Integrating GPS-enabled IOT Technology For Women Safety

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Abstract

With the rise of the trend where women's security and safety are ultimate, the introduction of GPS technology in the women's safety system can be taken as an important step towards empowerment and security. The developed model is composed of units like Node MCU and GPS Module. Node MCU could be designed to contain all the features like GPS tracking, Accelerometer based fall detection, panic button and live communication and GPS module device act as a necessary part in location tracking functionality. This unit receives and processes signals coming from GPS satellites which help to calculate the device's position in accordance with its geographic coordinates. Furthermore, the system's reactive capacity to combat is improved due to its synchronisation with emergency response systems as well as mobile applications. It intensifies system efficiency by providing an ability of sorting the risks on time and offering aid to people in danger as fast as possible. This technology can be tailored to fit different scenarios, ranging from urban metropolises to remote rural areas, providing women with the security they need.

Keywords Node MCU, GPS module, Gyro-meter sensor, I2C LCD Display, Internet of things, women safety system.

1 Introduction

Women's safety remains a concerning issue globally, with several factors facing various threats while navigating public spaces. Integrating GPS-enabled IoT technology provides a multifaceted approach to addressing these challenges. This technology allows for real-time tracking, emergency alerts, and geofencing capabilities, enhancing both prevention and response measures. IoT technology enables the collection and analysis of data related to safety incidents, trends, and patterns. By leveraging this data, authorities and organizations can identify high-risk areas, deploy resources more effectively, and implement targeted interventions to enhance overall safety. IoT devices equipped with panic buttons or

gesture-based triggers can instantly send distress signals, including location data, to predefined contacts or emergency services. This immediate communication can expedite assistance and intervention when needed most.

Integrating GPS-enabled IoT technology for women's safety represents a pre-emptive and innovative approach to addressing safety concerns in today's society. This device utilises the Multi-axis Gyrometer which can be used to sense movements and sequentially allows the system to identify situations of unexpected falls, enabling the necessary alerts for help.

The main motive of the proposed model is:

1. Providing a sense of reliability and safety for women
2. Incorporating both automatic and manual mechanisms to avoid any kind of false alerts.

By leveraging the capabilities of these technologies and implementing comprehensive strategies, we can create safer environments where women can thrive and pursue their aspirations without fear.

2 Literature Study

Viji R. et al. proposed health monitoring alongside to a women's safety gadget. Additionally, tilt sensor, vibration sensor, and heartbeat sensor are interfaced with the Microcontroller which keeps sending data every 20 seconds [1].

A similar model was proposed by A. Jesudoss et al. In this proposal, along with a microcontroller, a microprocessor - Raspberry Pi is also used with sensors for health monitoring purposes [2].

J J Jigesh et al developed a portable device which is activated by the user depending on his/her need. Apart from usual GSM modules a shock circuit is added here. [3].

A safety gadget that is fastened to the handbag's strap was suggested by M. A. Kumar et al. This device has a camera module, a microcontroller, GPS, and GSM modules. [4].

However sharp, the tool of timely alerts may seem to be, the shortage of balance can be seen after reviewing the literature. In the end, it was discovered that GSM was not suitable for each case. With thorough analyzation Node-MCU proved to be the most prevalent option, where Arduino Uno might not work efficiently.

3 Components

3.1 Node MCU

An ESP8266 Wi-Fi module is commonly included in the Node MCU development board, which allows wireless connectivity. Along with GPIO pins, SPI, I2C, UART, ADC, and pulse width modulation functions, it runs at 3.3 volts. Several development environments, such as the Arduino IDE and Node MCU use the programming language named Lua can also be used to program on the board. The main feature of Node-MCU is it is integrated with a Wi Fi module, permitting it to link to wireless network and communicate through the internet.

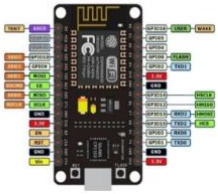

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Fig.1 Node MCU

3.2 GPS Module

Neo-6m GPS module is a known GPS module which can determine the coordinate of the point, precisely latitude and longitude on Earth's surface**.** It helps in accurate tracking of a person's movements by providing precise position information. It uses satellite signals which helps in locating the user's location. GPS receiver, antenna, and related electronics for communication with a microcontroller or other sources of electricity tend to appear in the module

Fig.2 GPS Module

3.3 LiPo Battery

A LiPo (Lithium Polymer) battery is a type of rechargeable battery that uses a lithium-ion technology in a polymer electrolyte format. LiPo batteries typically have a nominal voltage of 3.7 volts per cell although configuration might impact this value. These LiPo batteries are versatile power sources widely used in variety of electronics devices and applications. Their compact size, lightweight construction and high energy make them a reliable choice for this device.

Fig.3 Li-po Battery

3.4 Buzzer

A buzzer can be linked to a panic button or an independent emergency activation switch. This are an extra security layer to the system where different likely situations can trigger the users. Buzzers play a crucial role in electronics by providing audible alerts and notifications, enhancing user interaction, and improving the functionality and usability of electronic devices and systems.

Fig.4 Buzzer

3.5 Push Button

A push button is an element that helps users trigger specific actions or send signals with the press of a button. It can be incorporated into the safety system for easy user interaction. It is a versatile mechanical component which, when pressed, makes or breaks electrical contact within the switch mechanism, thereby helping to open or close a circuit. Here, their versatility, ease of use and durability makes them reliable for the device.

Fig.5 Push Button

3.6 Switch

A switch is an electronic component used to for diverting the direction of electric current in a circuit. It acts as the main input device for switching ON or OFF specific functions

Fig.6 Switch

3.7 Voltage Regulator

The LM7805 is a voltage regulator integrated circuit (IC) widely utilised in electronic circuits to provide a safe stepped down 5 volts DC output. Like name suggests, the overall 7.4V provided by LiPo batteries are stepped down to 5V**.** LM7805 Voltage regulator serves as a fundamental building block in countless electronic designs, providing a dependable and regulated power source for a wide range of applications in electronics.

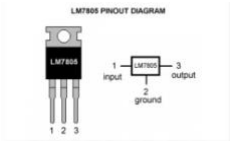

Fig.7 Voltage Regulator

3.8 I2C LCD Display

The I2C LCD display typically has a small on-board chip (such as PCF8574) that acts as an I2C expander, allowing the microcontroller to control the LCD using two wires (SDA for data and SCL for clock) instead of the conventional. I2C LCD display provides better high-resolution output, ensuring clear visuals for displaying real-time data and information.

Fig.8 I2C LCD Display

3.9 Gyro-meter Sensor

The Gyro-meter (Gy271) also known as the Magnetometer sensor, helps in the women safety system by detecting sudden movements and changes in axis.enabling the necessary alerts for help. The gyro-meter's sensitivity improvises the system's ability to detect potential risks and helps to provide swift responses.

Fig.9 Gyro Meter Sensor

Table.1 Component Specifications

S.NO	COMPONENTS USED	SPECIFICATIONS
1.	Node MCU (ESP8266) Wi-Fi Module	1. Microcontroller: Ten silica 32-bit RISC CPU Xtensa LX106 2. Operating Voltage:3.3V 3. Input Voltage: 7-12V 4. Digital I/O Pins (DIO):16 5. Analog Input Pins (ADC): 1 6. Flash Memory: 4 MB 7. SRAM: 64 KB 8. Clock Speed: 80 MHz
2.	GPS Module	1.Interface: RS232 TTL 2.Power supply: 3V to 5V 3.Default baud rate used here is usually around 9600 bps. 4. Current used – up to 20mA 5. Position Accuracy < 2m 6.GPS Neo6M module uses NMEA sentences or protocols to provide coordinates. 7. No of channels – 50
3.	Li-Po Batteries	Voltage: 3.7v
4.	Buzzer	1.Color is black 2.The frequency range is 3,300Hz 3.Operating Temperature ranges from – 20° C to +60°C 4.Operating voltage ranges from 3V to 24V DC 5.5The supply current is below 15mA
5.	Push Button	Push buttons can have various configurations, like normally open (NO), normally closed (NC), or changeover (CO) contacts.
6.	Voltage Regulator (LM7805)	1.Input Voltage: 7V - 35V 2.Output Voltage: 5V 3.Max Current: 1.5A 4.Temp: 0-125°C
7.	I2C LCD Display	1.Interface: I2C (Inter-Integrated Circuit) 2.Controller: Often based on the HD44780 or compatible controller chip. 3.Operating Voltage: Typically 5V or 3.3V 4..Number of Lines: 2 or 4 lines
8.	Gyro-Meter (GY271)	1.Operating Voltage: Typically 3.3V to 5.5V 2. Interface: I2C 3.Temp Range: 40°C to +85°C. 4. physical dimensions: 14mm x 13mm

4 System Architecture

The Block Diagram of Integrating of GPS enabled IoT technology for women safety system is shown in fig.1. The controller that is being used is Node- MCU(ESP8266)

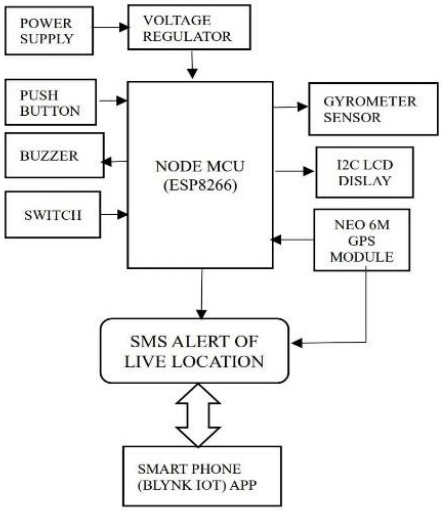

Fig.10 Block Diagram of Proposed model

The below flowchart illustrates the flow of the proposed system as shown in fig.2

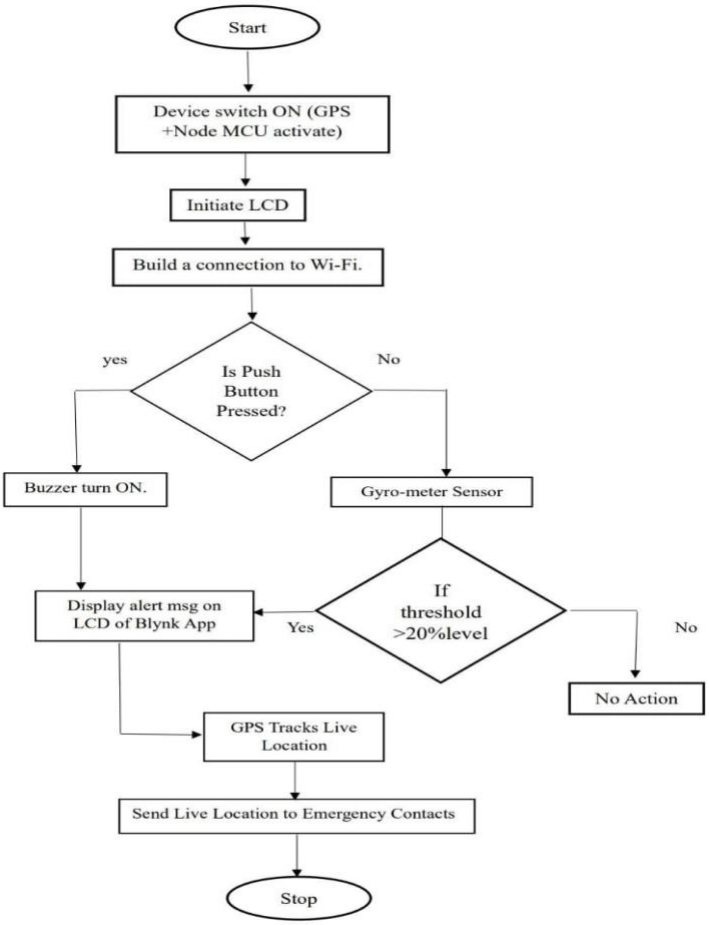

Fig.11 Flow Chart of proposed model

5 Implementation

5.1 Hardware Implementation

A hardware implementation of this GPS enabled IoT system for safety of women is done by uniting GPS modules, panic buttons, and microcontrollers. Besides that, important components such as the gyro-meter, the GSM module, and the power source are pivotal for the final reliable system.

The Proposed system is controlled by Node MCU. The model of Node MCU used in our project is ESP8266. GPS is used to get latitude and longitude coordinates**.** Integrating an I2C LCD can enhance user interaction with serial clock and serial data pins. Switch is a device used to interrupt or divert the flow of electric current in a circuit. The LM7805 is a voltage regulator (IC) widely utilised in circuits to provide a stepped down DC output. Push Button could initiate to trigger an emergency alert when the push button operated, it can immediately send out a signal to predefined contacts or activate a notification system to alert others about the emergency. When the user feels threatened or faces an emergency, she can press the panic button to activate the buzzer. Li-Po batteries energized by two batteries-7.4V (approx. 8V) i.e., 3.7V each. Since the electronic components are operated under 5V.

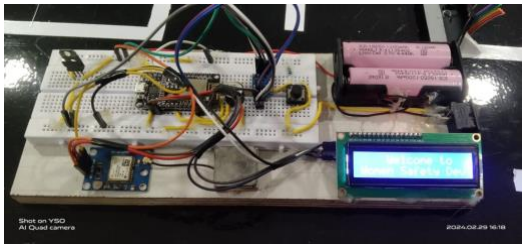

Fig.12 Prototype of proposed work

5.2 Software Implementation

The system's software component contains Blynk server holding, web and mobile apps, and creating and configuring the Internet of Things platform. This area also includes integration of user interfaces, emergency response systems, and real-time tracking.

The suggested way comprises the Blynk IoT software and the Arduino IDE. For not only does the user write the code but also run it in the tool. It significantly mitigates the creation of programs by providing simple interface and development with C++. Arduino IDE tool offers more because of its serial monitor for real time debugging.

Fig.13 Arduino IDE 1.8.19

The Blynk IoT platform is as shown in fig.14. and fig 15.

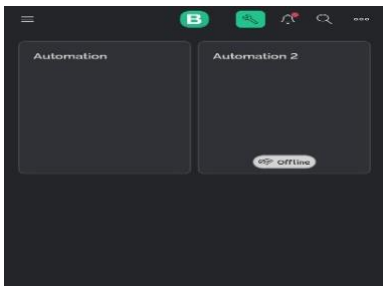

Fig.14

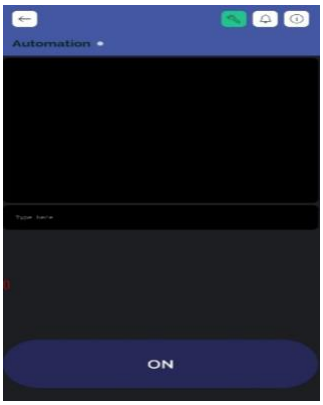

Fig.15

Blynk is a powerful IoT platform that enables the creation of custom applications for various smart devices and sensors. It provides an intuitive interface and robust backend infrastructure for seamless connectivity with IoT hardware. Blynk offers a wide range of widgets for journal entries, including text input, sliders, and graphic displays.
connectivity between sensors and the Blynk platform to automate journal data collection.

6 Analysis and Results

It analyses the design along with implementation of the women's safety system, with an extensive outline of the software and hardware features. The functioning of GPS-enabled IoT technology along with Node MCU and Blynk is analysed in this project. Using a Node MCU to integrate GPS-enabled IoT technology for a women's safety system, the Blynk app acquired emergency alerts.

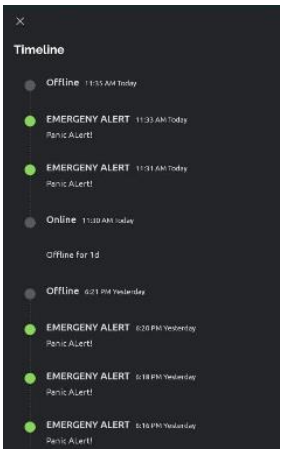

Fig.16 Display of alert message in the Blynk IoT App

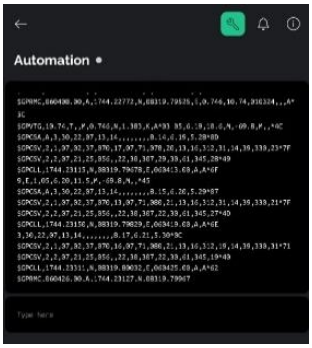

Fig.17 GPS Coordinates are shown in the Blynk IoT App

Provide the obtained GPS coordinates in any interactive map format for an easy-to-use interface. Allow the app to keep and retrieve your GPS location history by turning on data.

Fig.18 Location displayed using GPS Coordinates

GPS coordinates use latitude and longitude to pinpoint location on the surface of Earth. IoT devices receive coordinates and determine their exact location using GPS technology. GPS coordinates provide highly accurate location data for tracking and management.

Fig.19 Display of Welcome message

Fig.20 Display of alert message

7 Conclusion

The main objective behind building a woman safety device is to act as a rescue and prevent any harm at the time of hazard. Through the proposed system, A Smart GPS-enabled Device for Women's safety is designed. This system detects and notifies with the location coordinates of the user needless of the requirement of her interaction in hard times. It sends an emergency notification without any delay to the emergency contacts and nearby police station. The main boon of our proposed system is that both automatic and manual mechanism is implemented. It is cost-efficient and user-friendly.

8 Declarations

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Competing Interest Declaration All Authors do not have any competing interest that brings conflict.

Data Availability No Data is available outside the manuscript.

Author Contribution Declaration All Authors have contributed equally to the manuscript.

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