SMART SHOE WITH GPS TRACKING

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Abstract: **The main objective behind developing this smart shoe with gps tracking is to provide safety to people. It helps in tracking the wearer's location and movements send it to the wearer's friends or family, in case of an emergency. It reduces the risk and helps them in need by identifying the location of person who is in danger. By using this smart shoe, the women can alert their family members and even harm the attacker. In this,GPS module is being used for location tracking and a SIM800L module is integrated with the circuit for sending it to the wearer's relative's smartphone. As soon as the device present in the shoe is triggered, the location of the wearer is captured and converted into a proper google maps hyperlink and sent to the remote smartphone. The mechanical stress created by these impressions is then converted into electrical energy, which is stored in a battery for later use. Piezoelectric sensor is a great invention that has numerous applications, and one of them is to convert mechanical stress to electrical energy.**

Keywords***:*** *Microcontroller, Piezoelectric Transducer Sensor, DC-DC Buck Converter, Charging Module, Rechargeable Backup Battery, GPS Module, GSM Module, embedded C, Arduino IDE.*

I.INTRODUCTION

Innovative technologies have revolutionized the realm of wearable devices, offering solutions that blend convenience with functionality to enhance various aspects of daily life. Among these advancements, the smart shoe system stands out as a remarkable integration of cutting-edge technology with practical utility. This system, powered by piezoelectric sensor technology, represents a significant leap forward in wearable technology, leveraging the wearer's movements to generate electrical energy and power integrated sensors and devices seamlessly embedded within the shoe. The primary objective of the smart shoe system is to augment wearer safety through the integration of advanced features such as location tracking and emergency communication capabilities. By harnessing the power of piezoelectric sensors, the system ensures continuous energy supply, enabling real-time monitoring of the wearer's movements and immediate response to potential emergencies. Furthermore, the system's compact and unobtrusive design makes it an ideal companion for individuals seeking both convenience and peace of mind in their daily activities.

At the heart of the smart shoe system lies a sophisticated combination of hardware components, including the Seeed Studio ESP32C3 microcontroller, Ai Thinker A9G GSM/GPRS+GPS/BDS development board, piezoelectric transducer sensor, charging module, and rechargeable backup battery. These components work in harmony to create a powerful yet compact platform capable of delivering seamless functionality and reliable performance in various scenarios.

In times of emergency, the smart shoe system proves invaluable, leveraging GPS technology to accurately track the wearer's location and transmit this information to designated contacts via SMS. The activation mechanism, initiated by a trigger keyword sent from the wearer's relative's smartphone to a SIM card inserted in the shoe, ensures swift response and timely assistance during critical situations. Moreover, the system's ability to convert the wearer's location into a Google Maps hyperlink enhances communication efficiency, providing recipients with instant access to actionable information. Beyond its utility in emergencies, the smart shoe system also champions sustainability by

harnessing the energy generated from human movement. By encouraging physical activity and promoting clean energy production, the system embodies a holistic approach to wearable technology, aligning convenience, safety, and environmental consciousness in a single innovative solution. As wearable technology continues to evolve, the smart shoe system represents a compelling example of how advanced engineering and user centric design can converge to redefine the possibilities of everyday accessories.

II.EMBEDDED SYSTEMS

Embedded systems are specialized computing systems designed to perform dedicated functions within larger systems or devices. They typically consists of a combination of hardware and software tailored to specific tasks, operating within constraints such as limited processing power, memory, and energy consumption.

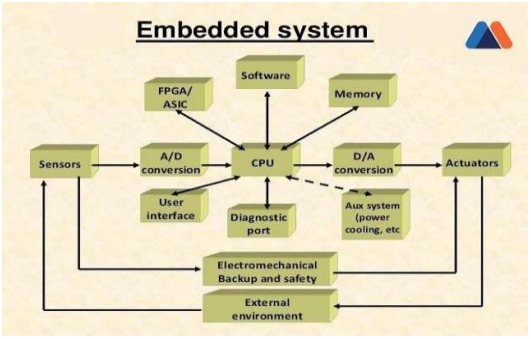

Fig: Block Diagram of Embedded Systems

***Applications of Embedded system*:**

Embedded systems find applications in a wide range of industries and domains due to their versatility, reliability, and efficiency.

Fig: Applications of Embedded systems

Automotive: Embedded systems control various functions in modern vehicles, including engine management, transmission control, anti-lock braking systems (ABS), airbag deployment, infotainment systems, navigation, and driver assistance features like adaptive cruise control and lane departure warning.

Telecommunications: Embedded systems are employed in telecommunications infrastructure and devices, including cellular base stations, routers, switches,modems, VoIP phones, set-top boxes, satellite communication systems, and network appliances.

Security and Surveillance: Embedded systems are employed in security and surveillance applications, including access control systems, alarm systems, video surveillance cameras, biometric identification systems, smart locks, and perimeter security systems.

III.PROPOSED METHOD

The smart shoe system represents a groundbreaking integration of cutting- edge technology into footwear, offering a unique blend of functionality and safety features. At its core, the system utilizes piezoelectric sensor technology to convert the mechanical stress generated by the wearer's movements into electrical energy. This energy is then harnessed to power a range of integrated sensors and devices seamlessly embedded within the shoe. Key components of the smart shoe system include the Seeed Studio ESP32C3 micro-controller, which serves as the central processing unit, coordinating the operation of various sensors, communication capabilities, ensuring wearer safety in critical situations. Additionally, the system incorporates a piezoelectric transducer sensor to capture mechanical stress and convert it into electrical energy, along with a charging module and rechargeable backup battery to maintain continuous power supply.

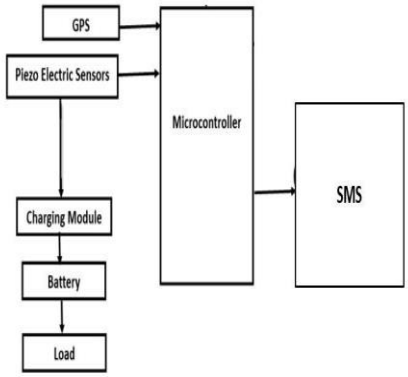

Fig:Proposed Block Diagram

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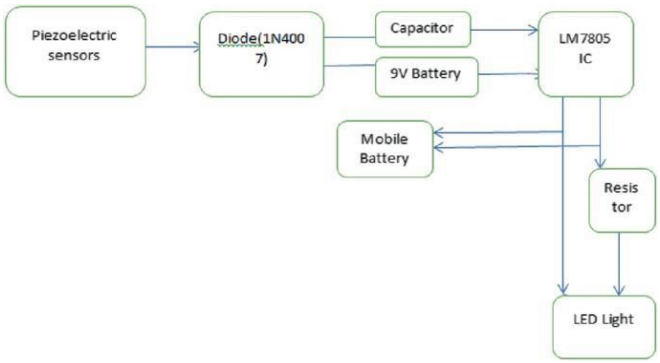
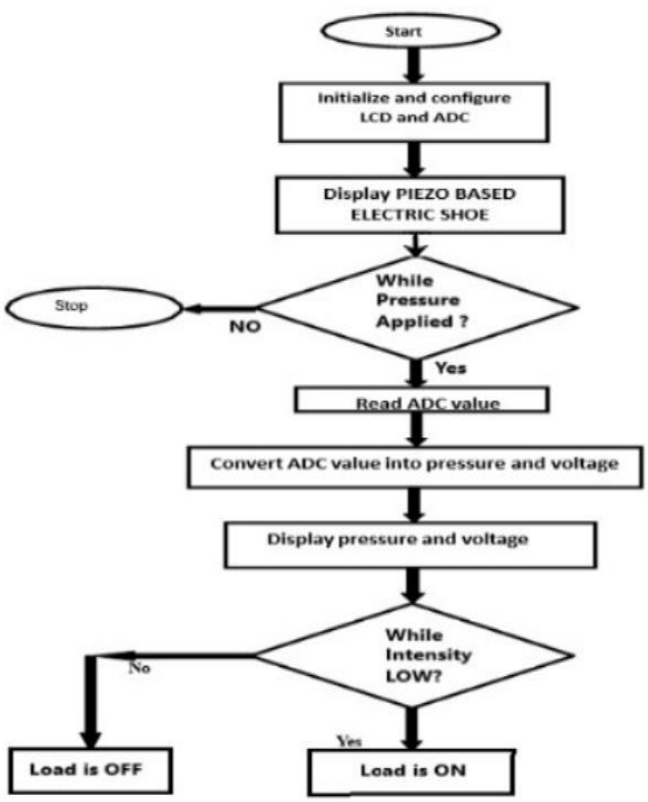


Fig: Existing Block Diagram

During emergencies, the system leverages GPS technology to accurately track the wearer's location in real-time. In the event of an emergency, such as a medical crisis or personal safety concern, the system automatically transmits the wearer's location data to designated relatives or friends via SMS. Activation of the emergency communication feature is initiated by a trigger keyword sent from the wearer's relative's smartphone to a SIM card inserted in the shoe, prompting immediate location capture and transmission of a Google Maps hyperlink to the remote smartphone. Overall, the smart shoe system represents a significant advancement in wearable technology, offering wearers a practical and reliable solution for enhancing safety, promoting physical activity, and contributing to clean energy initiatives.

IV.FLOW CHART



Specifications of A9G:

Featuring robust GSM and GPRS capabilities, the A9G module enables reliable cellular communication over GSM networks, facilitating remote monitoring, control, and data exchange. Moreover, the built-in GPS and BDS receivers provide precise positioning information, allowing for accurate tracking and navigation functionalities in both indoor and outdoor environments.

The A9G development board boasts a user-friendly design with accessible GPIO pins, UART interfaces, and onboard antennas, simplifying the integration process and enabling rapid prototyping of IoT applications. Additionally, it supports various development environments such as Arduino and ESP-IDF, offering flexibility and ease of programming for developers of all skill levels. Equipped with advanced features like voice calls, SMS messaging, and HTTP/HTTPS protocols support, the A9G module empowers developers to create innovative IoT solutions ranging from asset tracking and fleet management to environmental monitoring and smart agriculture. Its low- power consumption and compact form factor make it suitable for battery-operated and space-constrained applications, deployment in diverse scenarios.

Software Description:

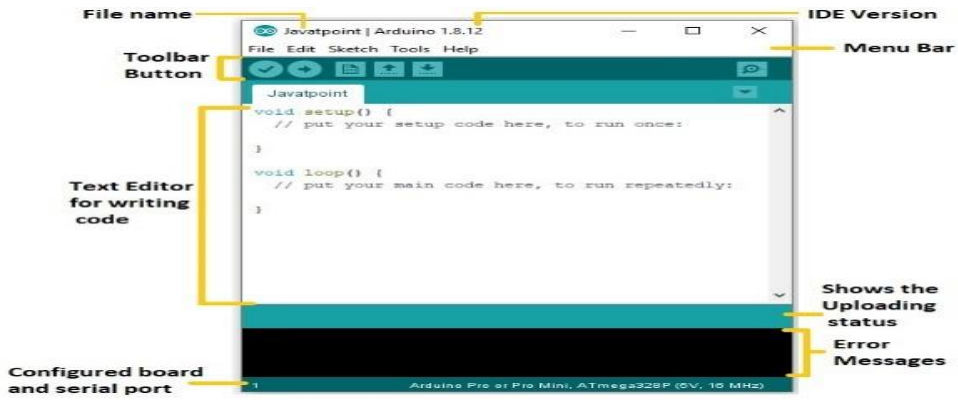
The Arduino IDE provides a user-friendly interface for programming Arduino boards, making it accessible to beginners and experienced developers alike. It supports a wide range of Arduino-compatible boards, including the popular Arduino Uno, Nano, Mega, and others, as well as third-party boards based on the Arduino platform. The IDE is available for Windows, macOS, and Linux operating systems, allowing users to develop Arduino projects on their preferred platform.

One of the key features of the Arduino IDE is its simplicity and ease of use. The IDE includes a text editor with syntax highlighting and auto-completion features, making it easy to write and edit code in the Arduino programming language, which is based on Wiring and C/C++. Users can write sketches (Arduino programs) using familiar programming constructs such as functions, variables, loops, and conditional statements.

Arduino IDE:

Arduino IDE includes a built-in compiler and uploader toolchain, allowing users to compile their sketches into machine code and upload it to the Arduino board with a single click. The IDE automatically detects connected

Arduino Arduino boards. Its simplicity, accessibility, and extensive features make it an indispensable tool for hobbyists, educators.



Toolbar Button

The icons displayed on the toolbar are **New, Open, Save, Upload,** and **Verify**

Upload

The Upload button compiles and runs our code written on the screen. It further uploads the code to the connected board. Before uploading the sketch, we need to make sure that the correct board and ports are selected. We also need a USB connection to connect the board and the computer. Once all the above measures are done, click on the Upload button present on the toolbar.

Open

The Open button is used to open the already created file. The selected file will be opened in the current window.

Save

The save button is used to save the current sketch or code.

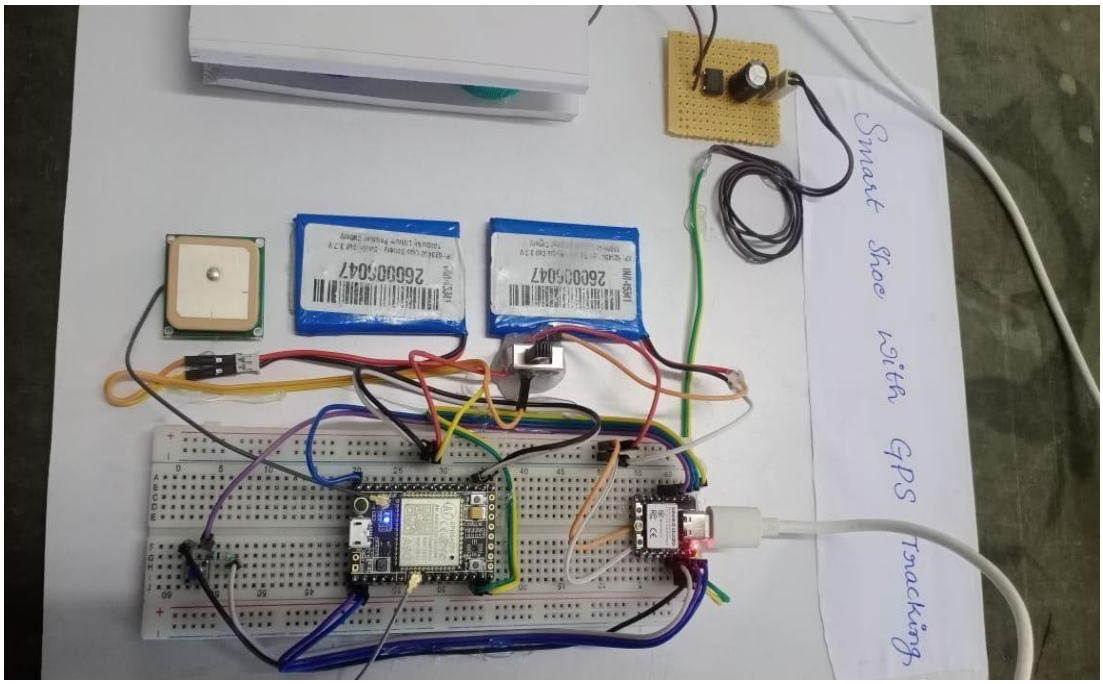
Verify

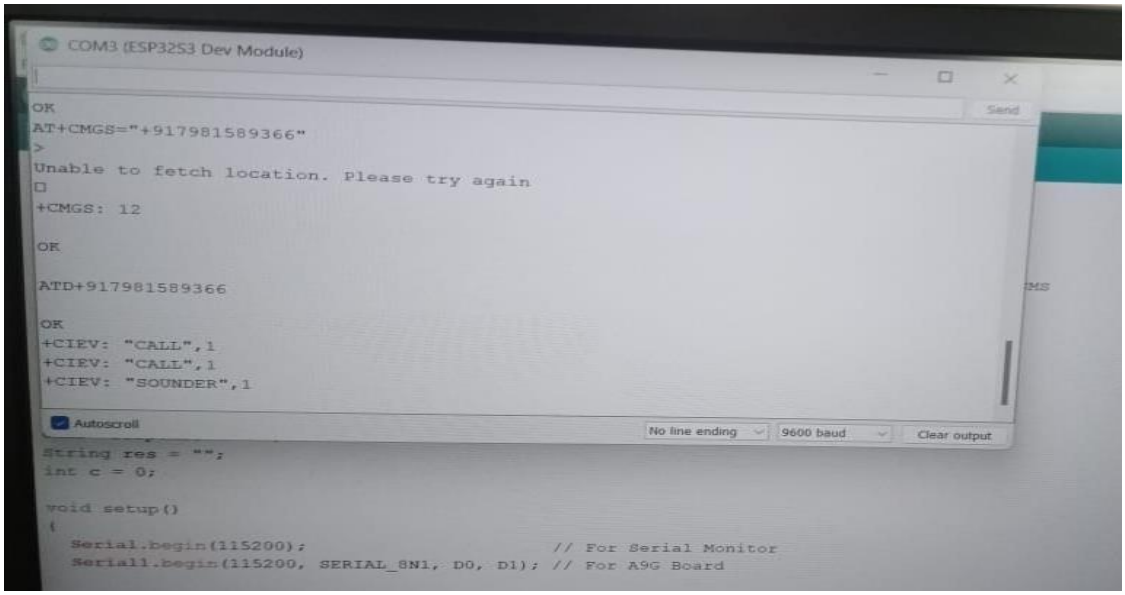
The Verify button is used to check the compilation error of the sketch or the written code.

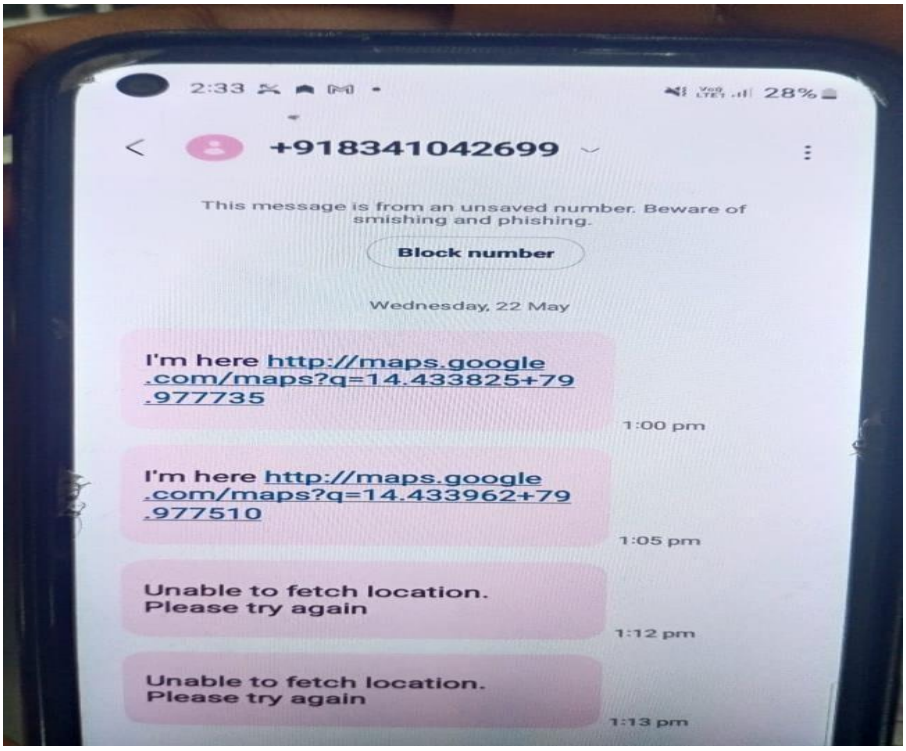
Serial Monitor

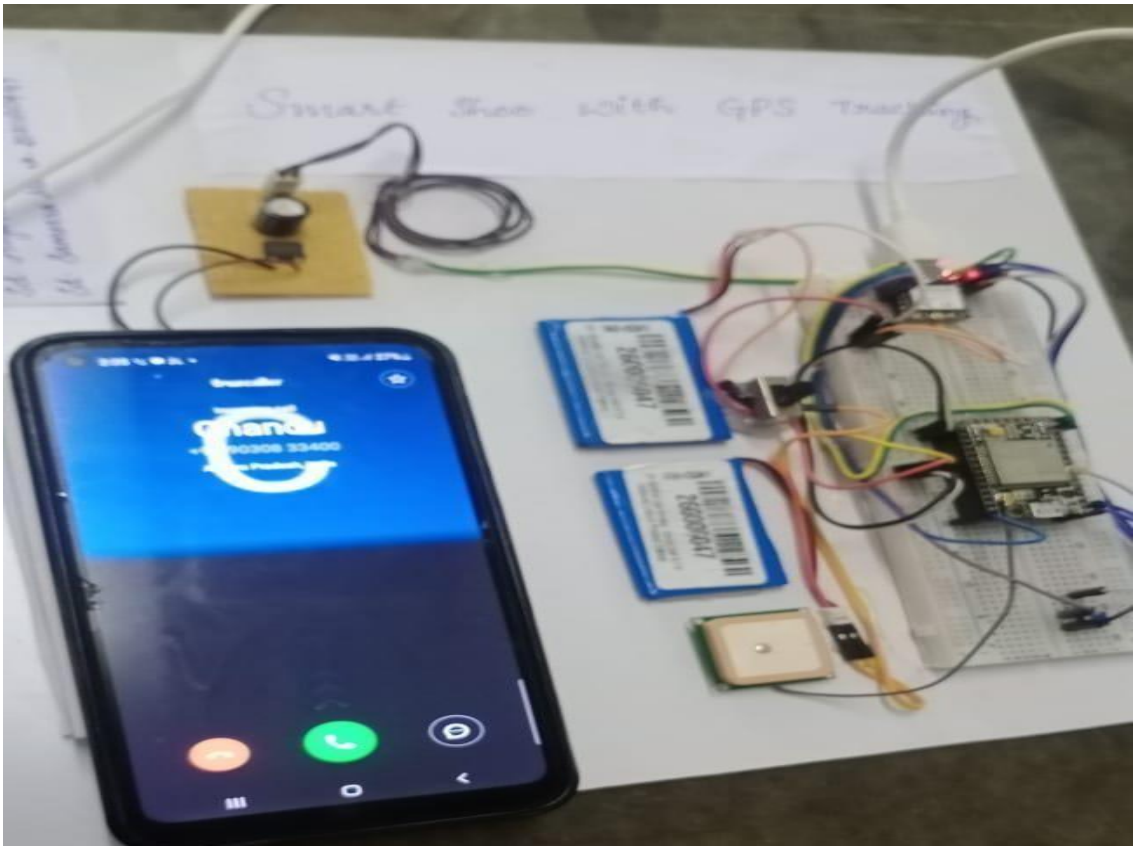
The serial monitor button is present on the right corner of the toolbar. It opens the serial monitor.

V. RESULTS









VI.CONCLUSION

The project "Real-time Location Tracking Shoe using Piezoelectric Sensors" demonstrated the feasibility of integrating piezoelectric sensors into footwear for energy harvesting and location tracking purposes. By efficiently converting mechanical stress from foot impressions into electrical energy, the project showcased the potential for sustainable power generation in wearable devices. The reliable storage of harvested energy in rechargeable batteries, coupled with stable power supply regulation by a microcontroller, ensured consistent performance of the shoe's functionalities. Additionally, the integration of GPS tracking functionality enabled accurate real-time monitoring of the user's position, enhancing the shoe's utility for location tracking applications. Overall, the project's successful implementation highlighted the effectiveness of piezoelectric sensors in footwear and laid the groundwork for further advancements in wearable technology.

VII.REFERENCES

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