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Child Safety Device for Location Tracking

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Abstract:

Child safety is a growing concern in today's fast-paced world. Traditional monitoring methods are no longer sufficient to track children in real-time. This work proposes a smart wearable IOT device designed to provide child location tracking and emergency alerting through a GPS and GSM –enabled wearable. It connects with parent's mobile device and sends live location updates, SOS alerts, and geofence notifications. The system is lightweight, cost-effective, and suitable for real-world implementation. Parents can monitor their child's location using a mobile application that communicates with the device via a cloud platform. In the event of danger, the child can press the SOS button, instantly notifying guardians with the precise location.

Keywords **—** Arduino uno, GPS, GSM, Child Safety, Emergency alerts.

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I. INTRODUCTION

All the device and systems that are constantly linked to the internet and physical sensors are together referred to as the "internet of things" (IOT). Providing a technology-based solution that can support children in emergency situations. In today's fast-paced world, ensuring the safety of children has become a growing concern for parents and caregivers. With increasing cases of child abduction, getting lost in crowded places, or wandering into unsafe areas, the need for a reliable child monitoring solution is more urgent than ever. As urban environments grow more complex and technology becomes a central part of daily life, families seek peace of mind knowing their children are safe-even when they are not physically present. Many working parents struggle with balancing professional responsibilities and constantly supervising their children, especially in public spaces like parks, malls, or during school commutes. Traditional method like verbal instructions or physical boundaries often fall short in unpredictable situations. Hence, there is a strong social demand for innovative safety measures that offer real-time monitoring and immediate alerts. The proposed system integrates IOT technology to provide smart monitoring and real-time assistance for parents.

At the core of this system is a Wi-Fi module that enables continuous data transmission and monitoring via a dedicated Android application. This app allows parents to access critical safety metrics and location tracking information stored on the cloud. Additionally, the system is equipped with GSM (Global system for mobile communication) and GPS (Global positioning system) modules, ensuring precise location tracking and secure communication. By leveraging GPS coordinates, the system provides real-time location updates to parents, enhancing their ability to monitor their child's safety effectively.

II. LITERATURE SURVEY

[1] Authors: Aditi Gupta, Vibhor Harit.
Published in: 2021 IEEE. Title: Child Safety & Tracking Management System by using GPS. This paper proposed a model for child safety through smart phones that provides the option to track the location of their children as well as in case of emergency children is able to send a quick message and its current location via short message.
Merits: The advantages of smart phones which offers rich features like Google maps, GPS, SMS etc.

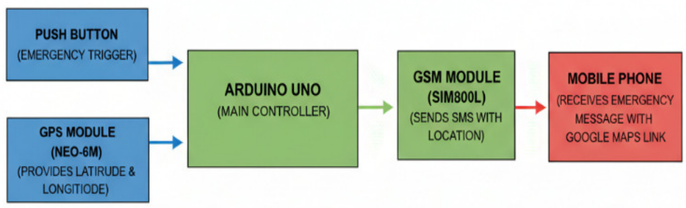
[2] Authors: Akash Moodbidri, Hamid Shahnasser
Title: Child safety wearable device. Published in: 2020 IEEE. The purpose of this device is to help the parents to locate their children with ease. At the moment there are many wearables in the market which helps to track the daily activity of children and also helps to find the child using Wi-Fi and Bluetooth services present on the device.
Merits: This wearable over other wearable is that it can be used in any phone and it is not necessary that an expensive smartphone is required and doesn't want to be a very technical skills to operate.
Demerits: As, this device's battery gives short life-time. High power efficient model will have to be used which can be capable of giving the battery life for a longer time.

[3] Authors: M Nandini Priyanka, S Murugan, K. N. H. Srinivas, T. D. S. Sarveswararao, E. Kusuma Kumari.
Title: Smart IOT Device for Child Safety and Tracking. Published in :2019 IEEE. The system is developed using Link-It ONE board programmed in embedded C and interfaced with temperature, heartbeat, touch sensors and GPS, GSM & digital camera modules. The novelty of the work is that the system automatically alerts the parent/caretaker by sending SMS, when immediate attention is required for the child during emergency.
Merits: The parameters such as touch, temperature & heartbeat of the child are used for parametric analysis and results are plotted for the same.
Demerits: To implement the IoT device which ensures the complete solution for child safety problems.

[4] Authors: Dheeraj Sunehera, Pottabhatini Laxmi Priya.
Title: Children Location Monitoring on Google Maps Using GPS and GSM. Published in: 2018 IEEE. This paper provides an Android Different devices are connected with a single device through channels of internet. The concerned device is connected to server via internet. The device can be used by parents to track their children in real time or for women safety. The proposed solution takes the location services provided by GSM module. It allows the parents to get their child's current location via SMS.
Merits: A child tracking system using android terminal and hoc networks.
Demerits: This device cannot be used in rural areas.

III. BLOCK DIAGRAM AND WORKING

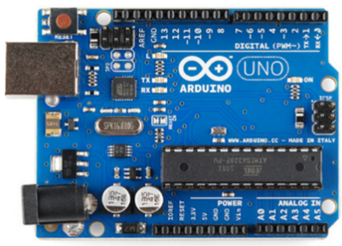
I. BLOCK DIAGRAM



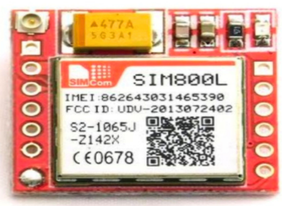
II. HARDWARE REQUIREMENT

1] Arduino Uno

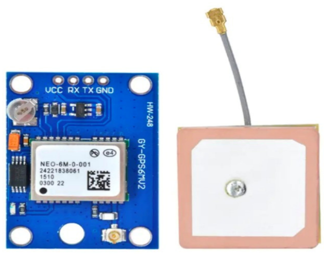
The Arduino Uno is a popular open-source microcontroller board based on the ATmega328P microcontroller. It features 14 digital input/output pins (6 of which can be used for PWM output), 6 analog inputs, a USB connection, and a power jack. It is used to control and sense external electronic devices and is often used by beginners and hobbyists. The board can be programmed using the Arduino IDE with C and C++ languages.



2] SIM800L GSM Module
The SIM800L is a cellular module that allows a microcontroller to connect to a GSM (Global System for Mobile communications) network. This enables the device to perform functions such as making and receiving calls, sending and receiving SMS messages, and connecting to the internet via GPRS.

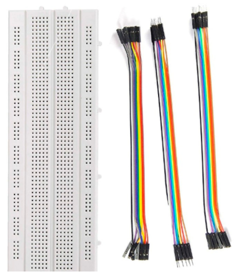


3] NEO-6M GPS Module
The NEO-6M is a GPS (Global Positioning System) module that uses satellites to determine a device's precise location, speed, and time. It is commonly used with microcontrollers like the Arduino Uno to add location-based functionality to projects.



4] Push Button
A push button is a simple electronic switch used to control a circuit. It has two states: on and off. When pressed, it completes a circuit, and when released, it breaks the circuit. It is a fundamental input component in many electronic projects.

5] Breadboard + Jumper Wires
A breadboard is a solderless construction base used for building temporary prototypes of electronic circuits. It has a grid of holes where components and jumper wires can be inserted to create connections. Jumper wires are used to connect components on the breadboard without soldering.



6] Power Supply (Arduino 5V)
The power supply provides the necessary electrical energy to operate the components. The Arduino Uno can be powered in several ways, including via its USB connection or a power jack. The recommended input voltage for the power jack is 7 to 12 volts, which the board's internal voltage regulator converts to the 5V needed to power the microcontroller and other components.

III. SOFTWARE REQUIREMENT

1]Arduino IDE
IDE - Integrated Development Environment C or C++ languages is used to code. It is an open source used to write, compile and upload code in Arduino.

2] Tiny GPS Plus Library
Purpose: Used to decode GPS data (NMEA sentences) from modules like NEO-6M.
Main Functions:

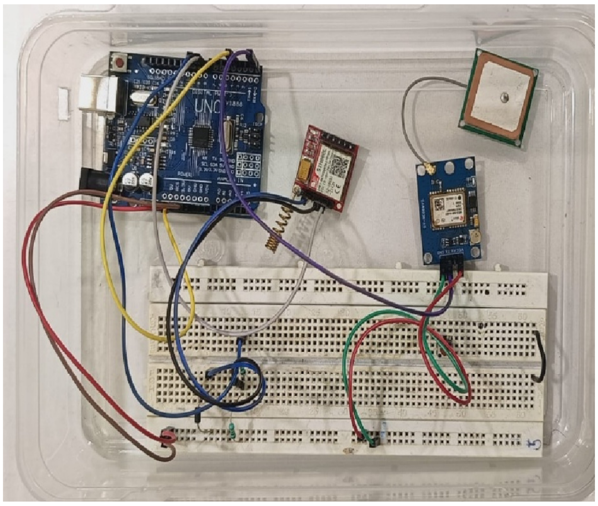
gps.location.lat (), gps.location.lng () → latitude & longitude
gps.speed.kmph () → speed
gps.altitude.meters () → altitude
gps.date.value (), gps.time.value() → date & time
gps.satellites.value() → number of satellites
Working: Reads serial GPS data → parses it → extracts useful info like location, speed, altitude, etc.

3] Software Serial Library
Purpose: Enables serial communication on any digital pins, apart from default (0,1).
Main Functions:
Software Serial (rx, tx) → create virtual serial port
begin(baudrate) → start communication
available(), read(), write() → read/write serial data
Working: Creates a software-based UART so multiple serial devices (like GPS, Bluetooth) can communicate simultaneously with Arduino.

4] USB Driver (CH340)
Purpose: A USB-to-Serial driver that allows your PC to communicate with Arduino boards (especially clones using the CH340 chip).
Working: Converts USB signals from your computer to serial (UART) signals understood by the Arduino's microcontroller.

IV. WORKING

This project is designed to send the location of the user through a GSM module when the emergency button is pressed. The system mainly consists of an Arduino UNO, GSM module, GPS module, and a push button. When the system is powered ON, the Arduino continuously communicates with the GPS module to receive the current latitude and longitude data. The GPS module sends the location information to the Arduino through serial communication.
When the push button is pressed, the Arduino immediately reads the latest GPS coordinates. These coordinates are then sent to the GSM module, which transmits an SMS alert message containing the location (latitude and longitude) to a pre-stored mobile number. If the GPS signal is not available, the system displays "GPS signal not found on the serial monitor. Once the GPS signal is received, it sends the correct location link.
This project can be used in emergency alert systems, vehicle tracking, and safety monitoring applications. where location information must be sent automatically during emergencies.



V. RESULT

The prototype successfully demonstrates the working of a GSM and GPS-based safety alert system. When the push button is pressed, the Arduino reads the GPS location and sends an SMS alert (with the latitude and longitude) to the registered mobile number using the GSM module (SIM800L). In simulation, the system correctly detects the button press and shows message outputs such as "Button Pressed!" and "GPS signal not found!"-which confirm that the Arduino and button logic work as expected. In real hardware implementation, once GSM and GPS modules are connected, the system will be able to:
Detect emergency situations using a push button.
Retrieve live GPS coordinates from the NEO-6M module.
Send an SMS alert to the registered number via the SIM800L GSM module.
Thus, the project proves to be an effective low-cost safety communication system for emergency location tracking and alerting.

IV. CONCLUSIONS

The proposed child safety system, combining a mobile application and IoT-based wearable device, offers an innovative, reliable, and cost-effective solution for ensuring children's security. Through real-time GPS tracking, geofencing alerts, SOS notifications, environmental monitoring, and live video streaming, parents can continuously monitor their child's safety and respond quickly during emergencies. The system's integration of smart sensors, GSM alerts, and efficient power management enhances its practicality and accessibility for modern families. While challenges such as GPS accuracy, connectivity, and long-term durability remain, future improvements like voice communication, predictive safety features, and smart home integration can further strengthen its performance. Overall, this technology represents a significant step toward reducing crimes against children and providing parents with confidence, security, and peace of mind.

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