

Smart Footwear System for Personal Security and Emergency Alert

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Abstract— The Smart Footwear System for Personal Security is designed as a wearable safety device integrated into footwear to provide immediate assistance during emergency situations. The system consists of a Node MCU as the main processing unit, a GPS module for location tracking, a VC02 voice module for voice-based command recognition and communication, an SOS push button, a taser-based self-defense mechanism, a rechargeable battery, and an ON/OFF control switch. All components are interconnected using a breadboard configuration to ensure proper functionality.

Personal safety has become a growing concern due to increasing incidents of sudden attacks and harassment. In many emergency situations, victims are unable to access their mobile phones or manually call for help. This delay in communication increases the risk and severity of the situation. Therefore, there is a need for a fast, wearable, and easily accessible security system that can operate without depending entirely on smartphones.

To address this issue, the proposed system provides dual activation mechanisms for emergency alerts. The user can either press the SOS button or speak a predefined voice command through the VC02 module. Upon activation, the system sends an alert message along with live GPS coordinates to specific emergency contacts such as parents or authorities. Additionally, a separate voice command is used to activate the taser mechanism for controlled self-defense.

The working method involves detecting input from either the SOS button or voice command, processing it through the Node MCU, acquiring real-time location data from the GPS module, and transmitting the alert message. The taser circuit converts 3.7V battery input into a higher voltage output to generate a controlled shock when activated intentionally through voice recognition.

The developed prototype successfully demonstrates reliable location tracking, effective emergency alert transmission, and controlled shock activation. The system provides a portable, cost-effective, and intelligent wearable safety solution that enhances personal protection and reduces emergency response time.

Index Terms— IOT, Node MCU 8266, Smart Shoes, GPS, Twilio API, VC02, Taser Circuit.

I. INTRODUCTION

In today's world, personal safety has become a serious concern, especially for women and other vulnerable individuals. Many emergency situations happen suddenly, and victims often do not get enough time to use their mobile phones to ask for help. This delay in communication can make the situation more dangerous. Therefore, there is a need for a safety system that can send alerts quickly and easily during emergencies.

Most existing safety solutions are mobile-based applications or handheld panic buttons. However, these systems depend on the user being able to access and operate a phone during stressful situations. In real-life emergencies, this may not always be possible. Because of this limitation, a wearable safety device can be a better and more reliable option.

This project proposes a Smart Footwear System for Personal Security and Emergency Alerts. The system is designed using a Node MCU as the main controller, a GPS module for location tracking, and a VC02 voice module for voice-based activation and communication. The footwear provides two methods to send alerts: pressing an SOS button or speaking a predefined voice command. When activated, the system sends the user's live location along with an alert message to specific emergency contacts.

In addition, the system includes a controlled shock mechanism that is activated only after recognizing a specific voice command. This ensures that the shock feature is used safely and intentionally. The device is powered by a rechargeable battery and includes an ON/OFF switch for controlled operation.

The aim of this project is to develop a simple, effective, and wearable safety solution that can help reduce response time and improve personal protection during emergencies.

II. METHODOLOGY

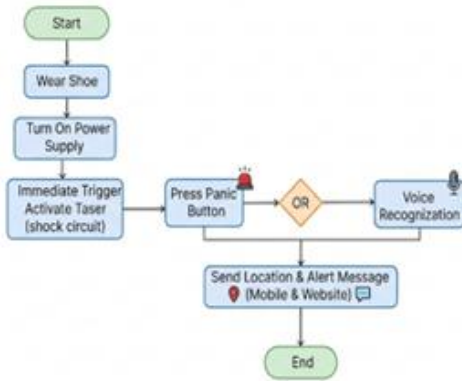


Fig.1: Working Flow Chart of The Smart Shoes

The proposed smart footwear safety system is designed to provide immediate self-defense and emergency alert communication during dangerous situations. The working methodology of the system follows a sequence of operations that begin when the user wears the smart shoe and activates the system.

Initially, the user wears the smart shoe containing the embedded electronic components. After wearing the shoe, the user turns on the power supply using the ON/OFF switch provided in the system. Once the power supply is activated, all the electronic modules such as the microcontroller, GPS module, communication module, and taser circuit become operational.

When the system is active, the taser circuit is immediately prepared to operate as a self-defense mechanism. In an emergency situation, the user can activate the shock circuit using the shoe-based trigger, which produces a controlled electric shock to help the user protect themselves from an attacker.

After securing immediate safety, the system provides two methods to trigger the emergency alert process. The user can either press the panic button or activate the system through voice recognition. Both methods act as emergency triggers for sending alerts.

Once the panic button is pressed or the voice command is detected, the system retrieves the real-time geographic location of the user through the GPS

module. The microcontroller processes this location data and prepares an emergency alert message.

Finally, the system sends the user's location along with the alert message to predefined contacts through mobile communication and also updates the information on a monitoring website. This allows family members or authorities to track the user's location and respond quickly to the emergency. After the alert message is successfully transmitted, the process reaches the end stage.

III. RESULT AND DISCUSSION

The proposed smart footwear safety system was developed and tested to evaluate its effectiveness in emergency situations. The prototype successfully demonstrated the integration of multiple components including the microcontroller, GPS module, panic button, voice recognition system, and taser circuit.

During testing, the system was able to activate the shock circuit immediately when the shoe trigger was pressed. This feature provides a quick self-defense mechanism that can help the user create distance from an attacker. The taser circuit successfully generated a controlled electric shock using the voltage boosting mechanism powered by the battery.

The emergency alert system was also tested using both activation methods: the panic button and voice recognition. In both cases, the system was able to retrieve the real-time location using the GPS module and transmit the alert message successfully. The alert message, along with the location information, was sent to the registered mobile number using the Twilio communication platform and was also displayed on the monitoring website.

The results indicate that the system can provide a rapid emergency response by combining self-defense and communication features. The integration of wearable technology with IoT communication improves personal safety by reducing the response time during critical situations.

However, some limitations were observed during testing, such as dependency on GPS signal availability and internet connectivity for message transmission. Despite these limitations, the system demonstrates a practical and cost-effective solution for enhancing personal safety.

IV. CONCLUSION

In this research, a smart footwear-based personal safety system was designed and implemented to improve protection during emergency situations. The system integrates self-defense functionality with real-time location tracking and alert communication.

The proposed system uses a combination of a panic button, voice recognition, GPS module, and a taser circuit to provide immediate safety and emergency notification. When the system is activated, it sends the user's location and alert message to predefined contacts and updates the information on a monitoring website.

The experimental results show that the system can effectively perform self-defense activation and emergency communication in real time. The integration of IoT technology with wearable devices makes the system practical, portable, and easy to use. Future improvements may include mobile application integration, improved voice recognition accuracy, and the addition of cloud-based monitoring systems to enhance reliability and system performance.

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