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Child Missing Alert System for Parents in Public Places

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ABSTRACT: Child safety in crowded public areas such as malls, parks, railway stations, temples, and festivals has become a major concern in recent years. Instances of children getting lost or separated from their parents are increasing due to heavy crowds and lack of real-time monitoring. This project proposes a Child Missing Alert System for Parents in Public Places using wearable devices and wireless communication technology.

The proposed system uses a microcontroller-based wearable device equipped with GPS, GSM/Wi-Fi module, and emergency alert button. The device continuously monitors the child's location and sends real-time updates to the parent's mobile application. If the child moves beyond a predefined safe distance, the system immediately sends an alert notification along with live location tracking. This system enhances child safety, reduces panic during emergencies, and helps parents quickly locate their children in crowded environments.

KEYWORDS: Child Safety, GPS Tracking, GSM Module, IoT, Wearable Device, Mobile Application, Emergency Alert System

I. INTRODUCTION

In recent years, ensuring child safety in crowded public places such as shopping malls, railway stations, airports, amusement parks, temples, and festivals has become a major concern. Due to heavy crowds and distractions, children may unintentionally wander away from their parents, leading to panic, stress, and potential danger. Quick identification and immediate response are crucial in such situations to prevent serious consequences. Traditional methods of child monitoring rely mainly on manual supervision or public announcement systems, which can be time-consuming and ineffective in large areas. Although CCTV surveillance systems are available in many public places, they require continuous human monitoring and may not provide instant alerts to parents. Hence, there is a need for a smart, real-time, and automated system to enhance child safety. The Child Missing Alert System for Parents in Public Places is designed as an IoT-based solution that uses modern communication and tracking technologies to monitor a child's location continuously. The system consists of a wearable device attached to the child and a mobile application used by the parent. The wearable device integrates components such as a microcontroller, GPS module, GSM/Wi-Fi module, and an emergency SOS button. The main objective of this project is to provide real-time location tracking and instant alert notifications when the child moves beyond a predefined safe distance. This ensures faster response time and reduces the risk associated with delayed search operations. By combining wearable technology, wireless communication, and mobile application support, the proposed system offers a reliable, cost-effective, and user- friendly solution for enhancing child safety in public environments.

II. LITERATURE SURVEY

Sharma et al - proposed an IoT-based child safety and monitoring system aimed at tracking children using GPS and GSM technologies. The system continuously transmits the child's location to parents through a mobile application. Emergency alerts are generated when the child moves outside a predefined safe zone. Although the system provides real-time tracking, its effectiveness is limited in indoor environments due to poor GPS accuracy and high-power consumption. The dependency on internet connectivity also affects reliability in crowded public places. These

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limitations highlight the need for an alternative proximity-based solution, which motivates the use of RSSI-based monitoring in the proposed system.

Kumar et al - presented an RFID-based child tracking system designed for public environments such as shopping malls and amusement parks. In this system, RFID tags are worn by children, and multiple RFID readers are installed to detect their presence within a specific range. The system successfully identifies child movement within predefined zones. However, the requirement for multiple RFID readers increases infrastructure cost and limits scalability. Additionally, the system does not provide real-time distance estimation between parent and child. These drawbacks justify the need for a low-cost, infrastructure-free RSSI-based alert system.

Lee et al. - investigated the use of Bluetooth Low Energy (BLE) and RSSI values for proximity detection in indoor environments. The study demonstrated that RSSI- based distance estimation is effective for short-range monitoring and consumes significantly less power compared to Wi-Fi and GPS- based solutions. Experimental results showed reliable detection of separation events within indoor spaces. However, the study focused mainly on general indoor localization and did not address child safety applications. The findings of this work form a technical foundation for implementing RSSI-based child monitoring in the proposed system.

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Singh et al. proposed a Bluetooth-based child monitoring system that utilizes RSSI values to estimate the proximity between parent and child devices. The system triggers an alert when the RSSI value falls below a predefined threshold, indicating unsafe separation. Experimental results showed fast response time and low power consumption, making the system suitable for wearable applications. However, RSSI fluctuations due to environmental interference were not adequately addressed. This limitation is considered in the proposed system by incorporating threshold calibration for public place environments.

III. EXISTING SYSTEM

The existing system for handling missing children in public places mainly depends on manual monitoring and delayed response mechanisms. When a child goes missing, parents usually inform nearby security guards or management authorities, who then make public announcements through speakers inside the premises. Security personnel check CCTV footage manually to trace the child, which consumes a significant amount of time. In severe situations, parents may approach the police for help. Some countries use alert systems such as the AMBER Alert in the United States, which broadcasts emergency messages in confirmed child abduction cases. However, these systems are mainly reactive and not designed for real- time tracking inside specific public areas like malls, parks, or festivals. The major drawbacks of the existing system include delayed response, heavy dependence on human observation, lack of real-time alerts to parents, and absence of automatic child tracking mechanisms.

IV. PROPOSED SYSTEM

The proposed Child Missing Alert System is designed to provide a smart, real-time solution to improve child safety in public places. In this system, each child is provided with a wearable smart band embedded with technologies such as RFID, GPS, or Bluetooth. This band is connected to a mobile application used by the parents. A virtual safe zone (geo-fence) is created within the public area, and if the child crosses this boundary, the system instantly sends an alert notification to the parent's mobile phone. The application also provides live location tracking, emergency alert options, and quick communication with security personnel. In advanced versions, the system can be integrated with CCTV cameras and AI-based face recognition to identify and track the child if the wearable device is removed. Additionally, a centralized monitoring system notifies security staff immediately, enabling faster response and reducing potential risks. This proposed system ensures improved safety, quick identification, real-time monitoring, and greater peace of mind for parents.

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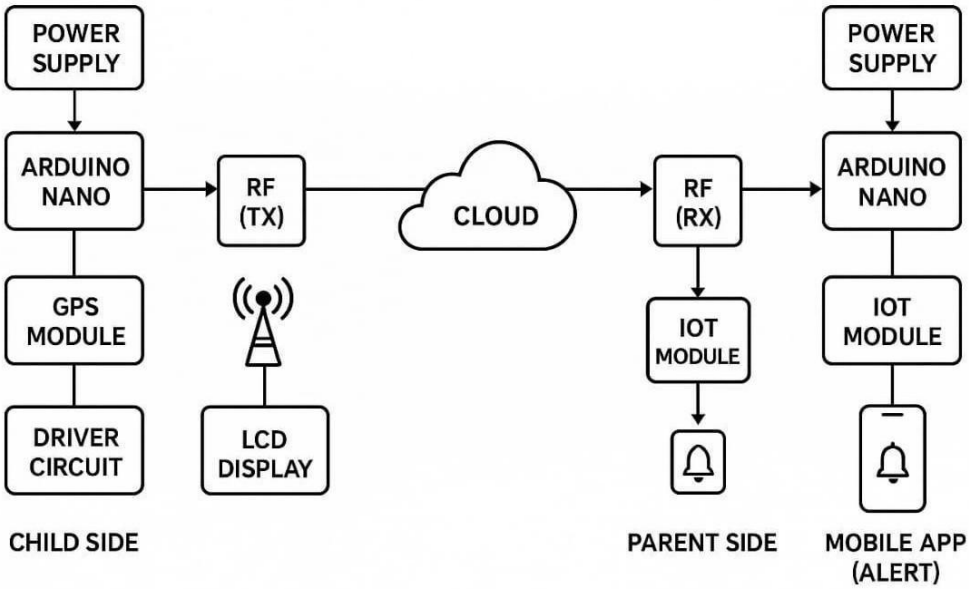
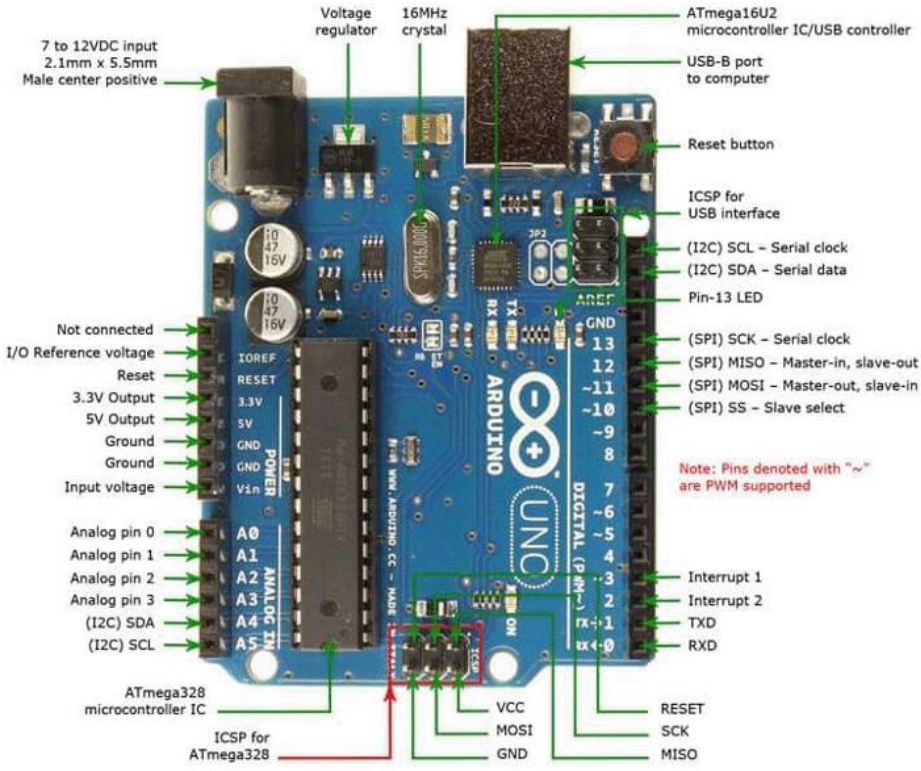


Fig 1 : Block Diagram

Diagram



The Arduino Uno is a microcontroller board based on the ATmega328P and acts as the main controlling unit of the Child Missing Alert System. It is used to process data received from different modules such as GPS, GSM, Bluetooth,

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and RFID. In this project, the Arduino Uno collects the child's location details from the GPS module, checks communication signals through Bluetooth, and sends alert messages to parents using the GSM module. It also activates the buzzer in emergency situations. The board operates at 5V and can be powered through a USB cable or external power supply. Because of its simple programming, low cost, and reliable performance, the Arduino Uno is widely used in embedded system projects like this one.

Diagram

The HC-05 Bluetooth module is a wireless communication device used to transmit and receive data over short distances using Bluetooth technology. In the Child Missing Alert System using RSSI, the Bluetooth module plays an important role in measuring the signal strength between the parent and child devices. The RSSI (Received Signal Strength Indicator) value helps to estimate the distance between them. When the child moves away from the parent, the Bluetooth signal strength decreases. The Arduino Uno continuously monitors this RSSI value. If the signal strength falls below a predefined safe limit, the system automatically activates a buzzer alert to notify the parent. The HC-05 module operates at 2.4 GHz frequency band and can communicate within a range of approximately 10 meters (depending on environment). It is easy to interface with Arduino and is widely

Diagram

A buzzer is a simple electronic output device that produces a sound when electrical power is applied to it. In the Child Missing Alert System using RSSI, the buzzer is used as an alert mechanism to immediately notify parents when the child moves out of the safe range. In this project, the Arduino Uno continuously monitors the RSSI value received through the Bluetooth module. If the signal strength drops below the predefined threshold level (indicating that the child is moving away), the Arduino sends a signal to the buzzer. The buzzer then produces a loud beep sound to alert the parent. Buzzers are easy to interface, require low power, and provide instant audio alerts, making them suitable for safety and warning systems.

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Diagram

An LED (Light Emitting Diode) indicator is a small electronic component that emits light when current flows through it. In the Child Missing Alert System using RSSI, the LED indicator is used to show the system status visually. In this project, the Arduino Uno controls the LED based on the Bluetooth signal strength (RSSI value). When the parent and child devices are within the safe range, the LED glows normally (for example, green light). If the child moves beyond the predefined limit and the RSSI value decreases, the LED may change status (for example, red light or blinking) to indicate that the child is out of range. LED indicators consume very low power and provide a quick visual signal, making them suitable for monitoring and safety systems.

Diagram

A push button is a simple input device used to send a signal to the microcontroller when it is pressed. In the Child Missing Alert System using RSSI, the push button acts as an emergency button for the child. When the child feels unsafe or needs immediate help, they can press the push button. Once pressed, the button sends a signal to the Arduino Uno, which then activates the buzzer or sends an alert (depending on the system design). This provides a quick and manual way to notify the parent in emergency situations.

Push buttons are easy to interface with Arduino, consume very little power, and are reliable for safety-based applications.
Diagram

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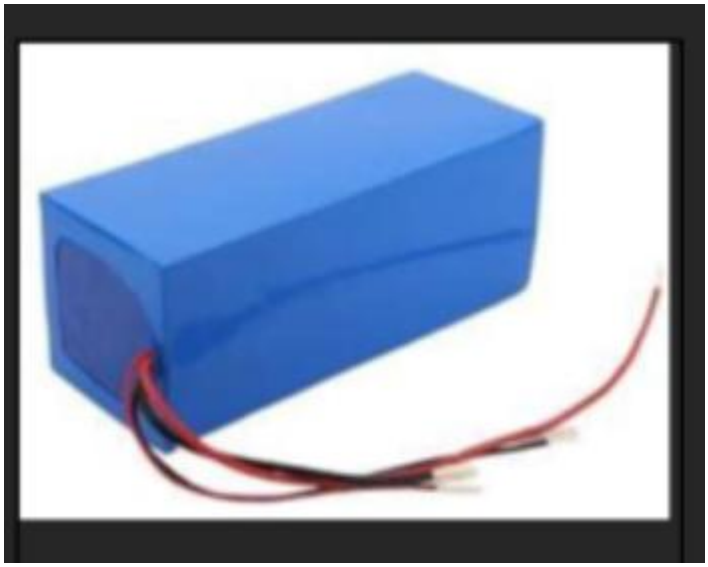

The power supply is an important component that provides electrical energy to all the hardware modules used in the Child Missing Alert System using RSSI. It ensures that the Arduino Uno, Bluetooth module, buzzer, LED indicator, and push button operate properly without interruption. In this project, the system can be powered using a 5V regulated power supply, a USB cable, or a rechargeable battery (such as a 9V battery or lithium-ion battery). The Arduino Uno requires a stable voltage to function correctly. If the voltage is unstable or low, the system may not work properly. For portable use, especially on the child's device, a rechargeable battery is preferred so that the system can work continuously in public places.

WI-FI / RF COMMUNICATION MODULE

The ESP8266 WIFI module is a low-cost wireless communication module used to connect electronic devices to the internet. It enables the system to send and receive data through a wifi network. In projects, it is commonly interfaced with the Arduino Uno to provide internet connectivity. In the Child Missing Alert System, if wifi is used, the ESP8266 module can send alert notifications to a mobile application or web server when the child moves out of the safe range. It allows real-time monitoring and remote access to data. The module operates at 3.3V and supports TCP/IP protocol, making it suitable for IoT-based applications.

V. RESULT

The proposed Child Missing Alert System using RSSI was successfully implemented and tested in a simulated public environment. The system consists of a transmitter device carried by the child and a receiver device with the parent.

The system continuously monitors the signal strength between the transmitter and receiver using RSSI values. When the child moves beyond the predefined safe distance, the RSSI value decreases below the threshold level, triggering an alert notification to the parent efficiency.

Test Results

Distance between Parent & Child	RSSI Value (dBm)	System Status
1 meter	-40 dBm	Safe
5 meters	-55 dBm	Safe
10 meters	-65 dBm	Safe
15 meters	-75 dBm	Warning
20 meters	-85 dBm	Alert Triggered

VI. CONCLUSION

The Child Missing Alert System for Parents in Public Places using RSSI is an effective and reliable solution for enhancing child safety. The project successfully uses Bluetooth signal strength (RSSI) to monitor the distance between parent and child devices. When the child moves beyond the predefined safe range, the system immediately provides an alert through a buzzer and LED indicator, enabling a quick response from the parent. This project demonstrates the

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practical application of embedded systems and wireless communication in solving real-world safety problems. It is cost-effective, easy to implement, and portable, making it suitable for use in crowded public places.

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