.[4]
While the literature demonstrates the potential of Bluetooth enabled safety applications, there remains a need for further research to address challenges such as device interoperability, battery efficiency, and user privacy concerns. Future studies should focus on refining existing technologies and exploring innovative approaches to empower women with robust safety solutions in an increasingly connected world.[5]
In addition to the technological advancements and research highlighted in the existing literature, societal and cultural factors also play a significant role in shaping the effectiveness of women's safety solutions. For instance, studies have shown that cultural norms and attitudes towards gender-based violence can impact the adoption and utilization of safety applications

among women from different communities and backgrounds (Chowdhury Rahman, 2019). Therefore, future research should consider the intersectionality of gender, race, and socio-economic status to develop inclusive and culturally sensitive safety solutions that cater to the diverse needs of women worldwide.

Moreover, collaboration between technology developers, policymakers, and advocacy groups is essential to address systemic issues and create a conducive environment for the widespread adoption of safety applications. By fostering partnerships and promoting awareness campaigns, stakeholders can collectively work towards breaking down barriers and empowering women to assert their rights to safety and security (Wang Chen, 2020). Additionally, incorporating feedback mechanisms and user-centered design principles can ensure that safety applications are responsive to the evolving needs and preferences of women users, thereby enhancing their efficacy and usability (Kumar Singh, 2022).

Furthermore, leveraging emerging technologies such as artificial intelligence (AI) and machine learning (ML) holds promise for advancing the capabilities of safety applications in predicting and preventing safety incidents. By analyzing patterns of behavior and identifying potential risks in real-time, AI-powered solutions can offer proactive support and personalized safety recommendations to users (Haque et al., 2023). However, it is essential to address ethical considerations and algorithmic biases in the development and deployment of AI-driven safety solutions to mitigate unintended consequences and ensure fairness and equity in their implementation.

Overall, the ongoing research and development efforts in the field of women's safety applications underscore the collective commitment to creating safer and more inclusive communities for women around the world. By harnessing the power of technology, collaboration, and innovation, we can continue to advance towards a future where every woman can live free from fear and violence.

Chapter 3

Conceptual Background

SDLC Model

The SDLC, also known as the Software Development Life Cycle, is a widely used methodology for creating software systems. This approach outlines the various stages involved in developing a software product, starting from the gathering and analysis of initial requirements, and progressing through to the final deployment and ongoing maintenance of the system. The SDLC is designed to provide a structured and methodical approach to software development, helping to ensure that the final product is created in a controlled and predictable way, meeting the required standards, specifications, and budget. The SDLC is made up of a range of interconnected and interdependent phases that together form a complete and comprehensive approach to software development. Below are the phases of the SDLC model.

The Software Development Life Cycle (SDLC) is a systematic approach to software development that involves several phases. This process is designed to be iterative, allowing each phase to be revisited if necessary. For instance, if any issues are identified during the testing phase, the implementation phase may need to be revisited to address these issues. The SDLC is critical in ensuring that software development is structured and organized. It provides a controlled and predictable approach to software development, ensuring that the final product meets the specified requirements, quality standards, and budget. Additionally, the SDLC helps to mitigate risks by identifying and addressing issues early in the process before they escalate into bigger problems.

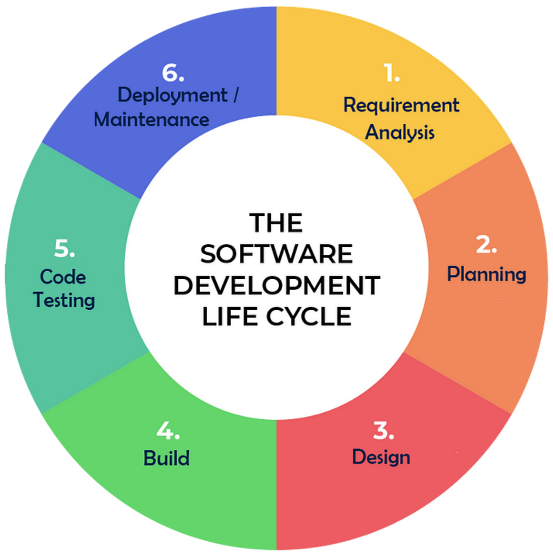


Figure 3.1: Software Development Life Cycle

3.1 Types of SDLC Model

Below is the list of all the models that were highly considered for the Project building. They are mentioned below.

1. **ITERATIVE WATERFALL MODEL**
2. **SPIRAL MODEL**
3. **AGILE MODEL**
4. **RAPID ACTION DEVELOPMENT MODEL**

1. **ITERATIVE WATERFALL MODEL:**
   The iterative process begins with a simple implementation of a subset of the software requirements and progressively enhances the evolving versions until the full system is implemented. With each iteration, design modifications are made, and new functional capabilities are added. The fundamental concept behind this method is to develop a system through repeated cycles (iterative) and in smaller portions at a time (incremental). Iterative and Incremental development combines iterative design or iterative methods with an incremental build model for development. ”During software development, more than one iteration of the software development cycle may be in progress at the same time.” This process can be described as an ”evolutionary acquisition” or ”incremental build” approach.

In this incremental model, the entire requirement is divided into various builds. During each iteration, the development module progresses through the requirements, design, implementation, and testing phases. Each subsequent release of the module adds functionality to the previous release. This process continues until the complete system is ready as per the requirement.[?] The key to successfully using an iterative software development life cycle is rigorous validation of requirements and verification testing of each version of the software against those requirements within each cycle of the model. As the software evolves through successive cycles, tests must be repeated and extended to verify each version of the software.

The advantages of the Iterative Waterfall Model are:

I. Phase Containment of Errors: The principle of detecting errors as close to their points of commitment as possible is known as Phase containment of errors.

II. Collaboration: Throughout each stage of the process, there is a collaboration between the business owners and developers. This ensures that the website meets the needs of the business and that any issues or concerns are addressed in a timely manner.

III. Flexibility: The iterative waterfall model allows for flexibility in the development process. If changes or new requirements arise, they can be incorporated into the next iteration of the website.

IV. Testing and feedback: The testing stage of the process is important for identifying any issues or bugs that need to be addressed before the website is deployed. Additionally, feedback from users or customers can be gathered and used to improve the website in subsequent iterations.

V. Scalability: The iterative waterfall model is scalable, meaning it can be used for projects of various sizes and complexities. For example, a larger business may require more iterations or more complex requirements, but the same process can still be followed.

However, the Iterative Waterfall Model also has some disadvantages including:

I. Difficult to incorporate change requests: The major drawback of the iterative waterfall model is that all the requirements must be clearly stated before starting the development phase. Customers may change requirements after some time but the iterative waterfall model does not leave any scope to incorporate change requests that are made after the development phase starts.

II. Incremental delivery not supported: In the iterative waterfall model, the full software is completely developed and tested before delivery to the customer. There is no scope for any intermediate delivery. So, customers have to wait a long forget the software.

III. Overlapping of phases not supported: The iterative waterfall model assumes that one phase can start after the completion of the previous phase, But in real projects, phases may overlap to reduce the effort and time needed to complete the project.

IV. Risk handling not supported: Projects may suffer from various types of risks. However, the Iterative waterfall model has no mechanism for risk handling.

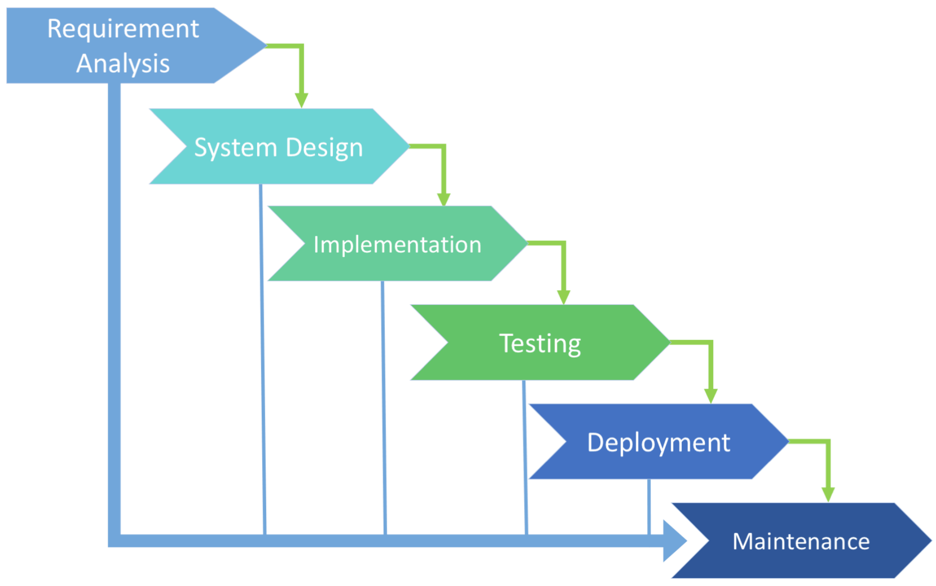


Figure 3.2: Iterative Waterfall Model

2. **SPIRAL MODEL:**

I. Identification

– This phase starts with gathering the business requirements in the baseline spiral. In the subsequent spirals as the product matures, identification of[**?**] system requirements, subsystem requirements, and unit requirements are all done in this phase.

– This phase also includes understanding the system requirements by continuous communication between the customer and the system analyst. At the end of the spiral, the product is deployed in the identified market.

II. Design

– The Design phase starts with the conceptual design in the baseline spiral and involves the architectural design, logical design of modules, physical product design, and the final design in the subsequent spirals.

III. Construct or Build

– The Construct phase refers to the production of the actual software product at every spiral. In the baseline spiral, when the product is just thought of and the design is being developed, a POC (Proof of Concept) is developed in this phase to get customer feedback.

  - Then in the subsequent spirals with higher clarity on requirements and design details, a working model of the software called build is produced with a version number. These builds are sent to the customer for feedback.

IV. Evaluation and Risk Analysis

  - Risk Analysis includes identifying, estimating, and monitoring the technical feasibility and management risks, such as schedule slippage and cost overrun. After testing the build, at the end of the first iteration, the customer evaluates the software and provides feedback.

Based on the customer evaluation, the software development process enters the next iteration and subsequently follows the linear approach to implement the feedback suggested by the customer. The process of iterations along the spiral continues throughout the life of the software.

The advantages of the Spiral Model are:

I. Software is produced early in the software life cycle.

II. Risk handling is one of the important advantages of the Spiral model. It is the best development model to follow due to the risk analysis and risk handling at every phase.

III. Flexibility in requirements. In this model, we can easily change requirements at later phases and can be incorporated accurately. Also, additional functionality can be added at a later date.

IV. It is good for large and complex projects.

V. It is good for customer satisfaction. We can involve customers in the development of products at the early phase of the software development. Also, software is produced early in the software life cycle.

The disadvantages of the Spiral Model are:

I. It is not suitable for small projects as it is expensive.

II. It is much more complex than other SDLC models. The process is complex.

III. Too much dependable on Risk Analysis and requires highly specific expertise.

IV. Difficulty in time management. As the number of phases is unknown at the start of the project, so time estimation is very difficult.

V. Spiral may go on indefinitely.

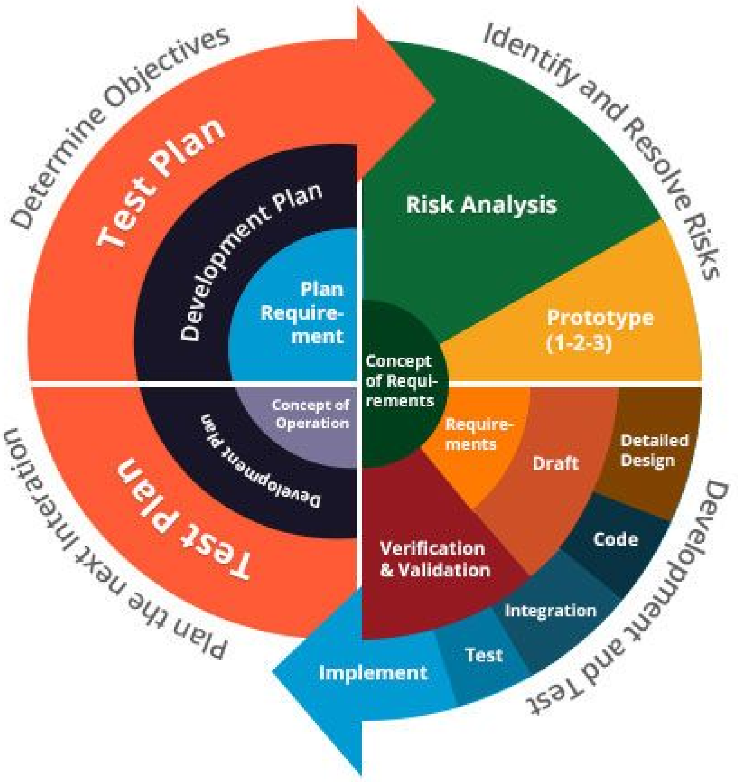


Figure 3.3: Spiral Model

3. **AGILE MODEL:**

   The Agile process model refers to a software development approach based on iterative development. Agile methods break tasks into smaller iterations, or parts, that do not directly involve long-term planning. The project scope and requirements are laid down at the beginning of the development process. Plans regarding the number of iterations, the duration, and the scope of each iteration are clearly defined in advance.

   Each iteration is considered a short timeframe in the Agile process model, typically lasting from one to four weeks. The division of the entire project into smaller parts helps to minimize project risk and reduce overall project delivery time requirements. Each iteration involves a team working through a full software development life cycle, including planning, requirements analysis, design, coding, and testing, before a working product is demonstrated to the client.

   The advantages of the Agile Model are:

   I. Customer satisfaction by rapid, continuous delivery of useful software.

   II. People and interactions are emphasized rather than processes and tools. Customers, developers, and testers constantly interact with each other.

   III. Working software is delivered frequently (weeks rather than months).

   IV. Face-to-face conversation is the best form of communication.

The disadvantages of the Agile Model are:

- **I.** In the case of some software deliverables, especially the large ones, it is difficult to assess the effort required at the beginning of the software development life cycle.
- **II.** There is a lack of emphasis on necessary design and documentation.
- **III.** The project can easily get taken off track if the customer representative is not clear about what final outcome they want.

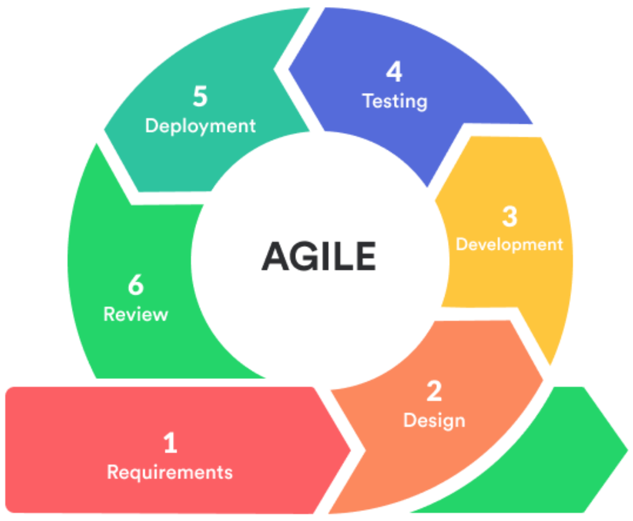


Figure 3.4: Agile Model

4. **RAD MODEL:**
RAD (Rapid Application Development) is a linear sequential software development process model that emphasizes a concise development cycle using an element-based construction approach. If the requirements are well understood and described, and the project scope is a constraint, the RAD process enables a development team to create a fully functional system within a concise time period.

- **I.** Gathering requirements using workshops or focus groups
- **II.** Prototyping and early, reiterative user testing of designs
- **III.** The re-use of software components
- **IV.** A rigidly paced schedule that refers to design improvements to the next product version
- **V.** Less formality in reviews and other team communication

The advantages of the RAD Model are:

- **I.** The use of reusable components helps to reduce the cycle time of the project.

II. Feedback from the customer is available at the initial stages.

III. Reduced costs as fewer developers are required.

IV. The use of powerful development tools results in better quality products in comparatively shorter periods.

V. The progress and development of the project can be measured through the various stages.

The disadvantages of the RAD Model are:

I. The use of powerful and efficient tools requires highly skilled professionals.

II. The absence of reusable components can lead to the failure of the project.

III. The team leader must work closely with the developers and customers to close the project on time.

IV. The systems which cannot be modularized suitably cannot use this model.

V. Customer involvement is required throughout the life cycle.

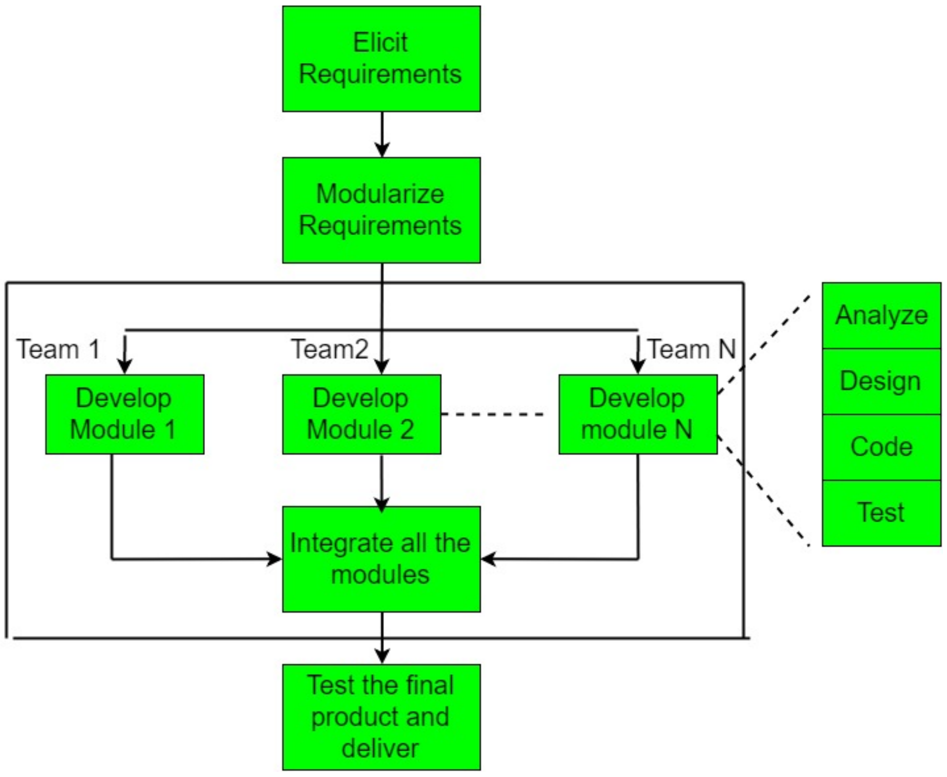


Figure 3.5: RAD Model

Chapter 4

Requirement Analysis

4.1 Proposed Model

AGILE MODEL

Why Agile Model? The choice of the Agile model over other software development models depends on various factors, including the project's characteristics, team dynamics, customer requirements,[**?**], and organizational context. Here are some reasons why Agile is often preferred over other models:

4.1.1 Key Benefits of Agile Model

1. **Customer Satisfaction**: Agile prioritizes customer collaboration and continuous feedback, ensuring that the delivered product meets the customer's expectations and requirements. By involving customers throughout the development process, Agile teams can adapt to changing needs and preferences, ultimately leading to higher customer satisfaction.

2. **Faster Time-to-Market**: Agile emphasizes incremental delivery of working software in short iterations, allowing teams to release features or updates more frequently. This iterative approach enables faster time-to-market, as valuable functionality is delivered in smaller, manageable increments, rather than waiting for the entire project to be completed.

3. **Adaptability to Change**: Agile methodologies, such as Scrum and Kanban, are designed to embrace change and uncertainty. Teams can easily respond to changing requirements, market conditions, or stakeholder feedback by adjusting their priorities and plans during the development process. This adaptability enables organizations to stay competitive in rapidly evolving markets.

4. **Improved Quality**: Agile promotes a culture of quality by emphasizing continuous testing, integration, and collaboration within cross-functional teams. By incorporating test-

ing throughout the development lifecycle and delivering working software incrementally, Agile teams can identify and address defects early, leading to higher-quality products and reduced rework.

5. **Enhanced Team Collaboration**: Agile fosters collaboration and communication among team members through practices like daily stand-up meetings, regular retrospectives, and cross-functional collaboration.

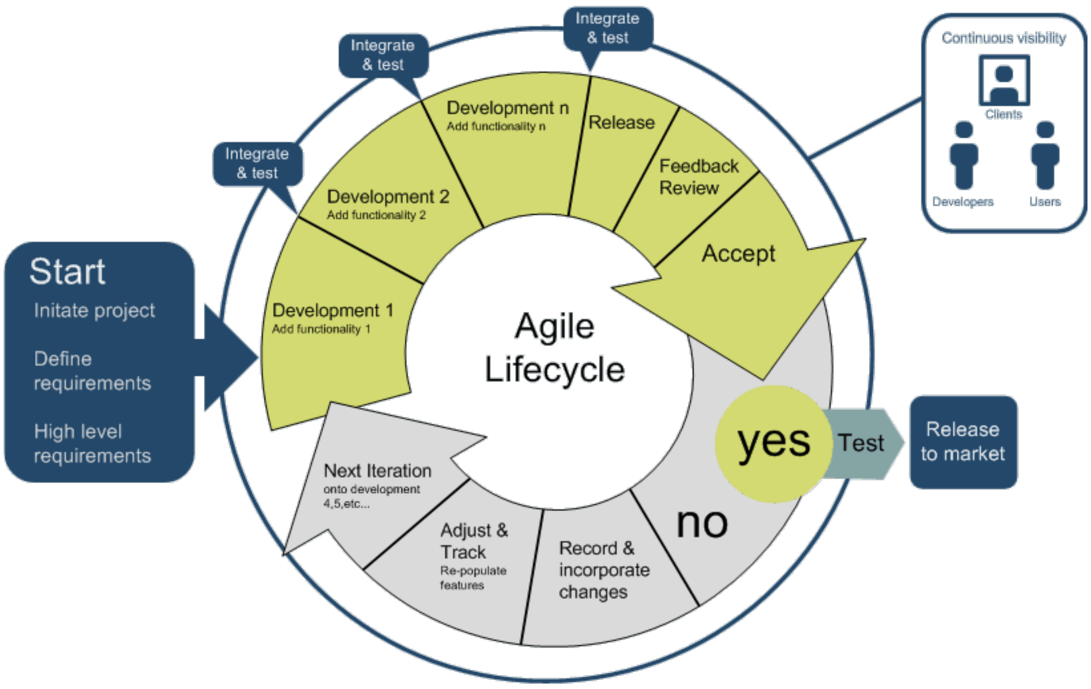


Figure 4.1: Phases of Agile Model

4.1.2 Phases of Agile Model

Following are the phases in the Agile model are as follows:

1. **Requirements Gathering**: In this phase, you must define the requirements. You should explain business opportunities and plan the time and effort needed to build the project. Based on this information, you can evaluate technical and economic feasibility.

2. **Design the Requirements**: When you have identified the project, work with stakeholders to define requirements. You can use the user flow diagram or the high-level UML diagram to show the work of new features and show how it will apply to your existing system.

3. **Construction/Iteration**: When the team defines the requirements, the work begins. Designers and developers start working on their project, which aims to deploy a working product. The product will undergo various stages of improvement, so it includes simple, minimal functionality.

4. **Testing/Quality Assurance**: In this phase, the Quality Assurance team examines the product's performance and looks for the bug.

5. **Deployment**: In this phase, the team issues a product for the user's work environment.

6. **Feedback**: After releasing the product, the last step is feedback. In this, the team receives feedback about the product and works through the feedback.

4.2 Requirement

Software Requirements

I. **Language**: Dart (for Flutter)

II. **Technology**: IoT (Bluetooth module, battery)

III. **GUI**: User Interface (UI) development using Flutter

IV. **Code Editor**: Visual Studio Code, Android Studio

V. **Version Control**: Git

VI. **Database**: Firebase Realtime Database

VII. **Backend Services**: Firebase, Blynk

VIII. **APIs**: Google Maps API, Twilio API (for SMS), SendGrid API (for email)

Hardware Requirements

I. **Microcontroller**: ESP8266/ESP32 for Bluetooth and Wi-Fi connectivity

II. **Storage**: On-chip Flash memory (4MB for ESP8266, 4MB or more for ESP32)

III. **Power Supply**: USB connection, battery packs, or external power supplies depending on the application requirements

IV. **Operating System**: Windows (10, 11) / Linux / macOS (for development environment)

Chapter 5

Design Analysis

5.1 Planning

Planning is a crucial aspect of any project, especially one as intricate as implementing a Women Safety App using Bluetooth connectivity and IoT technologies. The planning phase involves meticulous consideration of various factors, including system requirements, resource allocation, timeline, and potential challenges. Firstly, a thorough analysis of the current safety infrastructure and processes is conducted to identify areas for improvement and determine the specific objectives of the project. Next, detailed requirements are outlined, taking into account the hardware and software components needed, as well as any regulatory or privacy considerations.

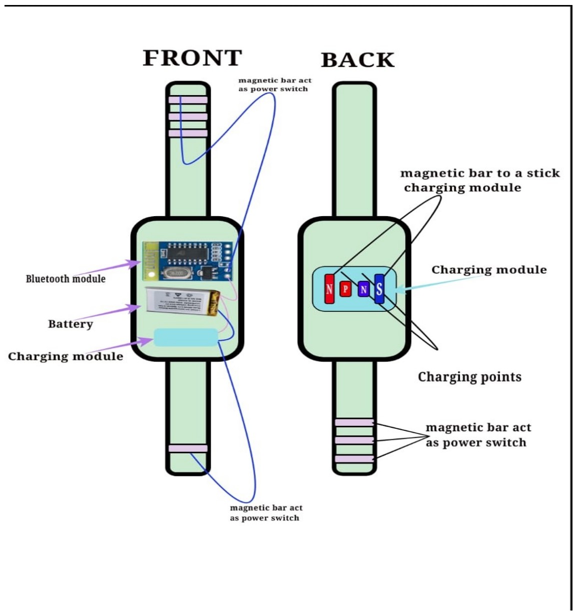

FRONT
BACK
magnetic bar act as power switch
magnetic bar to a stick charging module
Bluetooth module
Charging module
Battery
Charging module
Charging points
magnetic bar act as power switch
magnetic bar act as power switch
N
P
N
S

Figure 5.1: Circuit Diagram

Once the requirements are established, a comprehensive plan is developed to outline the project's scope, timeline, milestones, and deliverables. This plan includes tasks such as designing the system architecture, procuring necessary equipment, developing software algorithms, and conducting testing and deployment. The system architecture will involve integrating Bluetooth modules with the mobile application, ensuring reliable connectivity and seamless communication between devices.

The software development phase will focus on creating an intuitive user interface, implementing secure Bluetooth communication protocols, and integrating emergency features such as alert notifications and real-time location tracking. Hardware requirements will include Bluetooth-enabled devices and sensors that can be easily carried or worn by users.

Additionally, contingency plans are devised to address potential risks and challenges that may arise during the implementation phase, such as connectivity issues, data privacy concerns, or hardware malfunctions. These plans ensure that the project stays on track and within budget.

Overall, effective planning is essential for the successful execution of the Women Safety App project, laying the groundwork for efficient resource utilization and seamless integration of Bluetooth and IoT technologies into existing safety practices.

5.2 Use-Case Diagram

A use case diagram is a graphical view showing the interactions between actors (users or external systems) and a system in terms of the functionalities or use cases that the system provides. It captures the high-level behavior of a system from the user's perspective and helps to depict the various ways in which actors interact with the system to achieve specific goals.

Key elements of a use case diagram include:

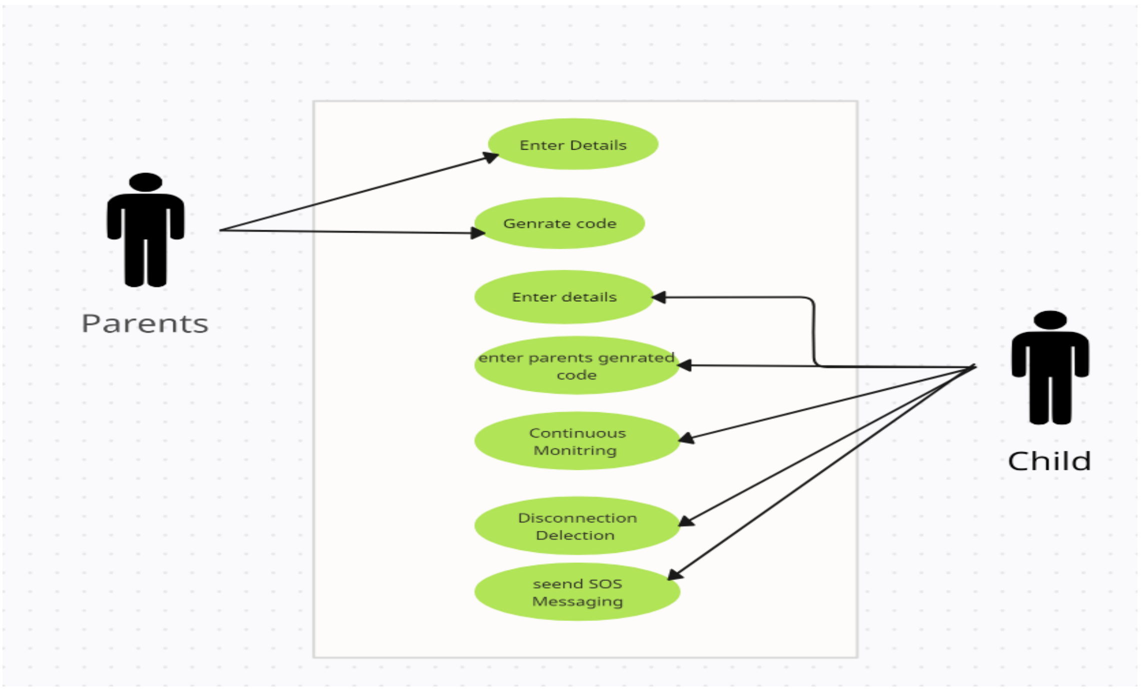


Figure 5.2: Use Case Diagram

5.3 Activity Diagram

An activity diagram is a visual representation of the flow of activities or actions within a system, process, or workflow. It depicts the sequence of activities, decisions, and parallel or concurrent flows that occur within the system. Activity diagrams help to visualize complex processes, system workflows, or business processes by breaking them down into manageable steps and illustrating the flow of activities, decision points, and parallel executions.

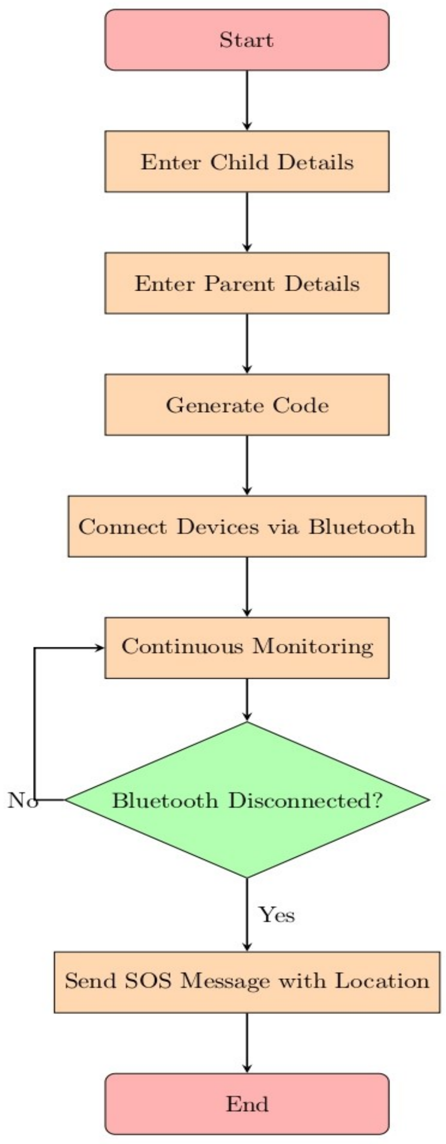


Figure 5.3: Activity Diagram

5.4 Zero-Level DFD

Level 0 Data Flow Diagram (DFD) is a high-level representation of a system that shows the major processes or functions and the data flows between them. It provides an overview of how data moves within the system and the interactions between different components without going into the details of each process.

In a Level 0 DFD, the system or software application is represented as a single process or function, also known as the main process. The main process is surrounded by external entities, which can be users, other systems, or data sources that interact with the system. The main process receives inputs from the external entities, processes them, and produces outputs that are sent back to the external entities.

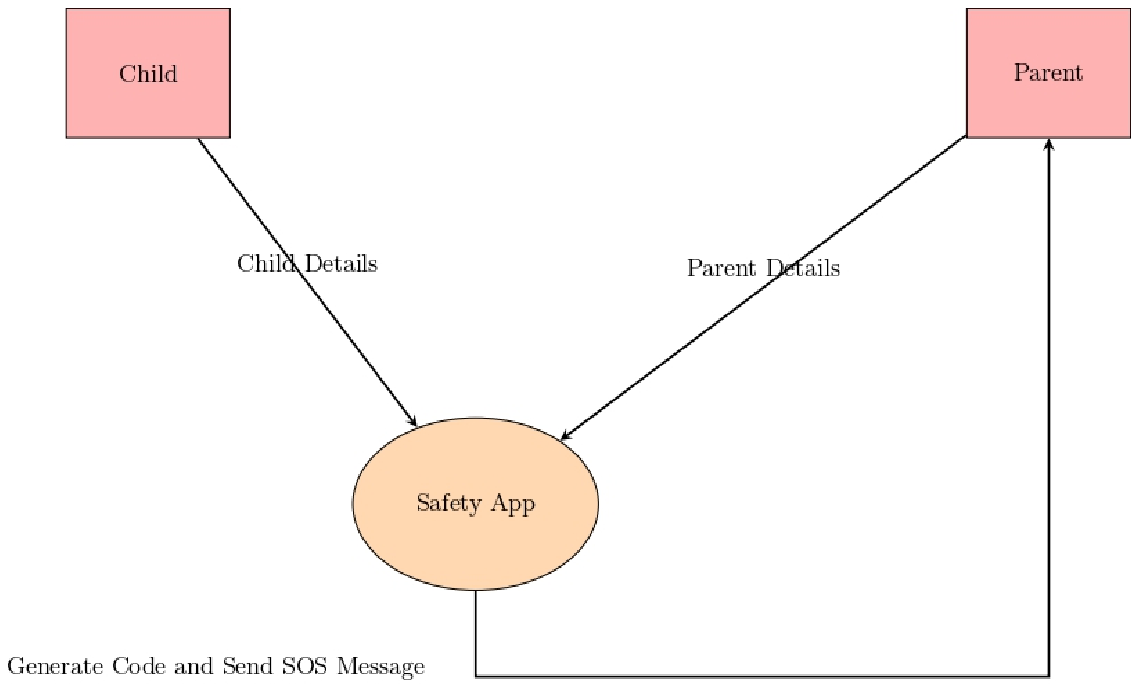


Figure 5.4: Data Flow Diagram (level 0)

5.5 One-Level DFD

A one-level Data Flow Diagram (DFD) is a simplified representation of a system that shows the major processes or functions, data stores, and data flows at a single level of detail. It provides a concise overview of the system's processes and the flow of data between them without delving into the internal workings of each process. In a one-level DFD, the system is represented as a single process symbol, often referred to as the main process or the context level. The main process represents the system as a whole, and its inputs and outputs are shown as data flows. The external entities, such as users or other systems, are depicted as rectangles or squares outside the main process symbol. They represent the sources or destinations of data flowing into or out of the system.

Data flows are depicted as arrows that show how the data is flowing between processes, databases, and external entities. Data stores are depicted as rectangles with parallel lines representing stored data. A one-level DFD provides a high-level view of the system's functions and the interactions between external entities and the system. It helps stakeholders understand the overall flow of data and the major processes involved in the system. However, it does not capture the internal details or the sub-processes within each main process. One-level DFDs are often used as a starting point for further decomposition into more detailed DFDs, where each main process in the one-level DFD is expanded into its own set of processes and data flows at a lower level of detail.

Overall, a one-level DFD serves as a simplified and abstract representation of the system, providing a top-level view of the major processes, data flows, and external entities involved. It is useful for initial system analysis, requirements gathering, and high-level system understanding.

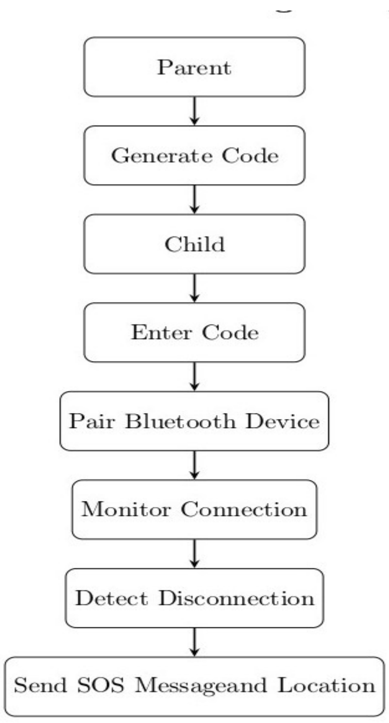


Figure 5.5: Data Flow Diagram (level 1)

Chapter 6

Implementation

6.1 Development of Modules

In this phase, we will focus on the development of individual modules that comprise our smart Women safety App. Each module will be designed, implemented, and tested iteratively to ensure functionality, reliability, and compatibility with the overall system architecture.

6.1.1 Code 1 - BleController:

1. The code defines a Flutter controller (BleController) responsible for scanning Bluetooth devices, requesting necessary permissions, and connecting to a selected device.

```
import 'package:flutter_blue/flutter_blue.dart';
import 'package:get/get.dart';
import 'package:permission_handler/permission_handler.dart';

class BleController extends GetxController {
  FlutterBlue ble = FlutterBlue.instance;
  Future scanDevices() async {
    final bluetoothScanStatus = await Permission.bluetoothScan.request();
    final bluetoothConnectStatus = await Permission.bluetoothConnect.request();
    if (bluetoothScanStatus.isGranted) {
      if (bluetoothConnectStatus.isGranted) {
        await ble.startScan(timeout: Duration(seconds: 15));

        // Delay stopping the scan to allow time for devices to be discovered
        await Future.delayed(Duration(seconds: 15));
        ble.stopScan();
        ble.scanResults.listen((List<ScanResult> results) {
          print('Scanned Devices:');
          for (var result in results) {
            print('Device Name: ${result.device.name}, RSSI: ${result.rssi}');
          }
        });
      }
    }
  }

  Future<void> connectToDevice(BluetoothDevice device) async {
    await device?.connect(timeout: Duration(seconds: 15));

    device?.state.listen((isConnected) {
      if (isConnected == BluetoothDeviceState.connecting) {
        print("Device connecting to: ${device.name}");
      } else if (isConnected == BluetoothDeviceState.connected) {
        print("Device connected: ${device.name}");
      } else {
        print("Device Disconnected");
      }
    });
  }

  Stream<List<ScanResult>> get scanResults => ble.scanResults;
}
```

6.1.2 Module 2 - Puse Notification:

2.This code defines a service for handling local notifications in a Flutter application. It initializes the FlutterLocalNotificationsPlugin, sets up initialization settings for Android, and provides a method to display notifications with the received RemoteMessage. It handles notification display with customizable settings such as sound, color, importance, and priority.

```
import 'package:firebase_messaging/firebase_messaging.dart';
import 'package:flutter/material.dart';
import 'package:flutter_local_notifications/flutter_local_notifications.dart';

class LocalNotificationService {
  // Instance of Flutternotification plugin
  static final FlutterLocalNotificationsPlugin _notificationsPlugin = FlutterLocalNotificationsPlugin();


  static void initialize() {
    // Initialization  setting for android
    const InitializationSettings initializationSettingsAndroid =
    InitializationSettings(
        android: AndroidInitializationSettings("@drawable/ic_launcher")
    );
    _notificationsPlugin.initialize(
      initializationSettingsAndroid,
      // to handle event when we receive notification
      onDidReceiveNotificationResponse: (details) {
        if (details.input != null) {}
      },
    );
  }

  static Future<void> display(RemoteMessage message) async {
    print("display function called");
    // To display the notification in device
    try {
      print(message.notification!.android!.sound);
      final id = DateTime
          .now()
          .millisecondsSinceEpoch ~/ 1000;
      NotificationDetails notificationDetails = NotificationDetails(
        android: AndroidNotificationDetails(
            message.notification!.android!.sound ?? "Channel Id",
            message.notification!.android!.sound ?? "Main Channel",
            groupKey: "SafeSteps",
            color: Colors.green,
            importance: Importance.max,
            sound: RawResourceAndroidNotificationSound(
                message.notification!.android!.sound ?? "SafeSteps"),

            // different sound for
            // different notification
            playSound: true,
            priority: Priority.high),
      );
      await _notificationsPlugin.show(id, message.notification?.title,
          message.notification?.body, notificationDetails,
          payload: message.data['route']);
    } catch (e) {
      debugPrint(e.toString());
    }
  }
}
```

6.1.3 Module 3 - Sending Sms:

3. This code will send the message to the parent mobile number

```
import 'package:easy_send_sms/easy_sms.dart';
```

```

@pragma('vm:entry-point')
void sending_sms(String text_message, List<String> list_receipents) async {
  String send_result = await sendSMS(message: text_message, recipients: list_receipents, sendDirect: true).catchError((err){
    print(err);
  });
  print(send_result);
}
```

6.1.4 Module 4 - Sending FCM Notification:

4. This section initializes a sending the notification to parents mobile if mobile is connected.

```
import 'package:http/http.dart' as http;
import 'dart:convert';

void sendFCMNotification(String recipientToken, String title, String body) async {
  // Define FCM endpoint URL
  final String fcmUrl = 'https://fcm.googleapis.com/fcm/send';

  // Define your server key obtained from Firebase Console
  final String serverKey = 'AAAAT9t3_zQ:APA91bHoVCOXvW8V_wMcR8yTJxF6Ih9Tq6MiORXsOCy7NxiuZdkn3_FT49RvdsjAb4
  KOgc987GKm9SmouH7E2jZuczru_cuPdqFiTIySqMGnE8bF6nwLDESgobSlOS13gMOPy
  saQAgI2';

  // Construct the notification payload
  Map<String, dynamic> notification = {
    'title': title,
    'body': body,
    'priority': 'high',
  };

  // Construct the message payload
  Map<String, dynamic> message = {
    'notification': notification,
    'to': recipientToken,
  };

  // Encode the message payload as JSON
  String jsonMessage = jsonEncode(message);

  // Send HTTP POST request to FCM endpoint
  await http.post(
    Uri.parse(fcmUrl),
    headers: <String, String>{
      'Content-Type': 'application/json',
      'Authorization': 'key=$serverKey', // Provide your server key
   here
    },
    body: jsonMessage,
  );
}
```

6.1.5 Module 5 -Parents Details:

5. This code represents a Flutter widget called ParentsDetails, which is a form screen where a parent can enter their details such as name, phone number, and email.

```
import 'dart:math';
import 'package:cloud_firestore/cloud_firestore.dart';
import 'package:flutter/material.dart';
import'package:safe_steps/screens/available_devices/AvailableDevices.
   dart';
import 'package:safe_steps/screens/dashboard/Dashboard.dart';
import 'package:safe_steps/screens/parent_dashboard/ParentDashboard.
   dart';
class ParentsDetails extends StatefulWidget {
  ParentsDetails({super.key, required this.fcmToken});
  String? fcmToken;
  @override
  State<ParentsDetails> createState() => _ParentsDetailsState();
}
class _ParentsDetailsState extends State<ParentsDetails> {
  TextEditingController parentNameController = TextEditingController();
  TextEditingController phoneNumberController = TextEditingController()
   ;
  uploadParentDetails(String parentName, int code, String phoneNumber){
    FirebaseFirestore.instance.collection("Users").doc(parentName).set
   ({
      "Parent Name": parentName,
      "token" : widget.fcmToken,
      "code" : code,
      "phone_number": phoneNumber
    }).then((value) {
      print("Data inserted"); });}
  int generateRandomNumber() {
    // Create an instance of Random class
    Random random = Random();
    // Generate a random 6-digit number
    int randomNumber = random.nextInt(900000) + 100000;
    return randomNumber;
  }
```

```
@override
Widget build(BuildContext context) {
  double screenWidth = MediaQuery.of(context).size.width;
  double screenHeight = MediaQuery.of(context).size.height;
  return Scaffold(
    appBar: AppBar(leading: GestureDetector(
      onTap: (){
        Navigator.pop(context);  },
        child: Icon(Icons.arrow_back_ios, color: Colors.white, )),
    actions: [Padding( padding: const EdgeInsets.only(right: 20),
          child: Icon(Icons.more_horiz, color: Colors.white,), ) ],
      backgroundColor: Colors.brown.shade400,),
    body: Container(
      padding: EdgeInsets.all(20),
      height: screenHeight,
      width: screenWidth,
      decoration:BoxDecoration(
        gradient: LinearGradient(
          begin: Alignment.topCenter,
          end: Alignment.bottomCenter,
          colors: [Colors.brown.shade400, Colors.black],),),) ,
      child: Column(crossAxisAlignment: CrossAxisAlignment.start,
 children: [Text("Enter Parent's Details", style: TextStyle(color:
 Colors.white, fontSize: 30),),
          Expanded(child:
          Center(child: Column(
              children: [
                SizedBox(height: 30,),
                TextField(
                  controller: parentNameController,
                  decoration: InputDecoration(
                  labelText: "Parent's name",
                  labelStyle: TextStyle(color: Colors.white, fontSize
 :12),
                  focusedBorder: UnderlineInputBorder( // Change
 focused border color
              borderSide: BorderSide(color: Colors.white),),
                  enabledBorder: UnderlineInputBorder( // Change
 enabled border color
                    borderSide: BorderSide(color: Colors.white),
                  ),
                ),
                  style: TextStyle(color: Colors.white),
                ),
                SizedBox(height: 20,),
                TextField(
                  controller: phoneNumberController,
                  decoration: InputDecoration(
                labelText: "Phone Number",
                labelStyle: TextStyle(color: Colors.white, fontSize: 12),
                focusedBorder: UnderlineInputBorder( // Change focused border color
                  borderSide: BorderSide(color: Colors.white),),
                enabledBorder: UnderlineInputBorder( // Change enabled border color
                  borderSide: BorderSide(color: Colors.white),),),
                style: TextStyle(color: Colors.white),
              ),
              SizedBox(height: 20,),
              TextField(decoration: InputDecoration(
                labelText: "Email",
                labelStyle: TextStyle(color: Colors.white, fontSize:12),
                focusedBorder: UnderlineInputBorder( // Change focused border color
                  borderSide: BorderSide(color: Colors.white),),
                enabledBorder: UnderlineInputBorder( // Change enabled border color
                  borderSide: BorderSide(color: Colors.white),),),
                style: TextStyle(color: Colors.white),),
              Expanded(child: SizedBox()),
              ElevatedButton(
                onPressed: (){
                  int r_num = generateRandomNumber();
        uploadParentDetails(parentNameController.text.toString(), r_num, phoneNumberController.text.toString());
                  Navigator.push(context, MaterialPageRoute(builder: (context) =>ParentDashboard(code: r_num.toString(),)));
                }, child: Container(width: double.infinity, height: 55, child: Center(child: Text("NEXT", style: TextStyle(color: Colors.brown, fontWeight: FontWeight.bold),))),style: ButtonStyle(
                backgroundColor: MaterialStateProperty.all<Color>(Colors.white), // Set background color
                shape: MaterialStateProperty.all<RoundedRectangleBorder>(
                  RoundedRectangleBorder(
                    borderRadius: BorderRadius.circular(10.0), // Set border radius
                    // side: BorderSide(color: Colors.red), // Set border color),),),),
            SizedBox(height: 30,)],),) )], ), ),);}}
```

6.1.6 Module 6 -Personal Details:

6. This code represents a Flutter widget called Personal Details, which is a form screen where

a user can enter their personal details.

```
import 'package:flutter/material.dart';
import 'package:safe_steps/screens/dashboard/Dashboard.dart';
import 'package:safe_steps/screens/parents_details/ParentsDetails.dart'
    ;
class PersonalDetails extends StatefulWidget {
  const PersonalDetails({super.key});
  @override
  State<PersonalDetails> createState() => _PersonalDetailsState();}
class _PersonalDetailsState extends State<PersonalDetails> {
  TextEditingController nameController = TextEditingController();
  TextEditingController parentCodeController = TextEditingController();
  String? fetchedToken;
  String? parentPhoneNumber;
  Future<String> fetchToken(String code) async {
    QuerySnapshot querySnapshot = await FirebaseFirestore.instance.
   collection("Users").where('code', isEqualTo: int.parse(code)).get();
    if(querySnapshot.docs.isNotEmpty){
      var documentSnapshot = querySnapshot.docs.first;
      var fcm_token = documentSnapshot['token'];
      var phone_number = documentSnapshot['phone_number'];
      print("Retrieved fcm token :   ${fcm_token}");
      print("Retrieved parent phone number : ${phone_number}");
      setState(() {
        fetchedToken = fcm_token;
        parentPhoneNumber = phone_number;});
  return fcm_token; }
    print("Empty object recieved");
    return "";}
  @override
  Widget build(BuildContext context) {
    double screenWidth = MediaQuery.of(context).size.width;
    double screenHeight = MediaQuery.of(context).size.height;
    return Scaffold(
      appBar: AppBar(leading: GestureDetector(
          onTap: (){
            Navigator.pop(context); },
          child: Icon(Icons.arrow_back_ios, color: Colors.white, )),
      actions: [
        Padding(
          padding: const EdgeInsets.only(right: 20),
          child: Icon(Icons.more_horiz, color: Colors.white,), ) ],
      backgroundColor: Colors.brown.shade400,),
      body: Container(
        padding: EdgeInsets.all(20),
        height: screenHeight,
        width: screenWidth,
        decoration:BoxDecoration(
          gradient: LinearGradient(
            begin: Alignment.topCenter,
            end: Alignment.bottomCenter,
            colors: [Colors.brown.shade400, Colors.black],),) ,
        child: Column(
          crossAxisAlignment: CrossAxisAlignment.start,
          children: [
            Text("Enter Your Details", style: TextStyle(color: Colors.white, fontSize: 30),),
            Expanded(child:
             Center(
               child: Column(
                 children: [
                   SizedBox(height: 30,),
                   TextField(decoration: InputDecoration(
                     labelText: "Enter name",
                     labelStyle: TextStyle(color: Colors.white, fontSize: 12),
                     focusedBorder: UnderlineInputBorder( // Change focused border color
                       borderSide: BorderSide(color: Colors.white),),
                     enabledBorder: UnderlineInputBorder( // Change enabled border color
                       borderSide: BorderSide(color: Colors.white), ), ),
                     style: TextStyle(color: Colors.white), ),
                SizedBox(height: 20,),
                   TextField(decoration: InputDecoration(
                     labelText: "Phone Number",
                     labelStyle: TextStyle(color: Colors.white, fontSize: 12),
                     focusedBorder: UnderlineInputBorder( // Change focused border color
                       borderSide: BorderSide(color: Colors.white),
                     ),
                     enabledBorder: UnderlineInputBorder( // Change enabled border color
                       borderSide: BorderSide(color: Colors.white),
                     ),),
                     style: TextStyle(color: Colors.white),),
                   SizedBox(height: 20,),
                   TextField(decoration: InputDecoration(
                     labelText: "Email",
                     labelStyle: TextStyle(color: Colors.white, fontSize: 12),
                     focusedBorder: UnderlineInputBorder( // Change focused border color
                       borderSide: BorderSide(color: Colors.white),
                     ),
                     enabledBorder: UnderlineInputBorder( // Change enabled border color
                       borderSide: BorderSide(color: Colors.white),  ),),
                     style: TextStyle(color: Colors.white), ),
                   SizedBox(height: 20,),
                   TextField(
                     controller: parentCodeController,
                     decoration: InputDecoration(
                     labelText: "Parent's Code",
                     labelStyle: TextStyle(color: Colors.white, fontSize: 12),
                     focusedBorder: UnderlineInputBorder( // Change focused border color
                       borderSide: BorderSide(color: Colors.white),),
                     enabledBorder: UnderlineInputBorder( // Change enabled border color
                       borderSide: BorderSide(color: Colors.white),),),
                     style: TextStyle(color: Colors.white), ),
                   Expanded(child: SizedBox()),
                   ElevatedButton(
                     onPressed: ()async{
                       await fetchToken(parentCodeController.text);
                       if(fetchedToken!=null)
                     Navigator.push(context, MaterialPageRoute(builder: (context)  => Dashboard(fcm_token: fetchedToken!, phone_number: parentPhoneNumber!)));
                   }, child: Container(width: double.infinity, height: 55, child: Center(child: Text("NEXT", style: TextStyle(color: Colors.brown, fontWeight: FontWeight.bold),))),style: ButtonStyle(
                     backgroundColor: MaterialStateProperty.all<Color>(Colors.white), // Set background color
                     shape: MaterialStateProperty.all<RoundedRectangleBorder>(
                       RoundedRectangleBorder(
                         borderRadius: BorderRadius.circular(10.0), // Set border radius
                         // side: BorderSide(color: Colors.red), // Set border color ), ), ),),
                   SizedBox(height: 30,)],),) )  ], ), ), ); }}
```

6.1.7 Module 7 - Dashboard:

7. This code represents a Flutter widget called Dashboard, which is a screen that displays various options for the user..

```
import 'package:flutter/cupertino.dart';
```

```dart
import 'package:flutter/material.dart';
import 'package:geolocator/geolocator.dart';
import'package:safe_steps/screens/available_devices/AvailableDevices.dart';
class Dashboard extends StatefulWidget {
  Dashboard({super.key, required this.fcm_token, required this.phone_number});
  String fcm_token;
  String phone_number;
  @override
  State<Dashboard> createState() => _DashboardState();}
class _DashboardState extends State<Dashboard> {
  @override Widget build(BuildContext context) {
    double screenWidth = MediaQuery.of(context).size.width;
    double screenHeight = MediaQuery.of(context).size.height;
    return Scaffold(
      appBar: AppBar(leading: Icon(Icons.arrow_back_ios, color: Colors.white, ),
        actions: [
          Padding(
            padding: const EdgeInsets.only(right: 20),
            child: GestureDetector(
                onTap: (){
                  Navigator.pop(context); },
                child: Icon(Icons.more_horiz, color: Colors.white,)), ) ],
        backgroundColor: Colors.brown.shade400, ),
      body: Container(
        padding: EdgeInsets.all(20),
        height: screenHeight,
        width: screenWidth,
        decoration:BoxDecoration(
          gradient: LinearGradient(
            begin: Alignment.topCenter,
            end: Alignment.bottomCenter,
            colors: [Colors.brown.shade400, Colors.black], ), ) ,

        child: Column(
          crossAxisAlignment: CrossAxisAlignment.start,
          children: [
            Text("Devices", style: TextStyle(color: Colors.white, fontSize: 30),),
            SizedBox(height: 30,),
            Text("Connect to your devices and let your parents discover if you are in trouble.", style: TextStyle(color: Colors.white),),
            SizedBox(height: 120,),
            Expanded(child:
            Center(
              child: Column(
                children: [
                  GestureDetector(
                    onTap: () async{
                      Position position = await Geolocator .
getCurrentPosition(desiredAccuracy: LocationAccuracy.high);
                      if(position != null){
                        Navigator.push(context, MaterialPageRoute(
builder: (context) => AvailableDevices(fcm_token: widget.fcm_token,
position: position, phone_number: widget.phone_number)));  }   },
                    child: Container(
                      height: 75,
                      padding: EdgeInsets.only(left: 20, right: 20),
                      decoration: BoxDecoration(
                        border: Border.all(
                          color: Colors.white, // Set border colo  ),
                  borderRadius: BorderRadius.circular(10), // Set
border radius   ),
                      child: Row(
                        children: [
                          Text("Discover your devices", style:
TextStyle(color: Colors.white, fontSize: 18),),
                          Expanded(child: SizedBox()),
                          Icon(Icons.arrow_forward_ios, color: Colors.
white,)   ],
                      ),  ),  )   ], ),  )   ) ],  )  ),); }}
```

Chapter 7

Result & Analysis

The Bluetooth Safety App is designed to enhance personal safety and provide peace of mind to users in various situations. Leveraging Bluetooth technology, the app enables users to connect with trusted contacts and send distress signals in emergency scenarios. Key features and functionalities have been implemented to ensure user security and ease of use.

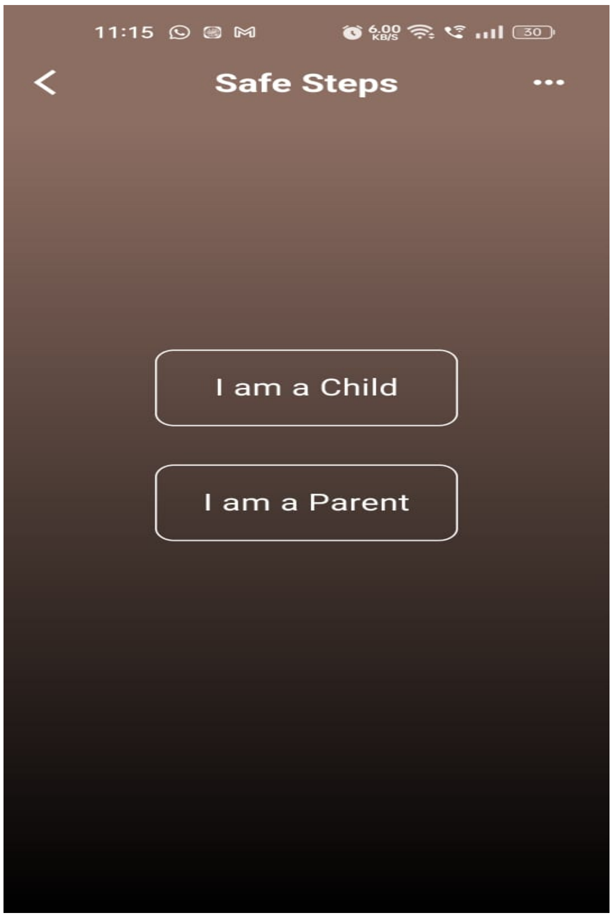


Figure 7.1: User Dashboard

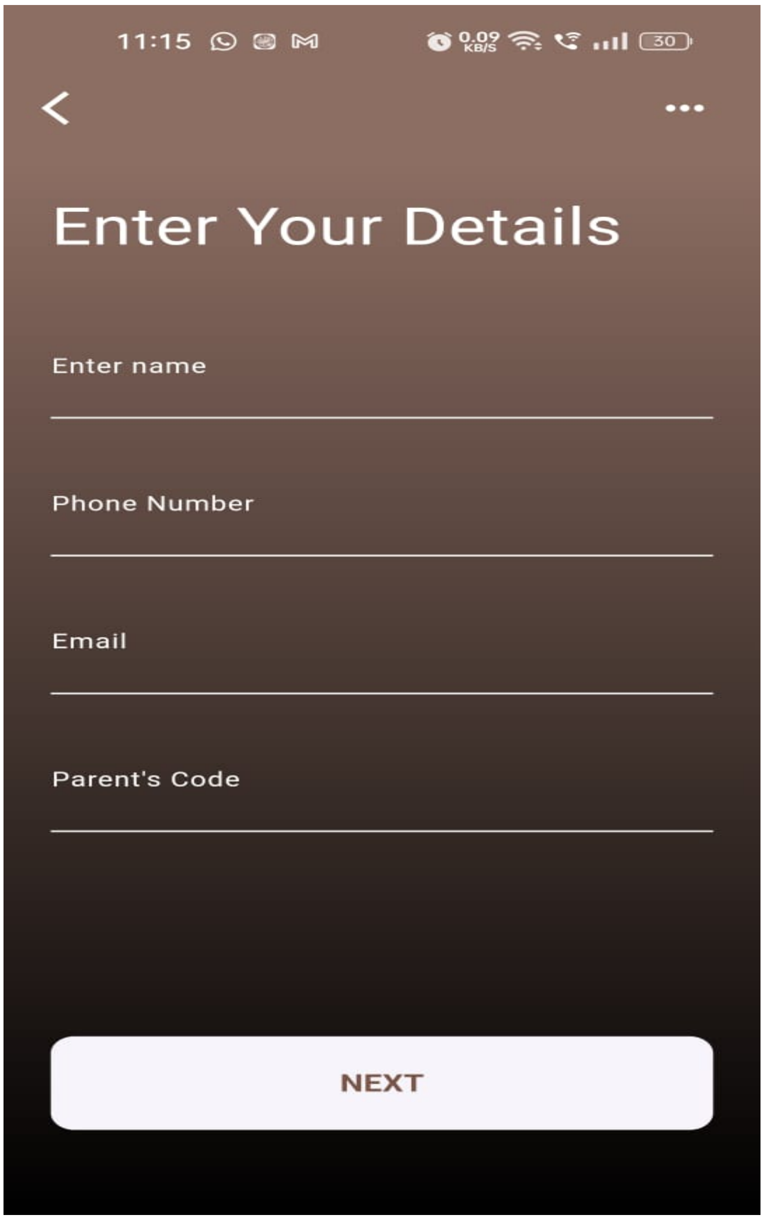
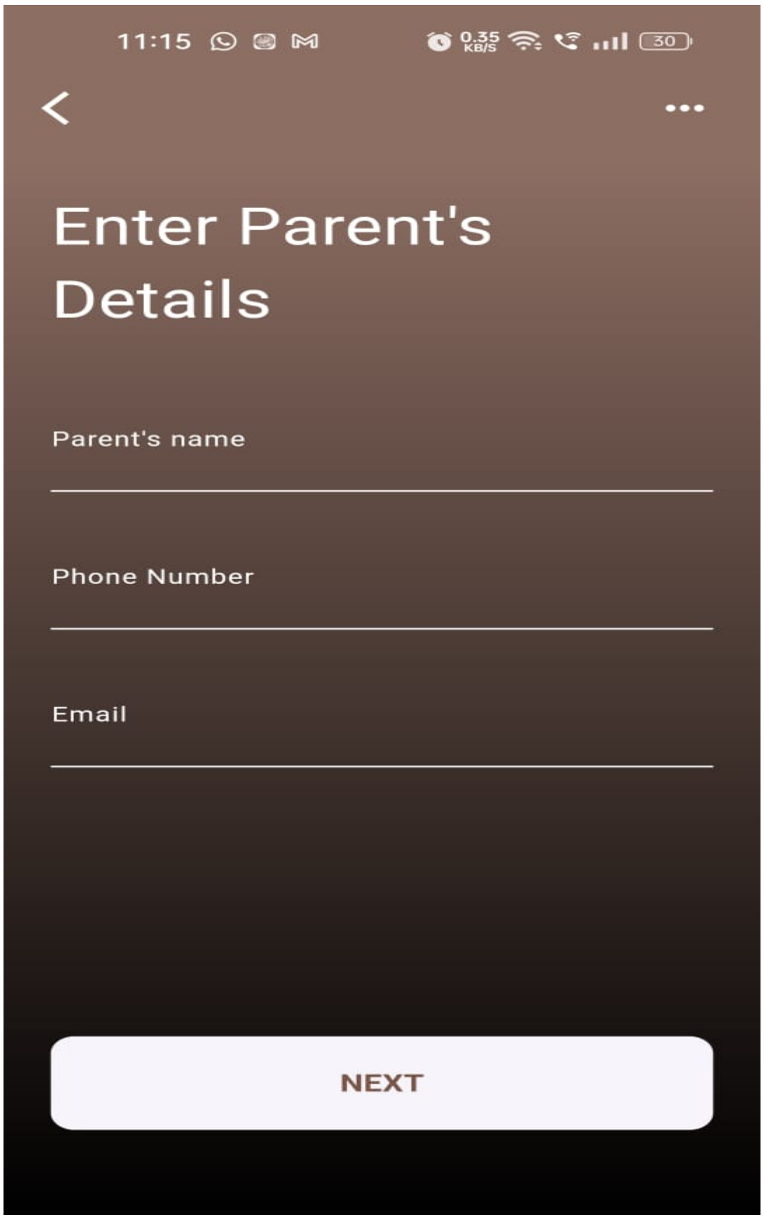


Figure 7.2: Personal Details Form


11:15

Enter Parent's Details

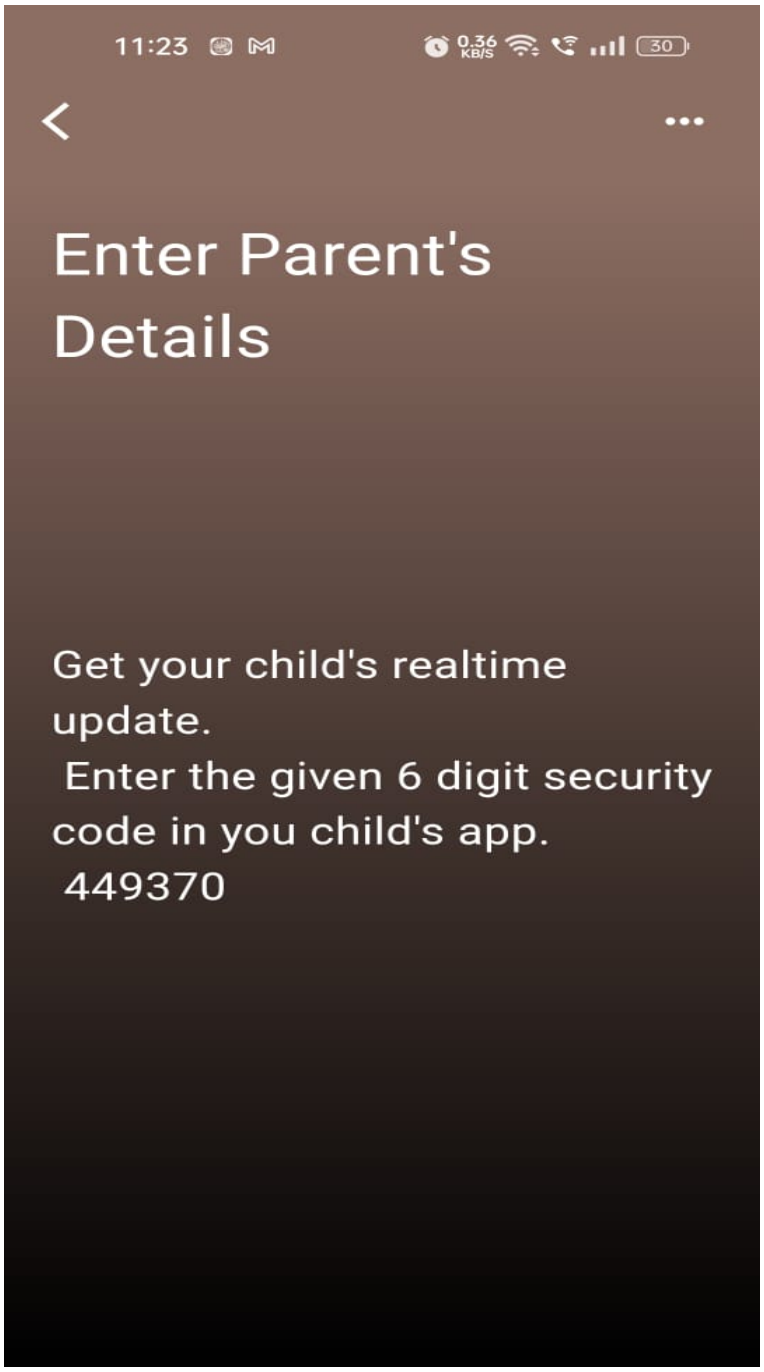
Parent's name

Phone Number

Email

NEXT

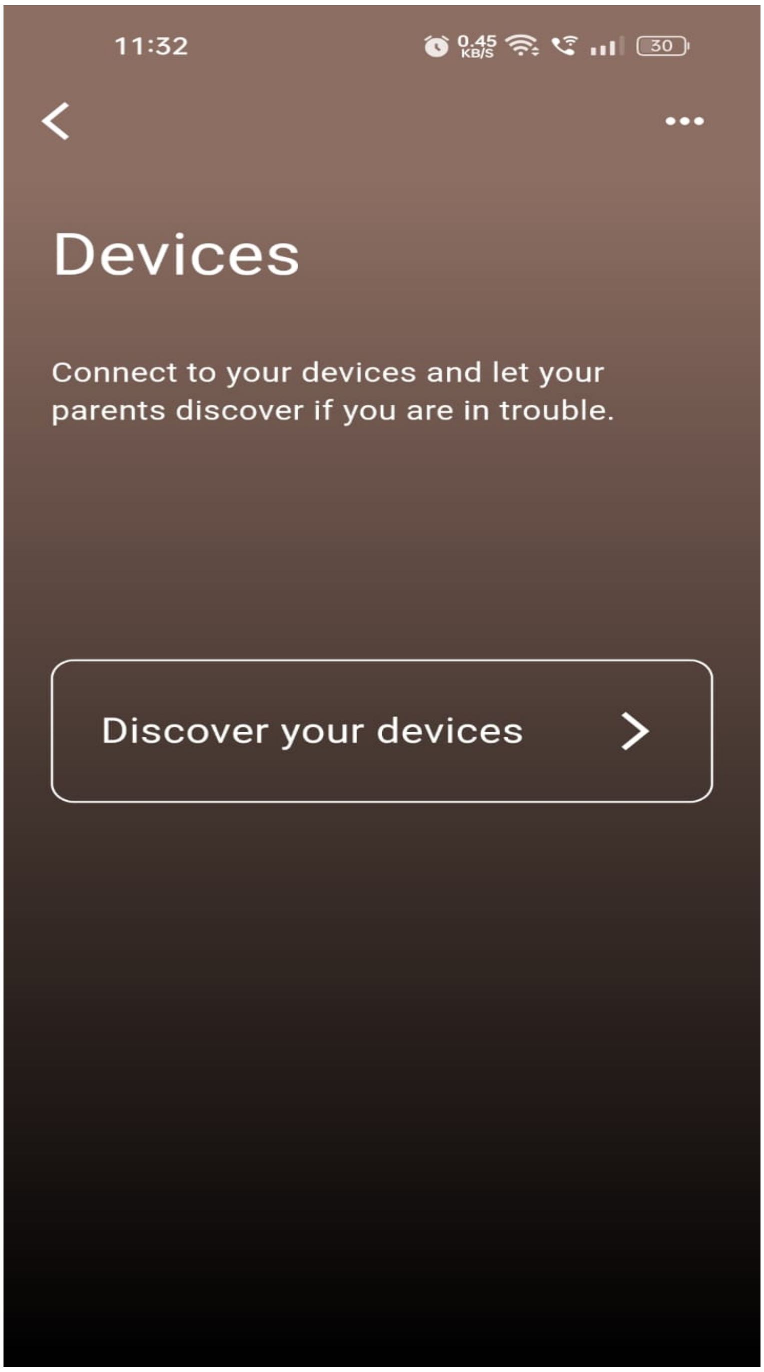
Figure 7.3: Parents Details Form


11:23

Enter Parent's Details

Get your child's realtime update.
Enter the given 6 digit security code in you child's app.
449370

Figure 7.4: Code generated in parents mobile


11:32

Devices

Connect to your devices and let your parents discover if you are in trouble.

Figure 7.5: Scanning Bluetooth device

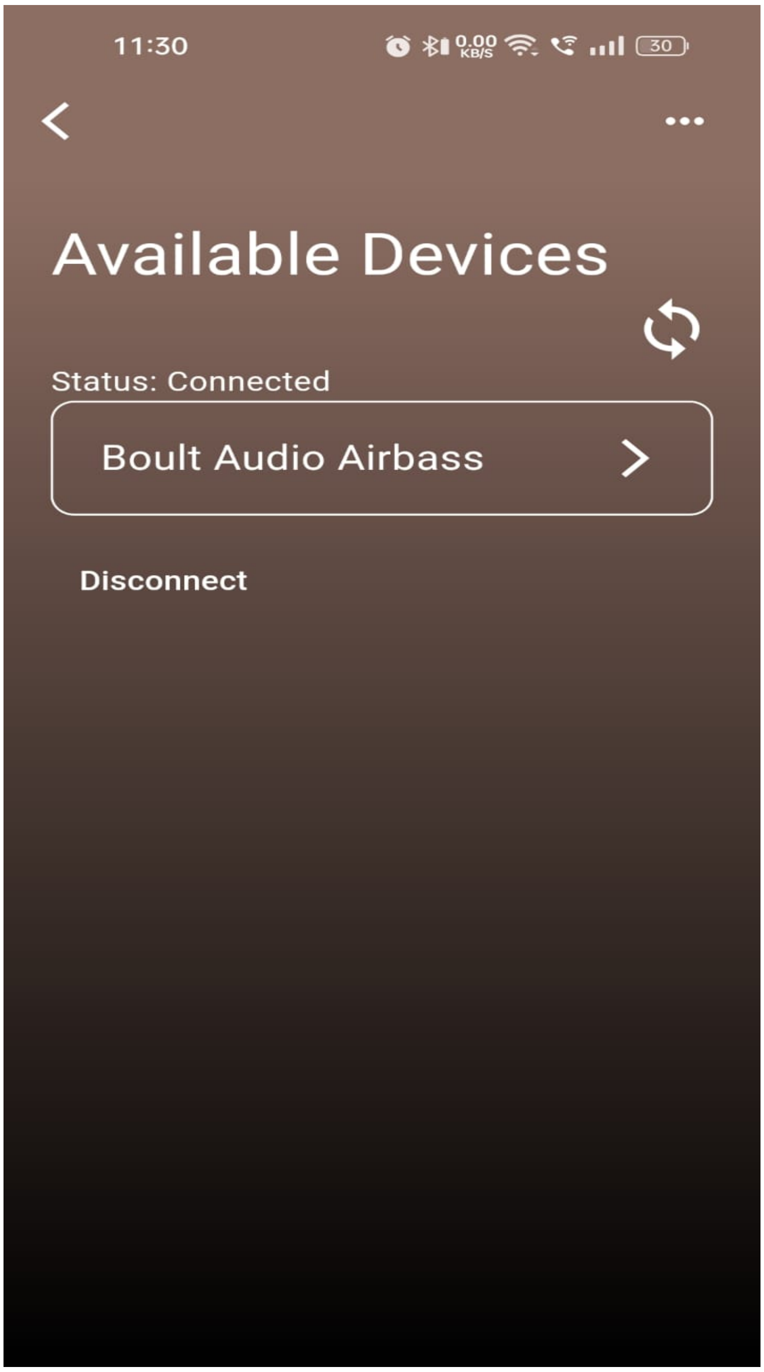
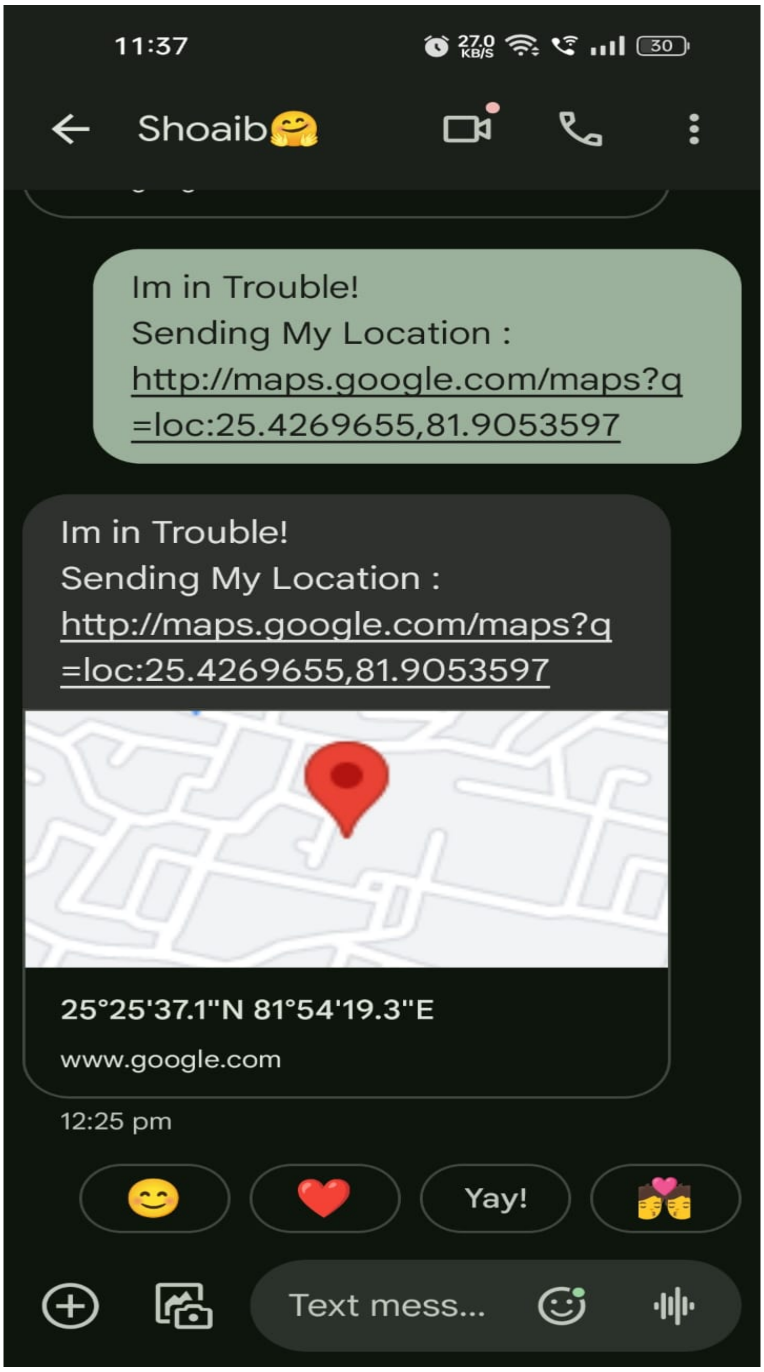


Figure 7.6: Connected Bluetooth device



Im in Trouble!
Sending My Location :
http://maps.google.com/maps?q=loc:25.4269655,81.9053597

Im in Trouble!
Sending My Location :
http://maps.google.com/maps?q=loc:25.4269655,81.9053597

25°25'37.1"N 81°54'19.3"E
www.google.com

12:25 pm

Figure 7.7: After disconnect send the message and notification

Chapter 8

Testing

After successful completion of the implementation phase testing of the product is performed. The process of testing is usually referred as a subset of all the phases in the modern software development model, with testing activities mostly occurring in all the stages of the development process. Software testing is a process that should be done during the software development process to ensure that the software is of the highest quality.
Software testing can be defined as the process of verifying that a software or application is free of bugs and meets specifications based on its design and development and effectively meets the requirements of users, handling all exceptional and borderline cases.

After the successful completion of our project, we performed three types of testing on the project, which are as follows:- Unit Testing, Integration Testing, and System Testing.

8.1 Types of Testing

8.1.1 Unit Testing

Unit testing is initial-level software testing that tests individual units or components of a software application. The goal of validation is to ensure that each unit of the software meets its intended specifications. A unit is the smallest testable part of any software. In procedural programming, a unit is a single program, function, procedure, or program module. In object-oriented programming, a method is the smallest unit of functionality. It may belong to a base class, an abstract class, or a derived class.

8.1.2 Integration Testing

Integration testing is a second level of software testing that evaluates the compliance of a system or component with specified functional requirements. Integration testing is conducted to ensure that a system or component works as intended when combined with other parts. After unit testing is complete, validation testing should be conducted. The integration test will use the modules that have been tested in units as input, group them into a larger collection, apply the tests defined in the integration testing plan to these pools, and deliver the integrated system as an output to the system for testing.

8.1.3 System Testing

System testing is the phase in the SDLC where the entire software system is tested as a whole to validate its functionality, performance, security, and compatibility. It ensures that the system meets the specified requirements and functions as intended in a real-world environment before deployment.

8.2 Test Cases

8.2.1 Unit Testing

Sr. No	Test Case	Result
Test Case 1	Test MQ3 Sensor Reading	Verify that the sensor reading falls within the expected range.
Test Case 2	Test Ultrasonic Sensor Reading	When an object is placed in front of the sensor, it detects the object and returns a signal.
Test Case 3	Test Display Output	Verify that the display shows the correct distance value.

Table 8.1: Unit Testing

8.2.2 Integration Testing

Sr. No	Test Case	Result
Test Case 1	Test the integration of sensors with the microcontroller	Ensure that sensor data is correctly received and processed by the microcontroller.

Table 8.2: Integration Testing

8.2.3 System Testing

Sr. No	Test Case	Result
Test Case 1	Test the real-time monitoring functionality	Verify that the central server can receive real-time data from smart dustbins and display it on a dashboard.
Test Case 2	Test the alert system functionality	Ensure that alerts are triggered and sent to administrators and truck drivers when predefined thresholds are exceeded (e.g., bin full, odor detected).
Test Case 3	Test the scalability of the system	Verify that the system can handle increasing numbers of smart dustbins and data volume without significant performance degradation.

Table 8.3: System Testing

Chapter 9

Conclusion and Future Work

In conclusion, the development of the Bluetooth Women Safety App marks a significant step forward in leveraging technology to address pressing societal concerns. Through the integration of Bluetooth technology and innovative safety features, the app provides women with a reliable tool to enhance their safety and security in various environments. The project's success in designing and implementing key functionalities, such as real-time location tracking and distress signal broadcasting, underscores its potential to make a tangible difference in the lives of women. Despite encountering challenges in the development process, including ensuring seamless connectivity and optimizing resource utilization, the project team's dedication and perseverance have yielded a robust and user-friendly application.
Looking ahead, there are several avenues for future work to further enhance the app's effectiveness and impact. Firstly, conducting extensive user testing and gathering feedback from target users can provide valuable insights for refining the app's features and user experience. Additionally, exploring partnerships with local law enforcement agencies and community organizations can facilitate the integration of emergency response protocols and support services within the app. Furthermore, leveraging advancements in wearable technology and artificial intelligence could enable the development of proactive safety measures, such as predictive risk assessment and personalized safety recommendations. By embracing these opportunities for innovation and collaboration, the Bluetooth Women Safety App has the potential to evolve into a comprehensive safety platform that empowers women and promotes a safer society for all.

Chapter 10

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