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Smart Shoes for Women Safety

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Abstract: *This project presents a novel design and development of smart shoes integrated with Arduino Nano, GSM, and GPS technologies. The system aims to provide real-time tracking, safety features, and emergency alerts for individuals, particularly women and children. The smart shoes utilize Arduino Nano to process data from GPS and GSM modules, enabling location tracking and communication with authorities and family members. The system features a panic button, voice assistant, and accelerometer-based unusual activity detection. The shoes are designed to be compact, wearable, and user-friendly. The proposed system has the potential to enhance safety, reduce response time in emergencies, and provide peace of mind for individuals and their loved ones.*

Keywords: Smart Shoes, Arduino nano, GSM, GPS, Safety, Tracking, Emergency Alerts, Wearable Technology

I. INTRODUCTION

In recent years, technological advancements have led to the development of innovative wearable devices that aim to improve our daily lives. One such device is the smart shoe, which integrates various sensors and communication technologies to provide enhanced safety, tracking, and convenience features. This project focuses on designing and developing a smart shoe system using Arduino Nano, GSM, and GPS technologies.The integration of Arduino Nano and GSM technology offers several advantages over traditional GPS tracking solutions. Firstly, it significantly reduces the cost of implementation, making GPS tracking accessible to a broader range of users, including hobbyists, small businesses, and individuals. Secondly, the compact size and low power consumption of Arduino Nano make it suitable for deployment in various environments, from vehicles and machinery to wearable devices and personal belongings. Lastly, the flexibility of Arduino Nano allows for customization and integration with additional sensors or modulesto enhance functionality according to specific requirements. This paper aims to provide an in-depth exploration of the design principles, hardware components, software implementation, and potential applications of the proposed GPS tracker system. By leveraging the capabilities of Arduino Nano and GSM technology, we seek to demonstrate a practical and scalable solution for real-time tracking that addresses the needs of diverse user scenarios. Ultimately, the goal is to empower users with the tools to develop their GPS tracker systems efficiently and cost-effectively, opening up new possibilities for innovation and application in the field of location-based services.

II. THEORY

In an increasingly connected world, the ability to accurately track the location of assets, vehicles, and even individuals has become essential for various applications, ranging from logistics and fleet management to personal safety and security. Traditional GPS tracking systems often comewith high costs and complex setups, limiting their accessibility to many users. However, with the advancement of microcontroller technology and wireless communication modules, it has become feasible to develop cost-effective and efficient GPS tracker systems. This introduction sets the stage for exploring the design and implementation of a GPS tracker system utilizing Arduino Nano and GSM (Global System for Mobile Communications) technology. The Arduino Nano, a compact and versatile microcontroller board, serves as the core component for data processing and control, while the GSM module enables communication over cellular networks, facilitating real-time tracking and monitoring from anywhere with cellular coverage.

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III. OBJECTIVES

The primary objective of the Smart Shoes for Women Safety project is to design and develop an intelligent, wearable safety device that empowers women to protect themselves and seek help during emergency situations. This smart footwear aims to offer a discreet, efficient, and accessible means for women to alert their trusted contacts and share their real-time location using modern embedded technologies. The key objectives are:

- Enhancing Women's Safety and Security
- Real-Time Location Tracking
- Emergency Alert System through GSM**.**
- Seamless and Unobtrusive Integration
- Quick and User-Friendly Emergency Trigger Mechanism
- Compact, Affordable, and Portable Design
- Promoting Technological Empowerment for Social Causes

IV. HARDWARE ARCHITECTURE

1. Components

Component	Function
Arduino Nano	Acts as the central controller, processes inputs, and manages all modules.
GPS Module (NEO-6M)	Provides real-time geographic location (latitude & longitude).
GSM Module (SIM800L)	Sends emergency SMS messages with location data via cellular network.
Pressure / Tap Sensor	Detects emergency trigger by user (e.g., foot press or tap).
Battery (Li-Po 3.7V)	Powers the entire system (with voltage regulator if needed).
Voltage Regulator	Ensures safe voltage levels for Arduino and modules (e.g., 5V, 3.3V).
Switch / Push Button (Optional)	Used for manual power ON/OFF or reset.

2. Block Diagram

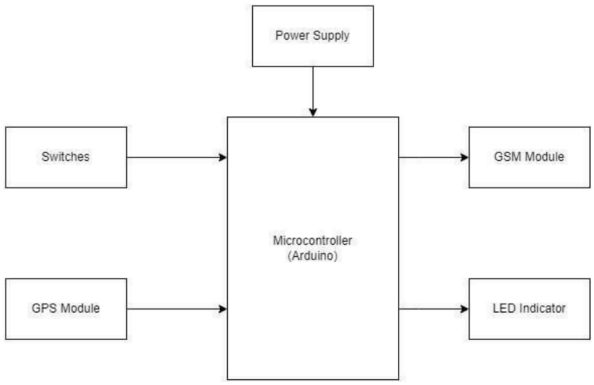

Fig.1 Block Diagram of Circuit

3. Arduino Nano

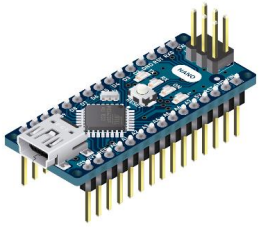

Fig.2 Arduino Nano

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The ArduinoNano is an open-source breadboard-friendly microcontroller board based on the Microchip ATmega328P microcontroller (MCU) and developed by Arduino.cc and initially released in 2008. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor.[1]

The Arduino Nano is equipped with 30 male I/O headers, in a DIP-30-like configuration, which can be programmed using the Arduino Software integrated development environment (IDE), which is common to all Arduino boards and running both online and offline. The board can be powered through a type-B mini-USB cable or from a 9 V battery.

4. GSM Module (SIM 800L)

Fig.3 GSM Module

For communication purpose Bluetooth technology can also be used in thetransmitter section. Bluetooth is a wireless networking standard that is aimed at remote control and sensor applications which is suitable for operation in harsh radio environments and in isolated locations. But, the main disadvantages of Bluetooth is short range, low complexity and low data speed. Therefore, GSM is more advantages over Bluetooth for communication. Hence author use GS modem. A GSM modem is a specialized type wireless modem that works with a GSM wireless network. It accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. A GSM modem can be an external device or a PC Card / PCMCIA Card. An external GSM modem is connected to a computer through a serial cable or a USB cable. When a GSM modem is connected to a computer, this allows the computer to communicate over the mobilenetwork. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS message.

GSM Modem sends and receives data through radio waves. In this project GSM SIM800L modem is used to send the messages which is shown in figure. It consists of a GSM/GPRS modem with standard communication interfaces like RS-232 (Serial Port), USB, so that it can be easily connected to the other devices. The power supply circuit is also built in the module that can be turn ON by using a suitable adaptor

5. GPS Module (NEO-6M)

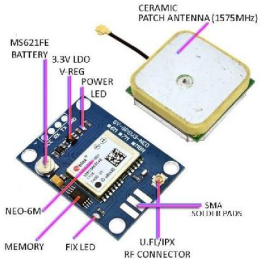

Fig.4. GPS Module

The u-blox NEO-6M is a compact and versatile Global Navigation Satellite System (GNSS) module designed for a wide range of applications that require accurate positioning and timing information. Developed by u-blox, a Swiss company specializing in positioning and wireless communication technologies, the NEO-6M is part of the NEO series, which includes various modules catering to different market segments.

Push buttons serve as user input devices, allowing the user to interact with the system. You can use push buttons for functions such as navigating menus, selecting items, or confirming actions. Each push button connects to a GPIO pin on the NodeMCU, and you can usen internal pull-up or pull- down resistors to detect button presses

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6. Shoe Construction Plan:

Upper Section (Shoe Body):

The upper part should be designed to house the button, LED, and provide easy access to the emergency features.

You might want to create a pocket for the battery to keep it secure but not too bulky.

Sole Section:

Insole Compartment: The insole will have a specially designed pocket (a small removable compartment) to fit the GPS module and accelerometer. These sensors should be placed in such a way as to detect fall movements accurately.

The battery can be placed in a side pocket in the sole of the shoe, securely fastened, so it doesn't disrupt walking comfort.

Heel/Ankle Section:

Create an accessible compartment in the heel where the GSM module can be mounted, ensuring it is well positioned to send SMS signals.

Place the buzzer and LED near the heel for visual and audio alerts, using a small, thin buzzer that can be embedded without compromising comfort.

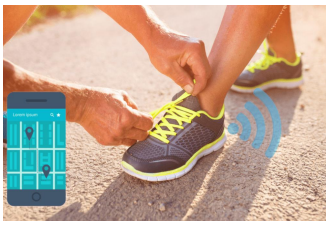

Fig.5 Prototype

V. CONCLUSION

The Arduino Nano's compact size, low power consumption, and ease of programming make it an ideal platform for developing GPS tracker systems. Combined with GSM modules for cellular communication, these systems enable real time tracking and monitoring from virtually anywhere with cellular coverage. Moreover, the flexibility of Arduino Nano allows for seamless integration with additional sensors and modules, enhancing the functionality and adaptabilityof the GPS tracker system to specific user requirements. From a practical standpoint, the affordability of Arduino Nano-based GPS trackers democratizes access to location based services, empowering individuals, businesses, and organizations to implement tracking solutions cost-effectively. Whether it's monitoring fleet vehicles, safeguarding valuable assets, or ensuring the safety of individuals, these systems offer a reliable means of real-time location tracking and management.

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