Republic of the Philippines
Western Mindanao State University
**COLLEGE OF COMPUTING STUDIES**
DEPARTMENT OF INFORMATION TECHNOLOGY

# ALERT+: A PORTABLE FAMILY DEVICE TO KEEP FAMILY MEMBERS CONNECTED WITH LOCATION PING AND PRESENCE CALL FEATURES

A CAPSTONE PROJECT PROPOSAL

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# CHAPTER 1

# INTRODUCTION

## 1.1 Project Context

Families today often face challenges in staying connected, especially when members are in different places throughout the day. Parents may worry about their children's whereabouts, while their children who needs to contact their parents. While smartphones are widely used, they are not always reliable or convenient for quick location updates or subtle check-ins during busy routines.

To address this, we propose **Alert+**, a small and portable device that family members, especially children, can easily carry. **Alert+** is designed to keep families connected by allowing users to send location pings and presence call alerts with a simple press of a button. When the Parent uses the portal to call their children, the device will send the user's current location and can trigger a light, vibration, or gentle sound to notify the family that their presence is being called, providing reassurance without disrupting activities.

The **Alert+** system requires an online network for registering user information but solely works offline using GSM Network and ensuring seamless connection within the family circle. It features real-time location sharing, a presence call button, and optional gentle alerts, making it easy for parents to know when children have arrived at school or to request attention without making a phone call.

By offering a dedicated, user-friendly device specifically for family connectivity, **Alert+** aims to promote peace of mind and ensure that loved ones can stay connected anytime and anywhere. This project aims to demonstrate how simple technology can enhance family safety and connectedness in daily life.

## 1.2 Statement of the Problem

Families often face challenges in staying connected throughout the day, especially when children and parents are in different locations. While smartphones are widely used, there are situations where children cannot easily call or message their parents, or parents want a quick way

to check on their children's location without interrupting their activities. Scenarios may include children who have arrived at school and need to notify their parents, parents wanting to check on their child's location without calling, or family members wanting a simple way to request attention without using a phone.

This study seeks to address the following questions:

1. How can parents reliably track the real-time location of their children without relying on smartphones?
2. How can location data be effectively stored and synchronized even in the absence of a stable internet connection?
3. What features are essential in creating a safe and functional device for minor users?

## 1.3 Purpose and Description

This project was proposed to give families a better way to stay connected and maintain peace of mind throughout the day. Many parents may need a simple way to check in with their children and share their location easily. **Alert+** offers a practical solution for these everyday needs.

**Alert+** is a small and portable device that a person can carry, with plans to offer it in the form of a keychain or in the future, a watch. With a simple location ping from the parent, the device can send a location ping to registered family contacts and can also trigger a gentle sound, light, or vibration to notify the child/children if their presence is being called by their Parent by the connected portal.

This system is easier and more convenient than using a phone, which is not always accessible or practical for quick check-ins. It is designed to work using GSM for reliable connectivity, making it especially helpful for parents who want to know when their children have arrived safely at school or for family members to request attention without needing to make a phone call.

## 1.4 Objectives

**Main Objective:**

To create a small and portable device that is carried by a child and allows Parents to send location ping to know their child/children`s whereabouts and to be able to notify them that their presence is being called without disturbing them in their activities.

### 1.4.1 Specific Objectives

**Specific Objectives:**

1. To design a device that can be carried by a child at all times
2. To allow parents to send location ping
3. To send the child's location to their parents
4. To notify the child that he/she is being called by his/her parent
5. To allow the child to send a notification to their parents that they need their presence.

## 1.5 Scope and Limitation

### 1.5.1 Scope:

- The project will have a **small device** that children can carry.
- The device can **send location and alerts** using a SIM card (GSM).
- The device can **receive a call for attention** using light, sound, or vibration.
- Parents will have a **simple website** to see location and send alerts.

### 1.5.2 Limitations:

- The device needs **mobile signal** to send location and alerts to parents.
- It will **not work in areas with no GSM signal**.
- The system **does not use internet** to send alerts or location.
- The device **cannot make calls or send messages like a phone**.

## 1.6 Significance of Study

This project is important because it helps families stay connected easily during the day. It let parents know where their children are without needing to call or message. It helps children let their parents know they need them with just a press of a button.

The system uses simple and affordable technology to improve family safety. In the future, Alert+ can be used by more families in other places. It shows how technology can help families stay connected anytime and anywhere in a safe and easy way.

## 1.7 Definition of Terms

This part of the study explains the important words used in the project. Some words may be technical or have special meanings. By giving clear definitions, readers can better understand the terms used in the research. The meanings in this section are taken from trusted sources like dictionaries, websites, and books. These definitions help avoid confusion and make the study easier to follow

Table 2.0: Definition of Terms

| Term | Definition |
|---|---|
| 1. Internet of things (IoT) | A system of devices connected to the internet that can send or receive data. (Techopedia) |
| 2. Location Ping | A signal sent to share the current location of the user. (Techopedia) |
| 3. Portable Device | A small gadget that can be easily carried or worn. (Cambridge Dictionary) |
| 4. Real-time Location Tracking | A process that continuously determines and transmits the current location of a device or individual to a monitoring system. |

| Term | Definition |
|---|---|
| | (Saini, H., Dutta, M., & Soni, S. (2017). |
| 5. Parent Portal | A simple website where parents can see location and send presence calls. (Project Document) |
| 6. GSM Network | A mobile network that allows the device to send location and alerts without internet. (GSMA) |
| 7. Family Connectivity | Staying connected with family members throughout the day. (Project Document) |
| 8. Notification | A message or alert sent by the device to the parent or child. (Oxford Dictionary) |
| 9. Signal | The mobile connection needed for the device to work. (Merriam-Webster) |
| 10. Offline Function | The ability of the device to work without internet, using only GSM. (Project Document) |
| 11. Safety | Keeping family members secure and connected during daily activities. (Oxford Dictionary) |
| 12. Simple Technology | Easy-to-use tools that help solve everyday problems. (Project Document |
| 13. Peace of Mind | Feeling calm because you know your family's location. (Cambridge Dictionary) |

# CHAPTER 2

# REVIEW OF RELATED LITERATURE AND SYSTEMS

## 2.1 Introduction

This chapter gives an overview of studies related to the development of Alert+, a small device that helps families stay connected through location tracking, offline communication, and presence call alerts. It includes studies about using simple technology and Internet of Things (IoT) devices for family safety, location sharing, and GSM-based communication, both in the Philippines and other countries.

This chapter reviews these studies to see current technology trends, check existing solutions, and find gaps that Alert+ can address. By reviewing these studies, this chapter shows the importance and usefulness of creating Alert+ as a simple way for families to stay connected, especially in areas with limited internet access.

### 2.1.1 Integrating GPS, GSM and Cellular Phone for Location Tracking and Monitoring

One modern way to detect traffic violations is by using mobile crowd sensing. Vinnetha et al. (2025) created a system called **Crowd Patrol**, which uses data from traffic officials and everyday people to find areas where traffic rules are often broken. This system uses a learning model called **Context-aware Spatiotemporal Adaptive (CSTA)** to find out where problems are likely to happen based on time, place, and past data. It also uses a **Tensor-based Integer Linear Programming (TILP)** model to help decide the best patrol routes using the available workers. Tests done in two cities in China, Xiamen and Chengdu, showed that the system was very accurate, finding over 90% of violation hotspots and covering more than 85% of problem areas.

### 2.1.2 Low-Cost SMS Driven Location Tracking Platform Towards Anti-Poaching Efforts

Burkett et al. (2022) introduced an offline SMS-based tracking device in an attempt to address the problem of real-time wildlife tracking in places without Wi-Fi or broadband infrastructure. Their SMS-TRACCAR project was used in anti-poaching applications where network access is limited and real-time GPS updates are crucial. The device sends location data via SMS using GSM communication, and the backend system interprets the messages to provide rangers with a map-based interface. The approach, which is designed for remote field deployment, offers a cost-functional balance. However, the lack of multimedia support (e.g., images or voice), limited SMS bandwidth, and vulnerability to delivery delays in areas with weak signals limit the solution. This study emphasizes how important SMS communication is for tracking emergencies in off-grid areas.

### 2.1.3 Wearable Device for Women Safety Using IoT

Nivedetha (2021) designed a smart wearable Internet of Things device that can respond to emergencies in real time using biometric monitoring and GSM-based alert transmission, addressing the growing safety concerns of women. In addition to GPS and GSM modules that send out SMS alerts when abnormal signs are detected or when the user manually presses a panic button, the device has sensors that track body temperature and pulse rate. Passive monitoring and active distress signaling are the two layers of safety that the system provides. In the event of an assault or other medical emergency, this invention may save lives. Its efficacy is contingent upon a continuous GSM signal and precise sensor calibration, which in some circumstances may lead to missed alerts or false positives. The study emphasizes how inexpensive wearable IoT solutions can improve individual safety.

### 2.1.4 A Smart Wearable Device Based on Internet of Things for the Safety of Children in Online Transportation

In response to growing reports of tracking failures and delayed emergency responses, Tunggadewi et al. (2022) created a smart wearable device to enhance children's safety when using online transportation services. The wearable's GPS module, camera, and Raspberry Pi Zero W

board work together to detect emergency triggers and transmit location and images to a Telegram channel in less than 15 seconds. In the event of an emergency, this feature allows parents and authorities to get quick, multimedia-based updates. Because of its surveillance capabilities, the innovation facilitates real-time monitoring and may discourage harmful behavior. However, its reliance on steady mobile data for Telegram communication and continuous camera activity could cause battery drain or connectivity problems, particularly during periods of high demand.

### 2.1.5 Smart Personal Safety Device Using IoT

In order to address the complex nature of personal safety, Shaji et al. (2024) suggested a wearable smart IoT device that integrates GPS tracking, GSM-based alerting, audio/video evidence collection, and an electric shock defense mechanism. Several sensors and microcontrollers are integrated into the system, along with a camera and microphone that turn on automatically in an emergency. The data is backed up to the cloud and alerts are sent via internet and SMS, giving instant location and audio-visual proof. This extensive feature set helps with legal proceedings in addition to informing authorities. The system's power requirements, however, are a drawback because ongoing sensor use and multimedia recording drastically shorten battery life. Reliance on the internet and GSM may also make it more difficult to function in isolated or signal-poor locations.

### 2.1.6 Policing the Smart Home: The Internet of Things as ‘Invisible Witnesses

Urquhart, Miranda, and Podoletz (2022) investigated how smart home appliances, like Google Home and Amazon Echo, can offer vital audio evidence in criminal investigations, particularly in cases of violent crimes or domestic emergencies. The study tackles the problem of insufficient eyewitness accounts or omitted background information in crimes that take place behind closed doors. The authors illustrated how smart assistants recorded arguments, background noise, and even ambient activity that helped establish timelines and motives through case studies where audio data was admitted in court. Analyzing court cases and the kinds of IoT data—such as voice logs and motion tracking—that were turned in to law enforcement were part of the methodology. However, restrictions include data encryption by manufacturers, legal restrictions on accessing private recordings, and the fact that many devices only turn on in

response to particular wake words, potentially missing important moments. The study emphasizes the increasing forensic value of IoT devices in emergency and criminal situations in spite of these problems.

### 2.1.7 Review of Related Works and System Comparison

| Table 2.0 Review of Related Works and System Comparison Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Features** | **Study 1** | **Study 2** | **Study 3** | **Study 4** | **Study 5** | **Study 6** | **Proposed Study** |
| Offline SMS alerts | Yes | Yes | No | No | Yes | No | Yes |
| GPS Tracking | Yes | Yes | No | No | Yes | No | Yes |
| Portability | No | No | No | No | No | No | Yes |
| Multi-Scenario Use | No | Yes | No | Yes | Yes | No | Yes |
| Low Power Consumption | No | No | Yes | Yes | No | Yes | Yes |
| No Internet Dependency | Yes | No | Yes | Yes | No | No | Yes |
| User Discretion | No | No | Yes | Yes | No | Yes | Yes |

## 2.2 Summary

The literature review emphasizes how well IoT-enabled gadgets work to enhance personal safety, location tracking, and emergency communication—especially in areas with poor connectivity. GPS and GSM-based tracking systems that use SMS instead of internet connectivity were examined in studies by Sahoo and Rath (2013) and Burkett et al. (2022). These systems provide affordable options for monitoring in remote or underserved areas. Despite their limited data payload and signal availability, these systems meet the need for real-time alerts without relying on broadband. By combining biometric sensors, panic buttons, and multimedia transmission capabilities, complementary studies like those by Nivedetha (2021) and Tunggadewi et al. (2022) developed the concept of wearable emergency devices. Their work shows how visual documentation and sensor-triggered alerts can facilitate quick emergency response.

In order to improve this area even more, Shaji et al. (2024) created a portable safety gadget that combines GPS tracking, SMS alerts, audio-visual evidence capture, and an electric shock deterrent. A developing trend toward layered personal protection mechanisms in a single IoT-based solution is reflected in this design. A forensic viewpoint was offered by Urquhart et al. (2022), who demonstrated how Amazon Echo and other smart home assistants can act as "invisible witnesses" by recording background noise during crises. Their results raise privacy and legal concerns regarding data access, despite the fact that they are encouraging. All of these studies highlight the possibility of combining offline communication, location-based tracking, and evidence-gathering features into a single IoT device. Their results support Alert+'s feasibility and social relevance, particularly as a proactive, portable real-time solution.

## 2.3 Synthesis

With an emphasis on offline communication, wearable safety devices, and real-time alert systems, the reviewed studies show a growing trend in the integration of IoT technologies for personal safety and emergency response. The use of GSM modules and SMS functionality as substitutes for internet-dependent systems is a recurring theme in the literature; this is emphasized in works like those by Sahoo and Rath (2013) and Burkett et al. (2022). These technologies show practical value for devices made to operate without internet access by enabling continuous communication and location tracking in rural or low-connectivity areas. Further confirming the

significance of user-friendly devices are studies such as those conducted by Nivedetha (2021) and Tunggadewi et al. (2022), which highlight the importance of wearability, portability, and real-time alerts in enhancing users' safety during emergencies.

Notwithstanding these developments, Alert+ seeks to fill in the gaps and limitations found in the literature. Few current systems integrate SMS-based alerts, audio evidence, and location tracking into a small, user-controlled gadget. Although a multi-feature wearable that incorporates multiple safety tools was introduced by Shaji et al. (2024), issues with power efficiency and operational complexity still exist. Additionally, Urquhart et al.'s study from 2022 highlights the forensic potential of audio evidence via Internet of Things devices, although its use has mostly been restricted to fixed home settings. The novelty of Alert+ is highlighted by the dearth of mobile solutions that provide real-time documentation of emergency events. By combining the advantages of these systems—wearable technology, evidence gathering, and offline alerting—Alert+ establishes itself as a timely and creative addition to the expanding portable emergency response market.

# CHAPTER 3

# CONCEPTUAL FRAMEWORK AND TECHNICAL BACKGROUND

## 3.1 Conceptual Framework

This part shows how the Alert+ device works to help families stay connected. It is a small device that lets parents know their child's location and call their attention without disturbing them. It works in three steps: input, process, and output.

**Input**

- The parent sends a location ping or presence call using the web dashboard.
- The child carries the Alert+ device with a SIM card.
- The GPS in the device gets the child's location.
- The child can press a button on the device to send a location ping to parents

**Process**

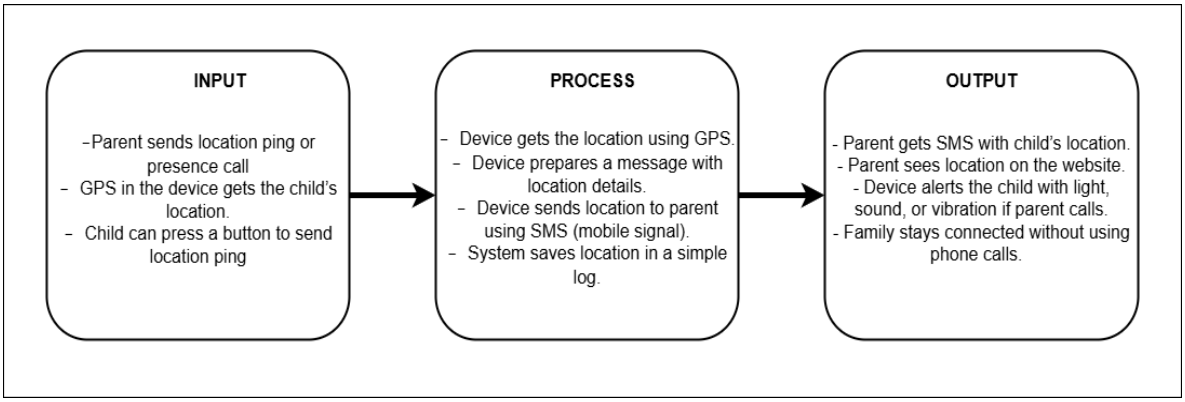
- The system detects a presence call or location ping request.
- The device gets the child's current location using GPS.
- The device prepares a notification with the location details.
- The device sends the location using mobile signal (SMS) to the parent.
- The system saves the location data in a simple log.

**Output**

- The parent receives an SMS with the child's location.
- The parent sees the location on the dashboard.
- The device alerts the child with light, sound, or vibration if a presence call is sent.
- The family stays connected without using a phone call.

### 3.1.1 Research Paradigm Diagram

Figure 3.1: Research Paradigm Diagram of the **Alert+** System




## 3.2 Technical Background

This part explains the tools and technology used for Alert+. It compares old and new technologies and shows what parts the system needs to work.

### 3.2.1 Current Technologies

Some devices today use **GSM** (mobile signal) and **SMS** to send emergency alerts. These technologies are reliable because they work even without an internet connection. Many modern systems depend on mobile apps or Wi-Fi, which may not be available in all places. For this project, we focus only on GSM and SMS to make sure alerts can still be sent during emergencies, even in areas with poor or no internet. This makes the system more useful and practical for real-life situations, especially in places like Zamboanga City.

### 3.2.2 Proposed Technologies for Alert+

- **GPS Module (Neo-6M)** – to find the user's exact location
- **GSM Module (SIM800L)** – to send emergency SMS
- **Microcontroller (ESP32 or Arduino Nano)** – to control the system
- **Wi-Fi Module (built-in ESP32)** – for registration, updates or settings when internet is available
- **Button** – the user presses this to send notification
- **Battery** – to power the device
- **Dashboard**– for parents to as main control

### 3.2.3 Hardware Specifications

Table 3.0 Hardware Specifications

| **Part** | **Details** |
|---|---|
| Microcontroller | ESP32 or Arduino Nano |
| GSM Module | SIM800L |
| GPS Module | NEO-6M |
| Wi-Fi Module | Built-in on ESP32 |
| Power | 3.7V Rechargeable Battery |
| Button | Tactile Push Button |
| Case | Plastic or waterproof shell |

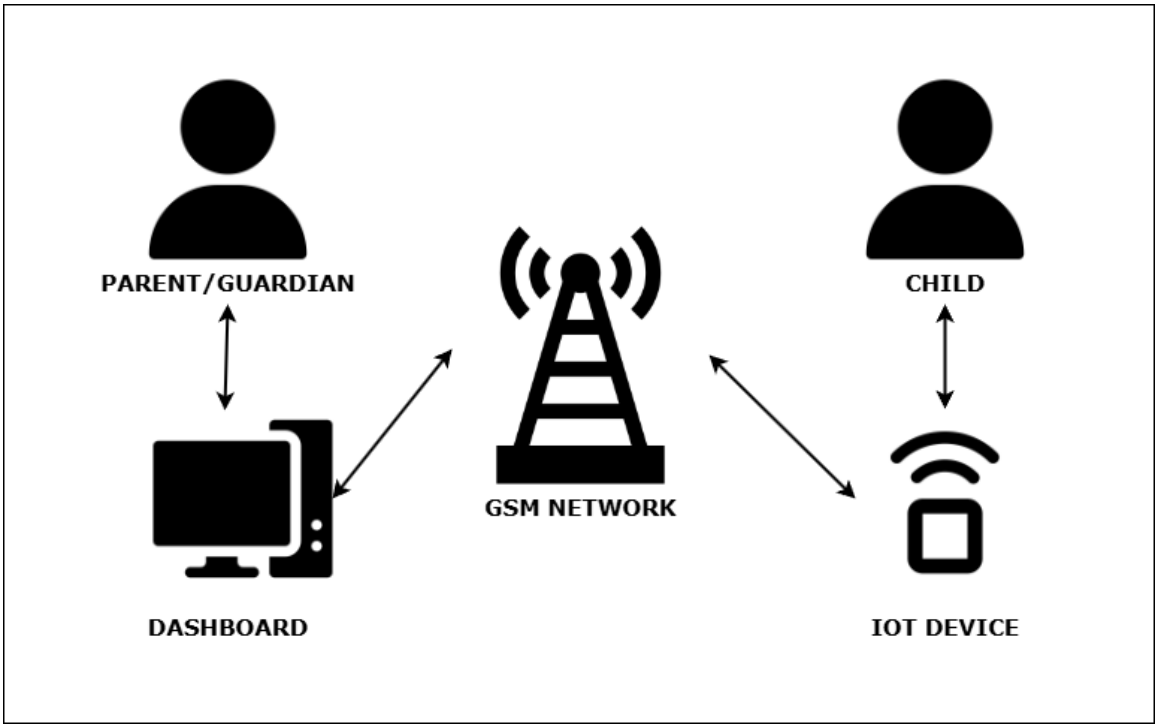
### 3.2.4 Peopleware

- **Child** – the person who carries and uses the Alert+ device.
- **Parent/Guardian** – the person who receives the location sent by the device and can call the child's attention.
- **Developer** – the person who designs, builds, and maintains the Alert+ system.

### 3.2.5 Network Architecture

- The device uses GSM Network not Wi-Fi or internet, to send the location.
- When the button is pressed, it sends the child's location to the parent.
- The location is included in the SMS.
- The dashboard is used by the parent to view the child's location and call the child's attention using presence call.

Figure 3.2: Network Architecture of the **Alert+** System




## 3.3 Integration and Summary

The **Alert+** device combines a GPS, GSM module, and a small controller to make a smart tool for emergencies. It lets people ask for help with just one button press. The device sends a text with the user's location using mobile signal only, no internet needed. The system is cheap, small, and easy to use, which makes it great for helping save lives in real emergencies in Zamboanga City.

# CHAPTER 4

# DESIGN AND METHODOLOGY

## 4.1 Research Design

This study will use a prototyping research design to develop and test Alert+, a small and portable device that helps parents know their child's location and call their attention without disturbing them. The project will focus on making a device that is easy to use, reliable, and works without internet by using GSM and SMS. It will help families stay connected during the day, even in places with poor internet.

## 4.2 Developmental Methodology

The Prototyping Methodology will be used to create Alert+ in simple steps:

1. **Planning** – list what the device needs to do, like being small, sending location using SMS, having a button, and working offline.
2. **Designing** – create the circuit using ESP32 or Arduino Nano, GSM module for SMS, GPS module for location, a button, and a rechargeable battery.
3. **Building** – connect all parts, set up SMS for sending location, and connect the button for sending location.
4. **Testing** – test the device to check if it can send location using SMS, if the button works well, and if it saves battery.
5. **Improving** – get feedback from parents and improve the device to make it strong and easy to use.

## 4.3 System Architecture

The Alert+ system has a simple design. It has a small device with GPS, GSM, a microcontroller, a button, and a battery. It uses GSM SMS to send the child's location to the parent. Parents can use the dashboard to see the location and send a presence call to the child to call their attention. The device is made to save power so it can be used for a long time while the child carries it during the day.

## 4.4 Data Collection Methods

- The device will be tested by letting children carry it in places with low but available mobile signal to check if it can still send location.
- SMS sending will be checked to record how fast the location is received by parents and how accurate the location is.
- Feedback will be collected from parents about how easy the device is to use, how fast it sends location, and how helpful it is for staying connected.
- Technical logs will record GPS accuracy, battery use, and GSM signal performance during testing.

## 4.5 Requirements Analysis

**Functional Requirements:**

- Send the child's location to the parent using SMS when the button is pressed.
- Include GPS location in the SMS.
- Work offline using GSM without needing internet.
- Show the location history on the dashboard.
- Allow parents to call the child's attention using a presence call.

**Non-Functional Requirements:**

- Use low power so the battery lasts longer.
- Be small, easy to carry, and water-resistant.
- Send SMS within 10–30 seconds.
- Location accuracy, depending on GPS signal.
- Keep user data private and secure.

### 4.5.1 Context Diagram

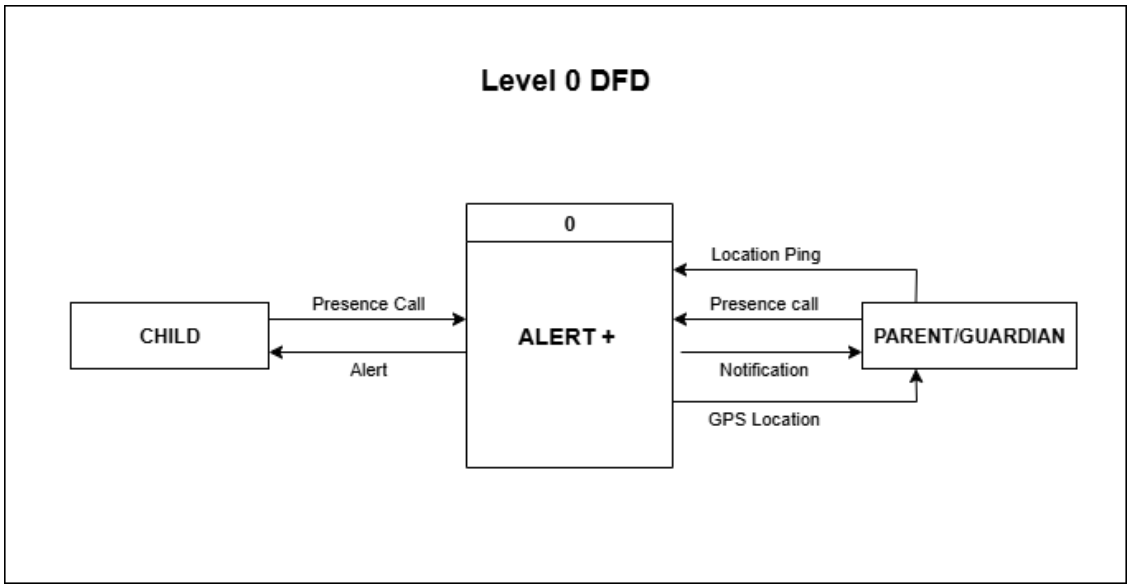
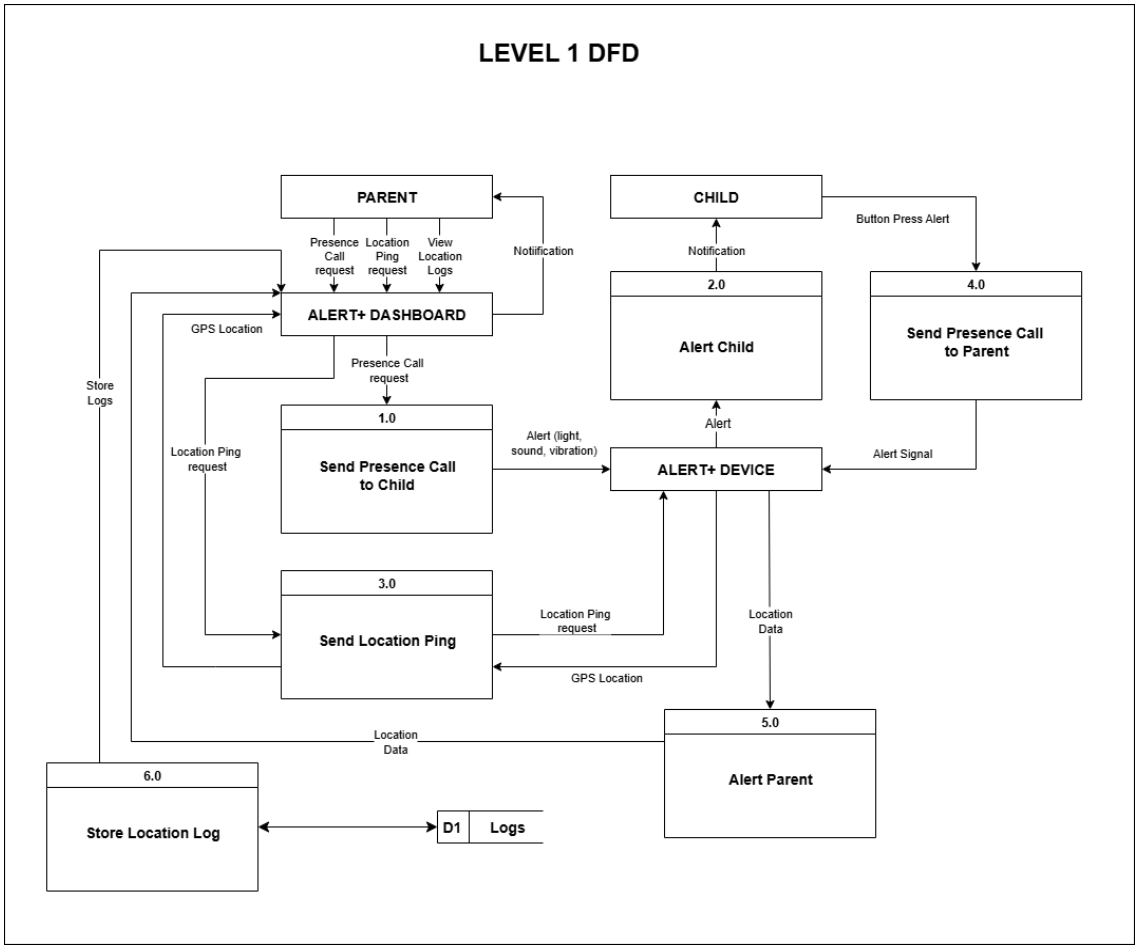



Figure 4.1: Network Architecture of the **Alert+** System

The context diagram shows how the Alert+ system works. The parent or guardian sends a location ping or presence call to the Alert+ device. The Alert+ device alerts the child with light, sound, or vibration. The child can press the button on the device to send their location. The device sends the GPS location using SMS to the parent or guardian. The parent or guardian sees the location and can send another presence call if needed.

### 4.5.2 Data Flow Diagram

Figure 4.2: Data Flow Diagram




The diagram above shows how the ALERT+ system works. First, the parent uses the Alert+ dashboard to send a presence call or location ping request to the Alert+ device carried by the child. If a presence call is sent, the device alerts the child with light, sound, or vibration. If a location ping request is sent, the device automatically gets the child's GPS location and sends it back to the parent via SMS. The child can also press a button on the device to send their location voluntarily to the parent when needed. All location data is stored in the dashboard so the parent can view location history and check logs easily. This process helps families stay connected and know the child's location without disturbing daily activities.

### 4.5.3 Flowchart

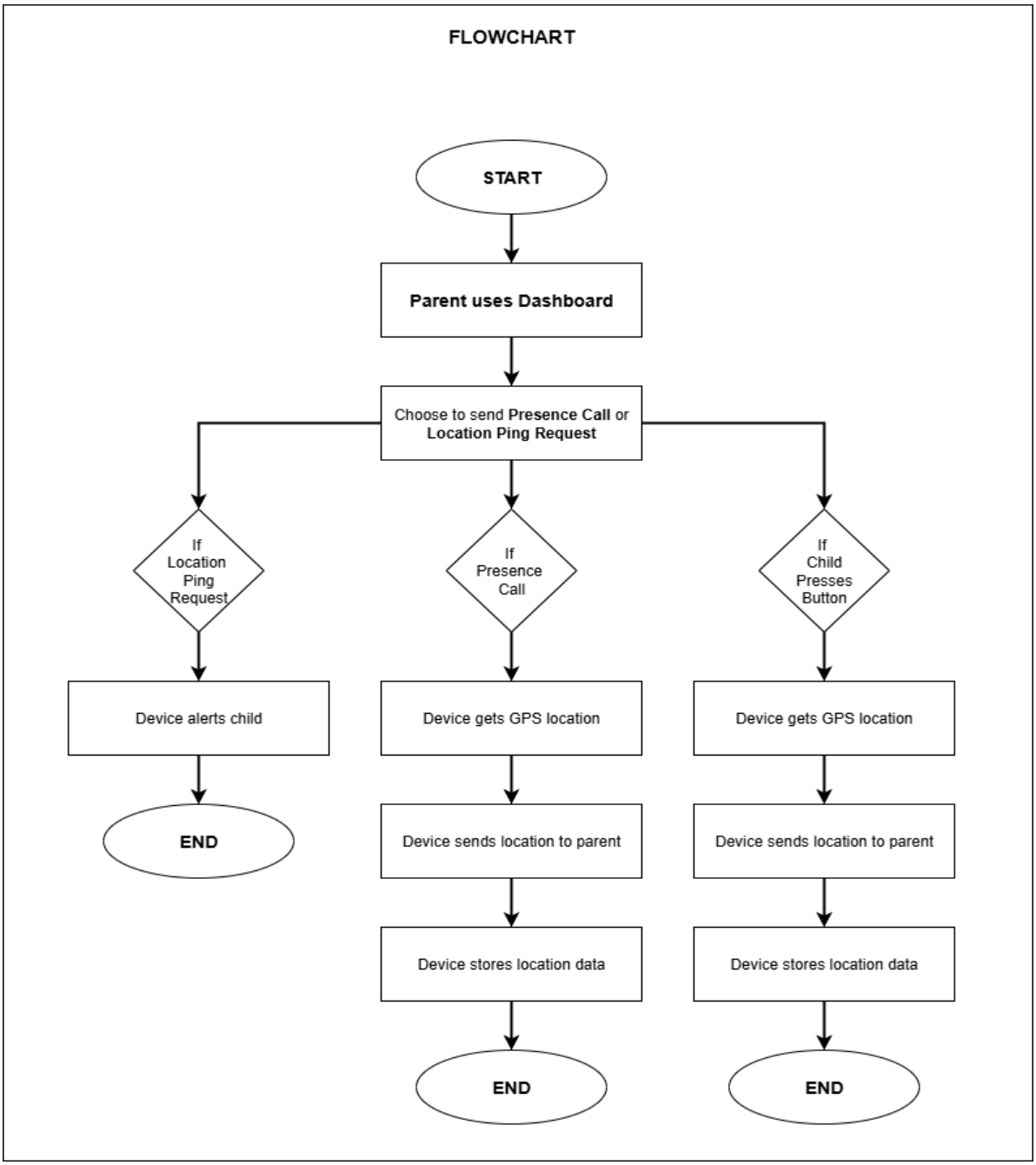



Figure 4.3: Flow Chart

The diagram above shows the flowchart of how the ALERT+ system works. The process starts when the parent uses the Alert+ dashboard to send either a presence call or a location ping request. If a presence call is sent, the Alert+ device alerts the child with light, sound, or vibration

to let them know their parent is checking on them. If a location ping request is sent, the Alert+ device gets the child's GPS location automatically. The device then sends the location to the parent through SMS and saves the location in the dashboard for viewing later. The child can also press a button on the Alert+ device if they want to send their location to the parent. After sending the location, the system goes back to standby mode, ready for the next request, helping families stay connected throughout the day without using phone calls.

### 4.5.4 Use Case

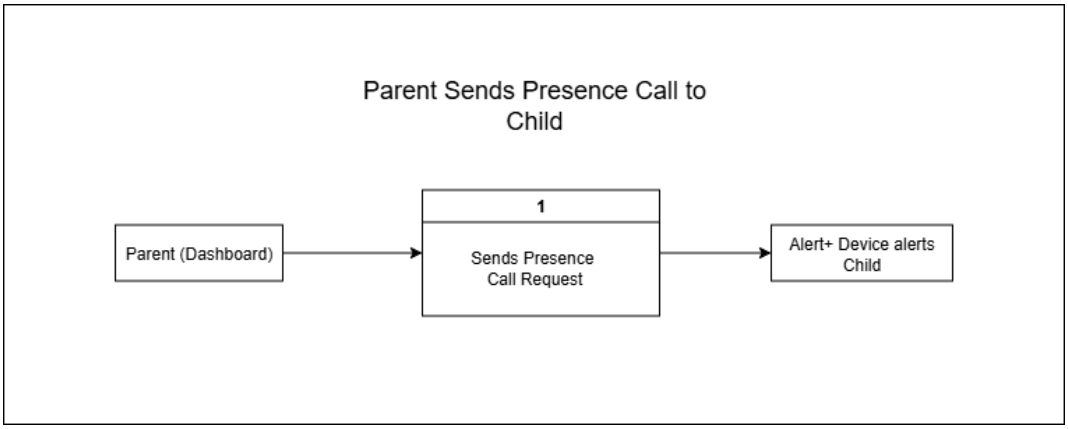



Figure 4.4: Use Case Diagram - 01

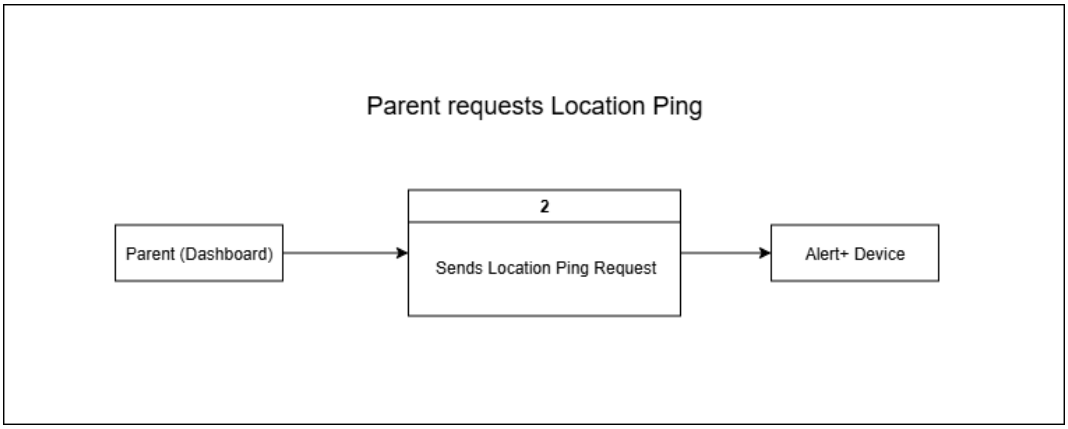



Figure 4.5: Use Case Diagram - 02

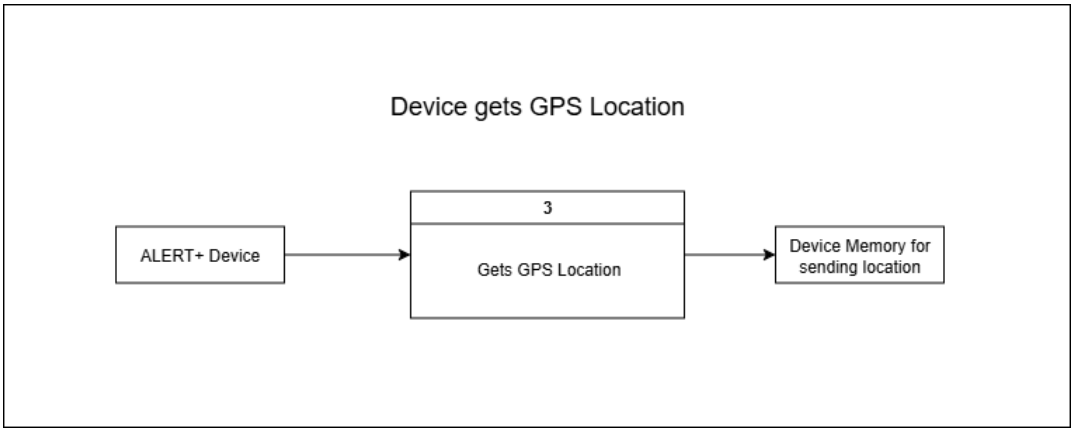



Figure 4.6: Use Case Diagram - 03

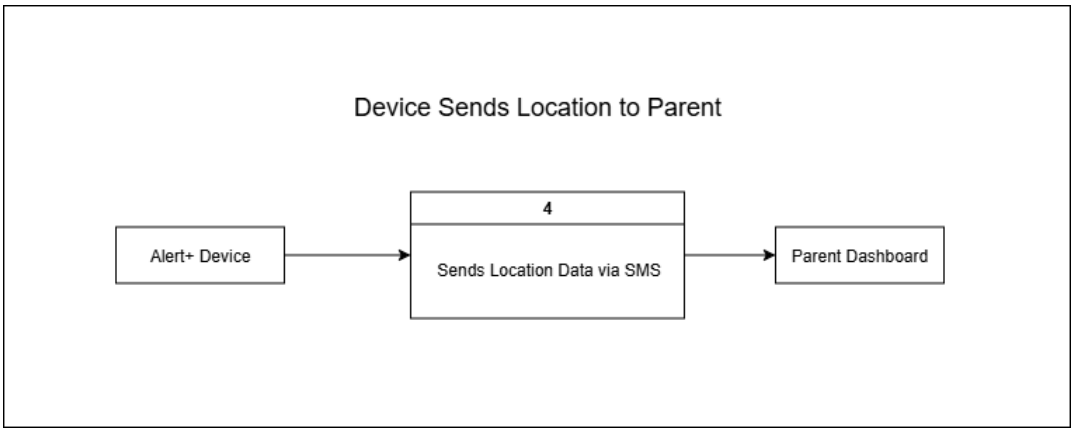



Figure 4.7: Use Case Diagram - 04

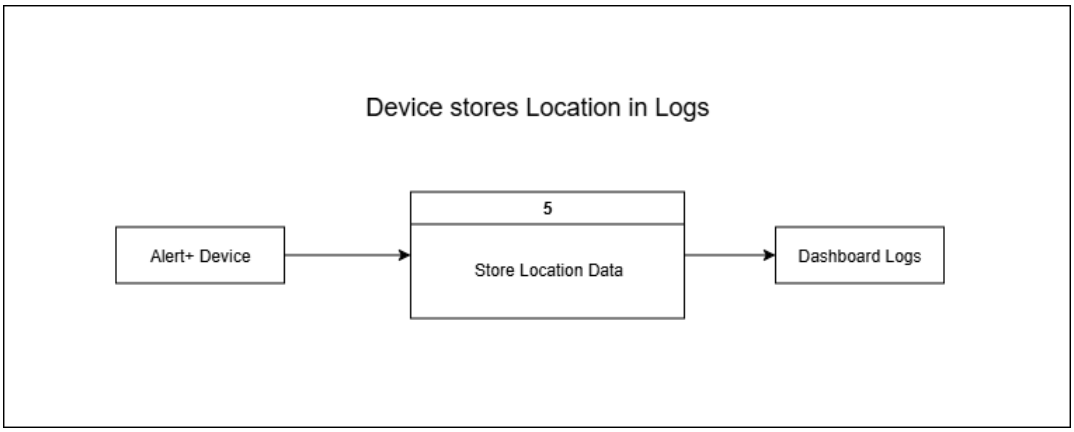



Figure 4.8: Use Case Diagram - 05

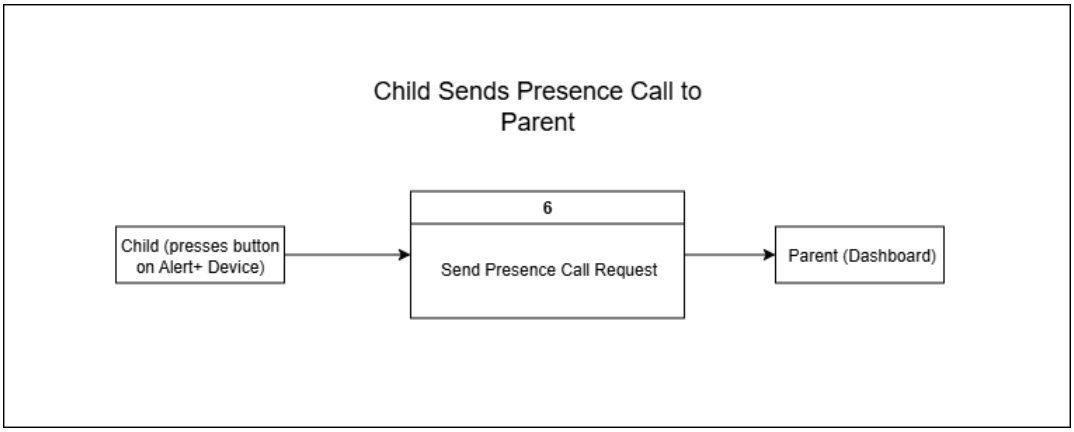



Figure 4.9: Use Case Diagram - 06

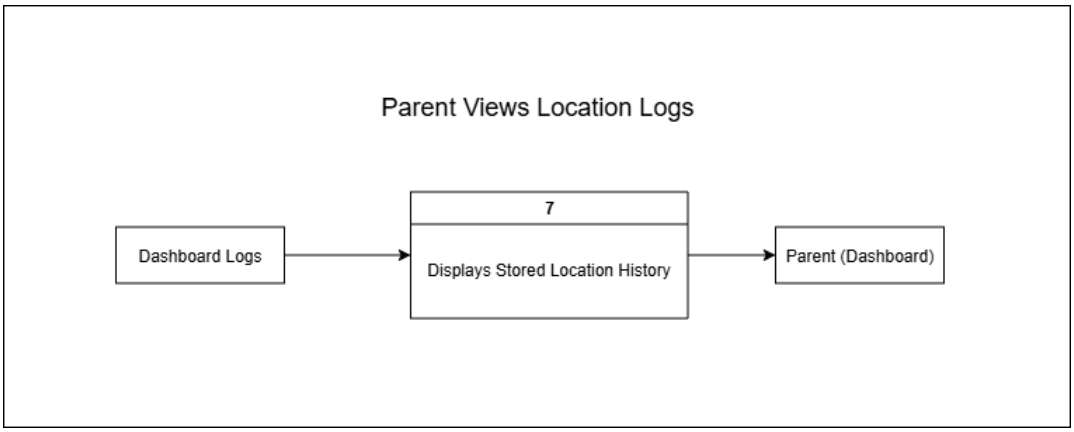



Figure 4.10: Use Case Diagram - 07

The use case diagram shows the main functions of the ALERT+ system. The system has three main actors: Parent, Child, and Dashboard. The Parent uses the Dashboard to send a presence call to the child or to request the child's location. The Alert+ device, carried by the Child, alerts the child with light, sound, or vibration when a presence call is sent. When the parent requests a location, the Alert+ device automatically gets the GPS location and sends it back to the parent using SMS. The child can also press a button on the device to send their location to the parent when needed. All location data is stored in the dashboard, allowing the parent to view the child's location history anytime. This process helps families stay connected, allowing parents to check on their children easily without interrupting their daily activities.

## 4.6 Requirement Specification

**Hardware:**

- ESP32/Arduino Nano (microcontroller)
- SIM800L GSM module
- NEO-6M GPS module
- SD card storage (optional)
- 3.7V rechargeable battery
- Tactile push button
- Water-resistant casing

**Software:**

- Arduino IDE for programming
- C++ for device logic and GSM/GPS module control
- Simple web-based dashboard for parents to send presence call and location ping requests and view logs

### 4.6.1 Functional Requirements

Functional requirements define what the ALERT+ system must do so that families can stay connected by sending location pings and presence calls without using a phone. These ensure the system can help parents check on their children in a simple and reliable way.

#### 4.6.1.1 Software Functionality

This section lists what the ALERT+ system software will do to meet the goals of the project. The system will use C++ in the Arduino IDE to program the ESP32 or Arduino Nano. The software will:

- Get GPS location when the parent sends a location ping request using the dashboard.
- Send the location to the parent using SMS over GSM.
- Alert the child with light, sound, or vibration when a presence call is sent from the parent using the dashboard.

- Detect when the child presses the button to send their location to the parent automatically.
- Store the location data in the dashboard for viewing by the parent.

#### 4.6.1.2 User Characteristics

- Child

  The child is the main user of the ALERT+ device. The device is easy to use and small enough to carry every day. The child does not need technical knowledge to use the device. The device will alert the child using light, sound, or vibration when a presence call is sent by the parent. The child can also press the button on the device to send their location to the parent when needed.

- Parent

  The parent uses the dashboard to send presence calls to the child and request the child's location. The parent can view the child's location and location history in the dashboard. The parent does not need technical expertise to use the dashboard, as it will be simple and clear for easy checking.

### 4.6.2 Non-Functional Requirements

Non-functional requirements define the ALERT+ system's performance, operational criteria, and quality standards to ensure a reliable and satisfactory user experience. Key non-functional requirements include:

#### 4.6.2.1 Technical Requirements

The ALERT+ system is designed to work in everyday family settings, both indoors (school, home) and outdoors (parks, travel) for location ping and presence call functions. All electronic parts will be inside a small, durable, water-resistant case so it can be carried safely by a child without worry.

The device uses a rechargeable battery for daily operation, allowing the child to carry the device all day without needing constant charging.

The ALERT+ device will use ESP32 or Arduino Nano microcontrollers programmed in C++ with Arduino IDE. These microcontrollers will handle:

- Getting GPS location when requested by the parent via the dashboard
- Sending location data via SMS using GSM
- Alerting the child with light, sound, or vibration when a presence call is sent by the parent
- Detecting button press from the child to send their location to the parent

The device does not require Wi-Fi, ensuring it works in areas with mobile signal only.

Since the ALERT+ system only sends real-time location data, it does not need large local storage for daily use, except for simple logs viewable by the parent on the dashboard..

#### 4.6.2.2 Performance Requirements

The ALERT+ system is designed to work consistently and reliably rather than needing instant rapid response since it is not an emergency alert device.
When the parent sends a location ping:

- The system will activate the GPS module to get the child's current location.
- Once the location is acquired, it will send the location via SMS to the parent's phone and dashboard.
- This process should be completed within 1–2 minutes, depending on GPS signal quality and GSM network availability.

When the parent sends a presence call:

- The device will activate light, sound, or vibration to notify the child.
- The child can then optionally press the button to send their location back.

The device will be optimized for low power consumption, allowing full-day standby operation without frequent charging.

The system will handle intermittent mobile signals gracefully by retrying sending the location if the signal is temporarily lost.

#### 4.6.2.3 Assumptions and Dependencies

During the design of ALERT+, the developer(s) made the following assumptions and dependencies to guide the project:

- The project will use Prototyping methodology for development.
- The child will carry the ALERT+ device daily for location ping and presence call use.
- The device will be charged regularly so it is ready when needed.
- There will be GSM network coverage in the areas where the device is used.
- GPS signal quality will vary depending on whether the child is indoors or outdoors.
- The device will send accurate location data to the parent when a location ping is requested or when the child presses the button.
- The parent will monitor the dashboard and receive SMS updates when location pings or presence calls are used.

#### 4.6.2.4 Security Requirements

The ALERT+ system will have **basic physical and operational security** to ensure safe and reliable use:

- The device will use a **closed, water-resistant case** to protect it from damage and tampering.
- It will use a **dedicated GSM module** to send location data via SMS, reducing the risk of data interception since it does not use unsecured Wi-Fi.
- The **button will require a firm press** to avoid accidental presses while the child carries the device.
- Location data will only be sent when a **parent requests it or when the child presses the button**, ensuring **privacy**.
- The system will **not store personal data beyond location logs needed for the parent's viewing on the dashboard**.

These measures will help keep the ALERT+ device secure while allowing parents and children to use it safely for **daily family location tracking and presence call notifications**.

## 4.7 System Design

The ALERT+ system will:

- Detect button press by the child to send their location to the parent.
- Get the current GPS location of the child when needed.
- Send SMS with location to the parent's phone and dashboard using GSM.
- Receive location ping and presence call requests from the parent through the dashboard.
- Alert the child using light, sound, or vibration when the parent sends a presence call.
- Operate without internet, using GSM network only for sending location data.
- Show location logs on the parent's dashboard for monitoring.

## 4.8 Tools and Technology

- Arduino IDE for programming the device firmware.
- ESP32 or Arduino Nano as the microcontroller for device operations.
- SIM800L for sending SMS using GSM.
- NEO-6M GPS module for getting accurate location data.
- Rechargeable battery for daily portable use with low power consumption.
- Simple parent dashboard for viewing location logs and sending presence calls.

## 4.9 Evaluation and Testing

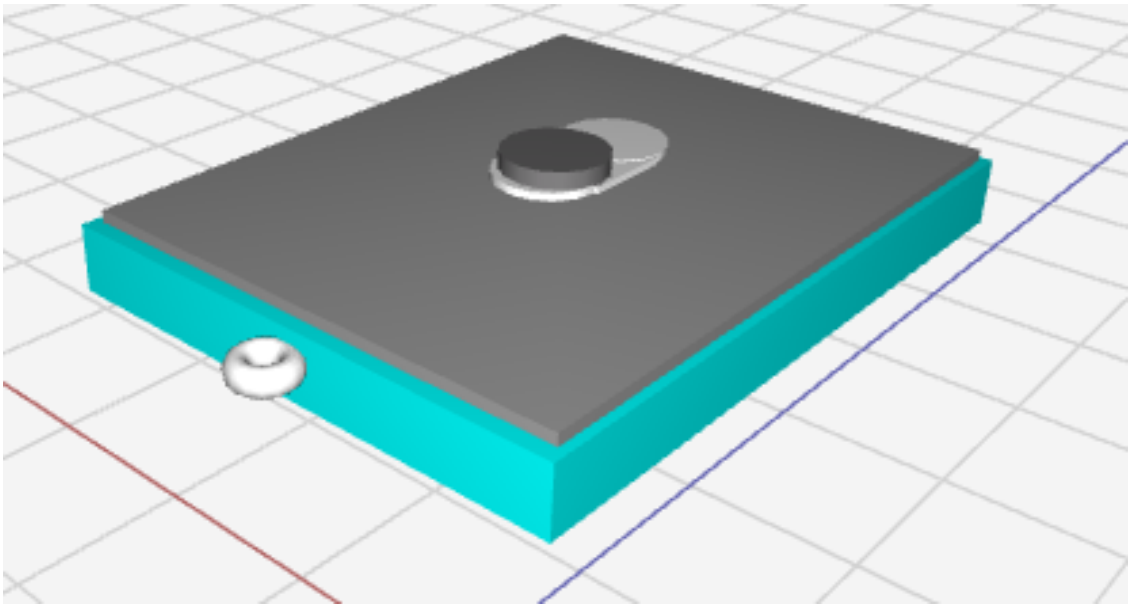
The ALERT+ device will be evaluated for:

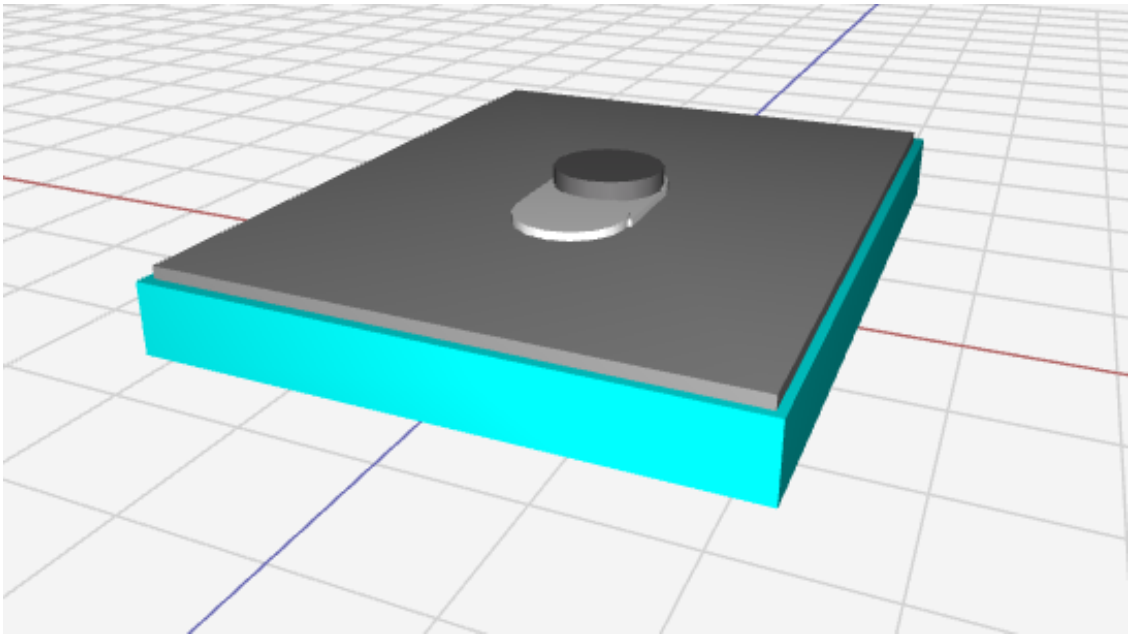
- **SMS Delivery Reliability**: Measuring successful delivery rates and latency.
- **GPS Location Accuracy**: Comparing reported and actual positions.
- **Power Efficiency**: Measuring battery duration in standby and active alert states.
- **Usability**: Testing ease of use during emergencies.
- **Durability**: Evaluating performance under different weather conditions.
- **Parent Feedback**: Gathering parent feedback on how useful the location ping and presence call features are for keeping track of their child.

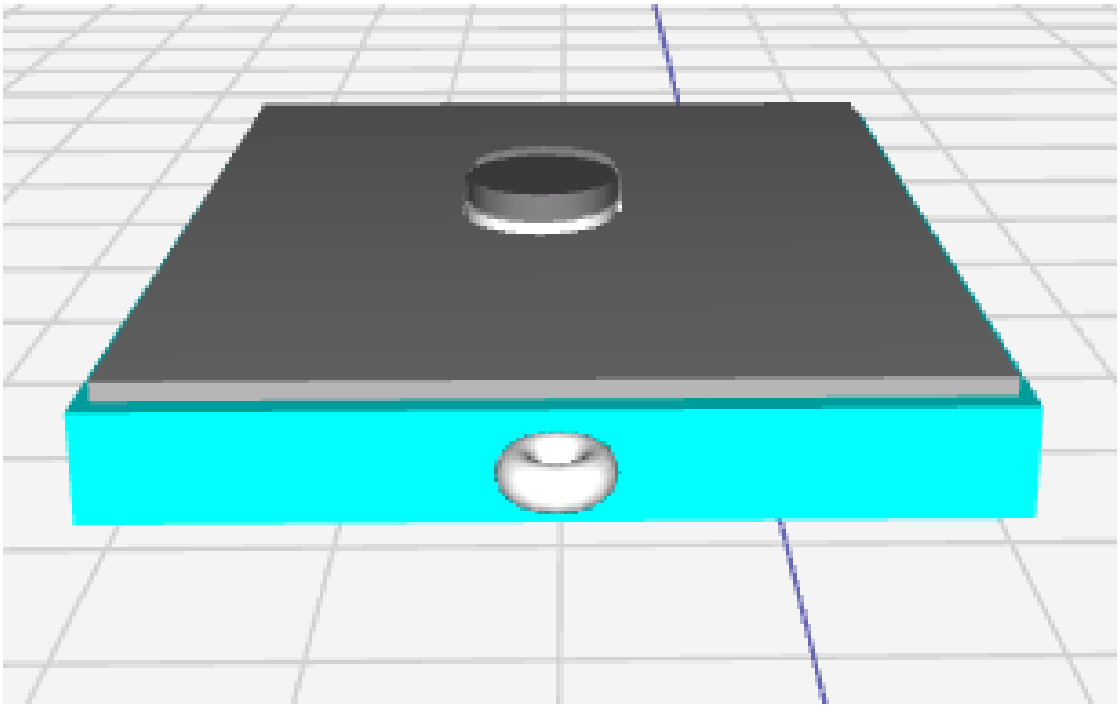
Feedback and test results will guide improvements to ensure ALERT+ is a practical, simple tool for family connectivity and child location monitoring.

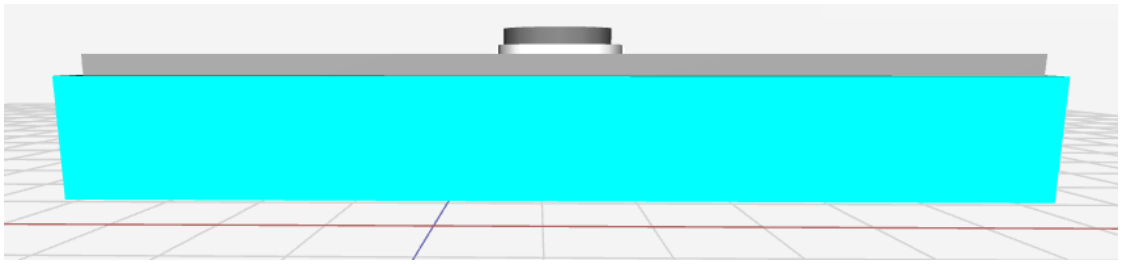
## 4.10 Prototype

**IOT Device:**

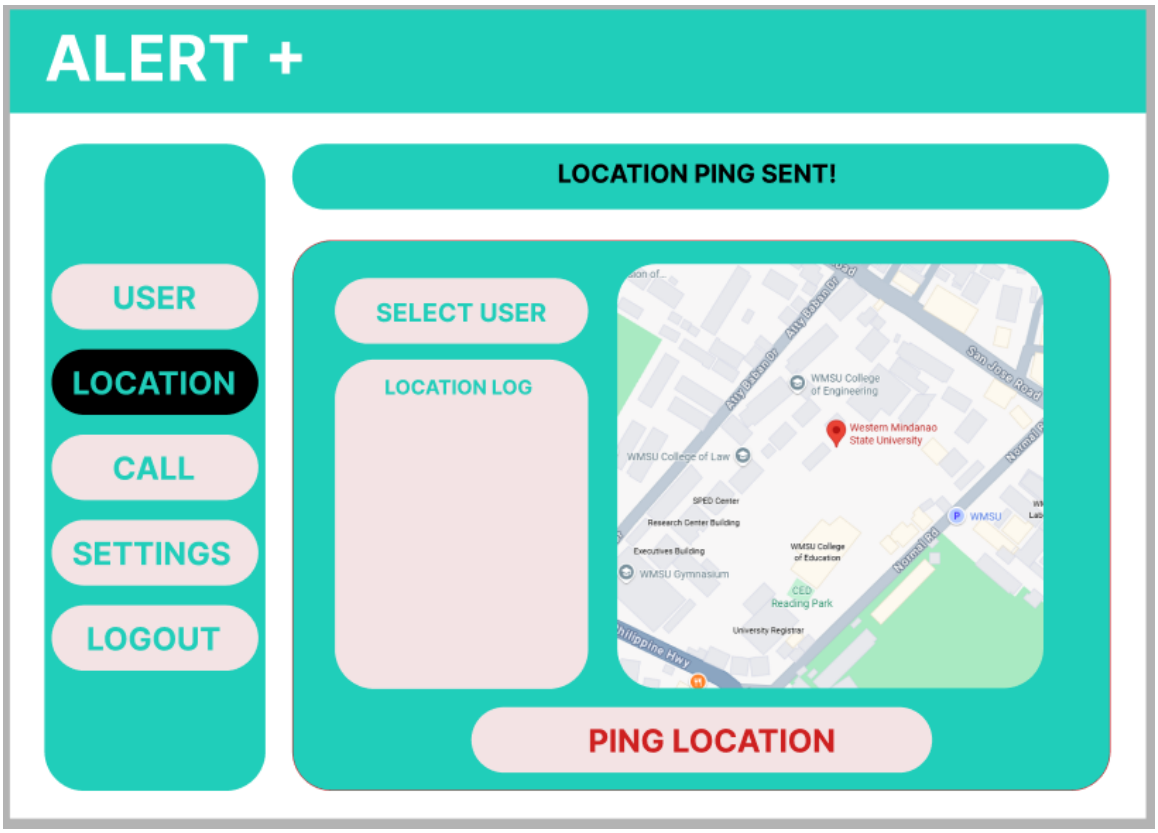








**Dashboard Prototype:**




**Panel Feedback:**

1. Make the system a family device intended for family use only, ensuring that only parents and their registered children can use the device.
2. Manual control by parents to manually decide when to ping their child's location or trigger the presence call.
3. Dashboard for parents where parents can log in to manage each device.
4. The Designed should support multiple user.
5. Manually send a location ping request from the dashboard, and the child's device will reply with its live GPS location.
6. When the parent sends a presence call, the device should vibrate, light up, or make a soft sound one after another to gently get the child's attention without being disruptive.
7. The Device should be online when it is to be registered but solely use 2g after.

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