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Secure Steps: Women's Safety Wearable Accessory

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Abstract:
Women's public safety has been a serious concern worldwide over the past few years. Having a means of effective, real-time safety is paramount no matter what other safety protocols may be in place. To address this issue, our system utilizes the implementation of a GPS-enabled device and ESP32-CAM module to provide accurate location and emergency messages in real time. During an emergency, the system is programmed to take pictures and send pictures of the emergency to chosen contacts along with a GPS location. It uses affordable, easy to use technology and has real-time capabilities that monitor constantly through the ESP32-CAM module, which provides a camera function with wifi and a more accurate GPS module. One of the more distinguished aspects of the system is that it being activated as soon as the user initiates the action in case of an emergency providing protection, thereby expediting the response time. This system utilizes picture taking and alert-in-real-time technology to provide women with disability a new way of rationalizing safety. Additionally, this approach addresses the safety of women in an easy-to-carry, portable way using practical, inexpensive technology to deliver to women an effective mechanism of protection at a moment notices if she is finding herself under attack.
Keywords: Women's Safety, ESP32-CAM, GPS Tracking, Immediate alert system.

1. INTRODUCTION

1.1 Background

Women's safety has remained a prevailing issue for decades, with efforts directed toward its reduction in the forms of harassment and violence. Conventional security measures such as mobile phones, emergency alerts, and personal protective technology include minimal intervention and timely responses. Technological advancement has increased multimedia and Internet of Things (IoT) applications for enhancing personal safety. Incorporating small-sized devices such as ESP32-CAM and GPS modules opens new horizons for security solutions. It is a high-performance microcontroller with low cost that combines Wi-Fi and camera functions and provides real-time positioning with a GPS module. The system was designed to bring about the primary security measures that are taken prior to the occurrence of the incident.

1.2 Motivation

The motivation stemmed from realizing the need to bridge the gap for an immediate and accurate response in the existing security system. Traditional mechanisms for securing life, like panic

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buttons or action apps, are a natural process and often fail in situations demanding urgent action. Besides, most of the time, mobile phones are not reliable because either they are not connected to the network or cannot dispatch urgent notifications. This project aims to provide suitable ideas and solutions for an independent system on smartphones operating with instant alerts based on accurate localized information with verification data. With the ESP32-CAM and GPS, intervention can be faster with real-time evidence of the incident, which has every possibility of saving a person's life.

1.3 Objectives

The main objectives are as follows:

- To design a reliable and compact safety system for women using the ESP32-CAM and GPS modules.
- To develop a responsive emergency alert system that includes location tracking and image capturing.

1.4 Problem Statement

The problem stated in this study is that current security protocols are not always able to offer immediate help to women in danger. The current solutions are based on smartphones or require human intervention which may lead to a delay in response or failure of response when users are unable to retrieve their phones. Furthermore, the current security systems have no image/audio recording capability which is very important in identifying serious incidents and providing evidence to the police. The project is intended to overcome these limitations by designing a standalone system that can send immediate alerts along with multimedia proof.

2. LITERATURE SURVEY

2.1 Existing Solutions

Various strategies have been adopted to address women's safety issues. One of the most common used technologies is the mobile phone because it has a variety of safety apps that can alert emergency contacts and even law enforcement in case of an emergency. These applications often include panic buttons as well as GPS tracking which provide additional support in case of emergencies. These devices would not work when the phone is out of battery, unreachable, or damaged. In addition, many applications only have text message notifications which are inadequate when image, audio or video evidence is needed. Other measures include safety personal alarms, safety wristbands, and smartwatches. Many of these tools, although useful in emergencies, lack critical features such as built-in cameras and GPS. Thus, they don't offer reliable solution for real-time monitoring or proof of an emergency situation.

2.2 Technology Adoption

One other major reason for the popularity of the ESP32-CAM is its price. As a standalone device, it is already very cheap. When paired with other peripherals like a camera, Wi-Fi and even additional processing power, the device price increases but it still remains cheap and therefore an effective IoT device. The popularity further increases when the device is paired with a GPS module which enhances it into a powerful real-time monitoring and location tracking device. This system not depends on smartphones to work which makes it more useful during emergency situations when access to a phone is not possible.

2.3 Advantages of Hybrid Systems

These systems utilize GPS, Wi-Fi and even the media capture of images. By combing the strengths of these technologies, these systems outperform single technology systems. An Illustration of this is the integration of the tracking systems GPS with an ESP32-CAM, which facilitates location tracking as well as capturing video evidence of the crime. This allows for a greater responsiveness and accuracy towards the safety matters.

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3. Methodology

3.1 System Architecture

The architecture of the women's safety system is designed to be efficient, compact, and autonomous. The core of the system is the ESP32-CAM module, which integrates a camera, Wi-Fi, and Bluetooth capabilities. The ESP32-CAM then transmits this data via Wi-Fi to preprogrammed emergency contacts, which may include family members and friends. The ESP32-CAM module which have Wi-Fi and a camera, Wi-Fi powers the system's core. Once the system gets activated, pictures are taken using the ESP32-CAM. It is coupled to a GPS module tracking the user's real-time location. When the user turns on the system by pressing a button the data flow commences. Once triggered, the ESP32-CAM module gathers an image while the GPS module finds the user's precise geographic coordinates this both will send to emergency contacts. The architecture is modular with the ESP32-CAM and GPS unit serving as the most important parts. A battery supply power to the system. The Wi-Fi feature that comes with the ESP32-CAM facilitates rapid communication in emergencies, which enables the system to send emergency alerts. Also, the system is designed to show whether the device is armed or has already been turned on.

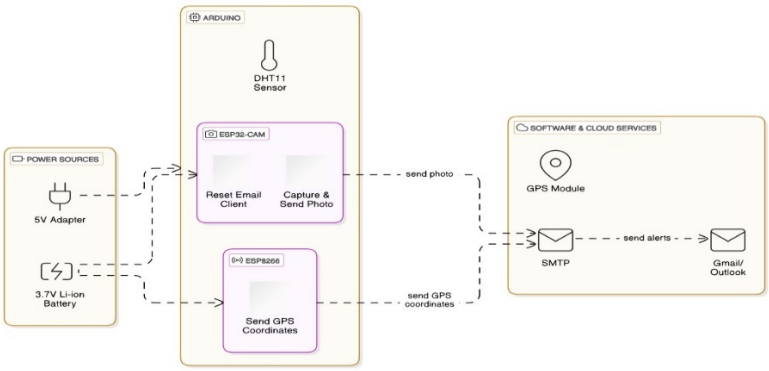

Figure 1. Architecture

3.2 Workflow of the System

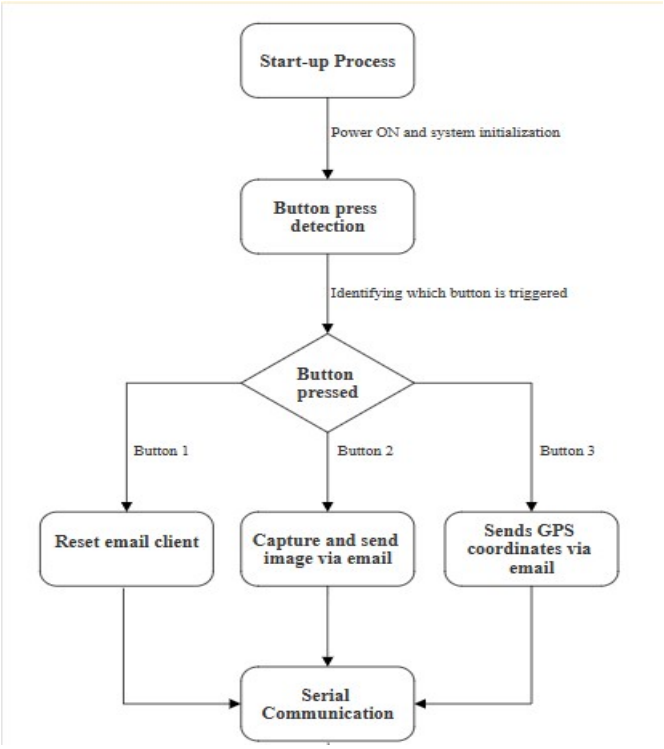

Figure 2. Workflow

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The operation of the safety system can be broken down into several stages:
1. Upon the initial booting, both the GPS module and the ESP32-CAM switch on. The camera is activated to start taking pictures instantly, while the GPS begins tracking the user's location in real time.
2. The system needs to be able to operate in an emergency mode, so it can detect a set parameter, such as button press.
3. The image captured together with the coordinates is transmitted over Wi-Fi without any configuration to emergency contacts.
4. A preset image and the most recent location is sent to emergency contacts. This allows the responders to quickly analyze the situation and contact the police or other aid.

3.3 Components

Figure 3. Button

Used to manually activate emergency features. Provides an easy-to-use interface for triggering alerts.

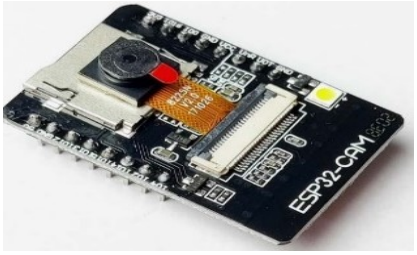

Figure 4. ESP32-CAM Microcontroller with Camera Module

An integrated camera and microcontroller which helps to capture real-time images. It also has Wi-Fi connectivity, which helps in data transmission.

Figure 5. NEO-6M GPS Module

A GPS module that gives the present location. In a situation of emergency, it helps in transmitting the user's exact coordinates.

Figure 6. Touch Sensor

A touch sensor is a type of electronic device that detects physical contact. When a finger gets closer, it detects changes in capacitance or resistance.

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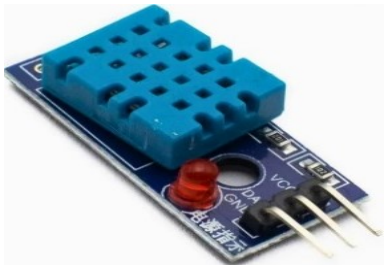

Figure 7. Humidity Sensor

A humidity sensor is a device that detects the moisture in the air. It senses and send exact humidity readings by identifying alterations in electrical characteristics brought on by moisture.

Figure 8. Power Supply Module

Converts and regulates voltage to power all components efficiently. Ensures stable operation of the system.

Figure 9. Arduino UNO

The Arduino Uno is an open-source microcontroller board with sensor and light control capabilities. It is widely used for IoT applications, automation, robotics, and prototyping since it is user-friendly.

Figure 10. ESP 8266

The ESP8266 is a Wi-Fi module that makes it possible for gadgets to connect to the internet. It is widely used for smart devices, and remote monitoring applications due to its portability, affordability, and simplicity of usage.

4. Results and Evaluation

4.1 Experimental Setup

The device was tested under real-life conditions by requesting a volunteer to walk around the city and residential areas, parks, and other locations where the device was carried and used.

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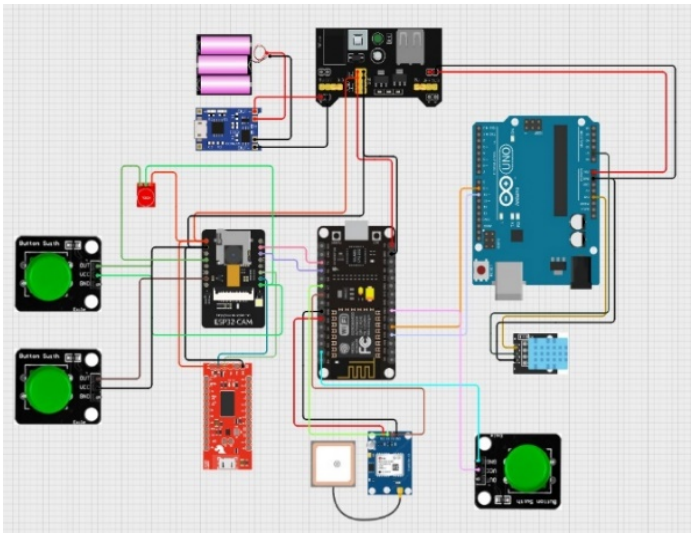

Figure 11. Experimental Setup

The main performance indicators were:

Real-time performance: Speed with which a multimedia alert was received by predetermined contacts after an emergency was detected.

Accuracy of GPS tracking: Precision of the module in determining user location in different environments.

Image capture quality: Quality of captured image during the emergency and its practicality.

Pre-programmed Emergency Contacts: A wi-fi enabled set of contacts programmed to receive alerts.

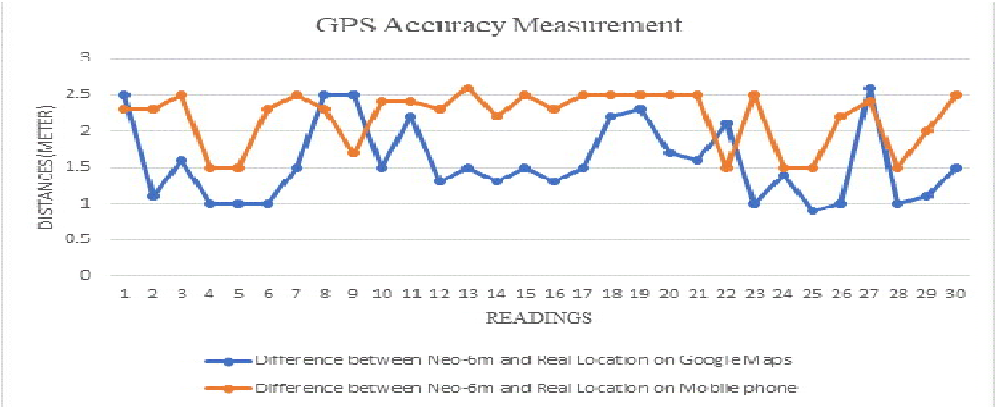

Figure 12. Accuracy of GPS tracker

4.2 Performance Analysis

The system handled warnings properly, and its real-time alert response was effective. While the ESP32-CAM module took images the GPS module provided accurate location data with link. In regions with poor signals, performance was somewhat impacted. In these situations, the alert may still be transmitted in ten to fifteen seconds, although the data transfer takes a bit longer. Additionally, it was discovered that GPS tracking accuracy was fairly accurate within a 10-meter range and significantly less accurate in cities with towering structures.

Real-Time Media Capture: Existing solutions usually send only the location data or text-based alerts; however, the ESP32-CAM system is capable of capturing images, thereby providing more context to emergency responders.

Low Cost: The least price of ESP32-CAM and GPS modules, which makes the system affordable and accessible compared with expensive wearable safety devices.

The combined use of GPS and multimedia creates an all-around emergency response system that can be most useful in a real-life situation.

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4.3 Results:

The ESP32-CAM module and GPS technologies are integrated in the device to offer real-time security. During emergencies, the system takes pictures and sends them to contacts along with GPS data. The outcomes show that this device is user-friendly way to improve personal security by providing real-time surveillance and immediate alerts. It provides a useful and flexible strategy for enhancing women's safety in public areas.

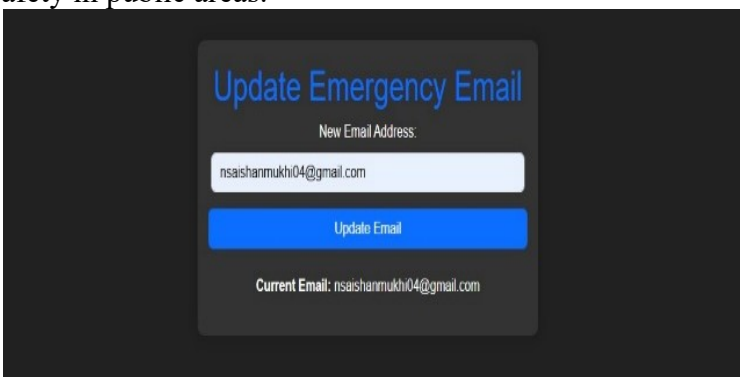

Figure 13. Emergency Email Update

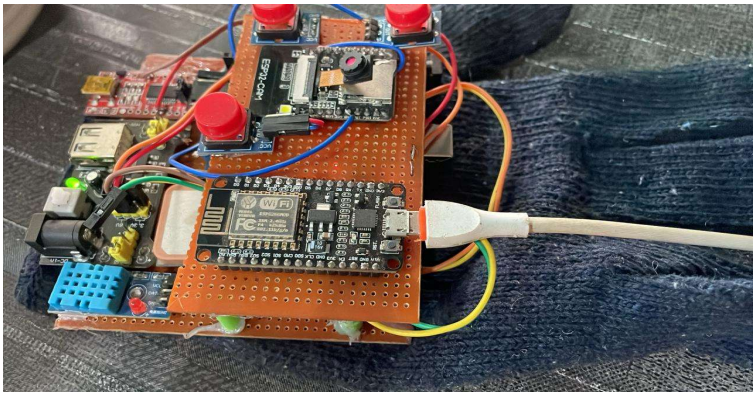

Figure 14. Women Safety Device

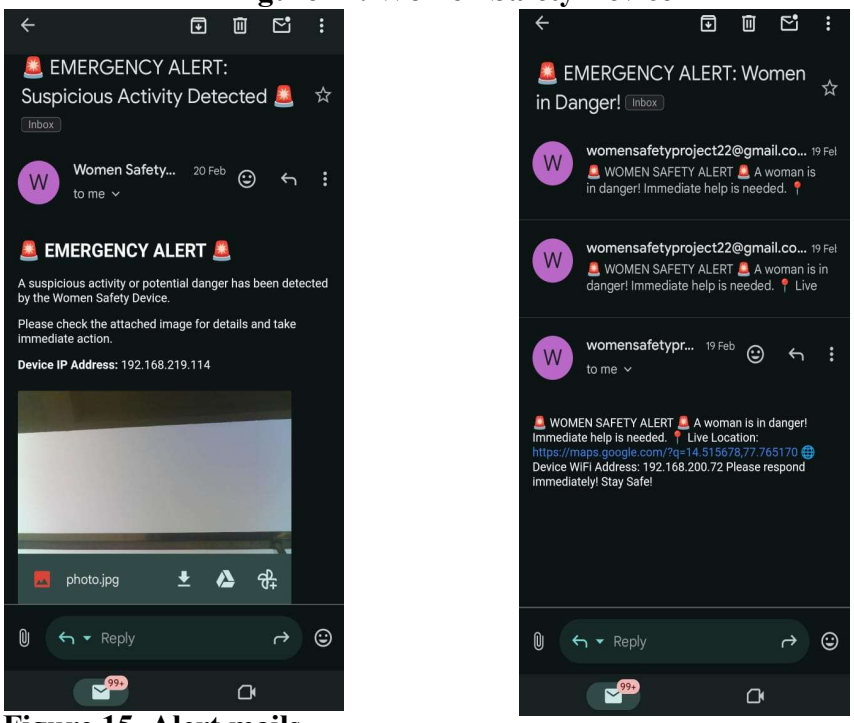

Figure 15. Alert mails

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5. Conclusion

The ESP32 CAM and GPS modules provide a new approach to women safety. Through the integration of these methods, the system sends instant alerts to emergency contacts, as well as real-time location tracking and images. It is an effective tool for improving women's safety in potentially hazardous situations by offering useful help, real-time evidence, like images and location data.

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