



SMART WOMEN SAFETY AND DEFENSE SYSTEM USING RASPBERRY PI

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Abstract: In this paper, Strengthening Women's Safety with Raspberry Pi and IoT Technology is a smart safety system designed to enhance protection for women using advanced IoT solutions. At the core of the system is a Raspberry Pi, which serves as the central processor. A camera module is connected to the Raspberry Pi, and an emergency switch is included for quick activation in critical situations. Upon pressing the emergency switch, the system immediately activates the camera to capture both images and video of the surroundings. The captured media is then sent to the registered email address, providing instant remote awareness to a designated recipient. The system goes beyond image capture by recording a short video clip, offering a more detailed account of the surroundings that might be missed with a static image alone. In addition to this, a buzzer is triggered to alert nearby individuals, and a shock mechanism is employed as an added layer of security to deter potential attackers. This multi-layered approach ensures both real-time alerts and physical deterrents, making PiGuard a robust and proactive solution for women's safety.

Index Terms -Raspberry Pi, Women safety, Inverter, Shock Mechanism, Mail alert.

1. INTRODUCTION

Personal safety, especially concerning women, has become such a vital issue in the world today, which calls for innovative and reliable technological solutions. The PiGuard meets that need through the use of power from the Raspberry Pi, a small but powerful microcomputer, combined with IoT technology for real-time monitoring and emergency intervention. When a threat is detected, PiGuard gets an emergency switch to activate a camera module that captures pictures and videos, which are then sent, through the registered email address, to provide necessary evidence and contact those in charge for an immediate response.

The user safety of the system comes in a real multi-layer form of both alerting and physical deterrence methods, that is, on pressing the emergency switch, it activates a buzzer for the public to be aware and a shock module activates for deterrence of attackers. This combination serves even if help is late; the system itself will provide active protection for the individual. Fast alerting system coupled with real-time video and localization helps in making completely new provisions for safety other than those offered by available tools such as whistles or pepper sprays.

It aims to create a smart, compact, and easy-to-operate safety system to be used in emergencies or without need of any external aid. PiGuard achieves the collection of evidence, calling for help, and initiation of physical defense at the fastest possible time. While making real-time communication, live monitoring, and active defense work together, the project, therefore, supports not only personal safety, but it also facilitates changes in the societal sense towards safer environments for women.

1.1 Objective

The major purpose of this project is to design and implement a women's safety and defense system, which is smart, real-time, and can be powered by Raspberry Pi and IoT technologies. The system aims to maintain a speedy emergency response: it has a manual panic button and automatic fall detection for people in distress, GPS for exact location tracking, real-time information through SMS and email, evidence collection through a camera module, and physical deterrence with a buzzer and shock mechanism. Communication, monitoring, and self-defense are integrated into a single small solution, and we the team working on the project aims to enhance personal security for women with a technology-based tool that is fast and efficient in emergency responses.

2. METHODOLOGY

The methodology of the project "Smart Women Safety and Defense System" revolves around the integration of different hardware modules with the Raspberry Pi 3B+ to realize a seamless and responsive safety solution. First and foremost, powering the system on is achieved through a stable DC power source, and the Raspberry Pi initializes all the connected peripherals: USB camera, GSM and GPS modules, MPU6050 motion sensor, and the buzzer. With this setup, the Raspberry Pi remains in standby mode, constantly monitoring the state of the push button and the sensor for any manual activation or sudden movements that could potentially indicate an emergency. The manual or automatic dual-triggering ensures that the system is always alert and responsive without needing any human intervention.

On the detection of either of these triggers corresponding to a threat or an emergency, the Raspberry Pi concurrently carries out a number of functions of utmost importance. The USB camera captures an image with good resolution and records a 20-second video clip showing the surroundings: all these serve as a visual proof of the ongoing situation. The Raspberry Pi then uses the SMTP protocol to send this media to a predefined email address so that the situation can be monitored remotely in real-time. At the same time, the module NEO-6M GPS locks the current location of the user, whereas the SIM800L GSM module sends a text message alerting to predefined emergency contacts, including a Google Maps link. In addition to this, the system actuates a loud buzzer, an obvious means of drawing attention to the surroundings from nearby people; while a relay turns ON a shock mechanism serving as a physical deterrent against attackers. These actions are executed almost simultaneously to provide comprehensive protection by way of visual evidence, real-time communication, location sharing, and immediate human deterrence.

The system design ensures that either a manual room reset can be initiated after every emergency response, or the system can automatically revert to standby after a timeout for the next activation. All data collected can then be analyzed later and may act as legal evidence in court. The software is managed through Python scripts, which control the GPIO pins and automate the flow in between the sensor detection, capturing the media, sending alerts, and activating the defense mechanism. Through this tightly integrated methodology, the Smart Women Safety System achieves a high degree of reliability, responsiveness, and autonomy, an effective real-life solution for personal protection.

2.2 Block Diagram

A Smart Safety and Defense System for Women Block Diagram shows the complete interfacing of various hardware components managed by the Raspberry Pi 3B+. The block diagram shows the internal organization and working of the entire system. At the center is the Raspberry Pi, which acts as the controller. It is then connected to other essential modules like a USB camera, GPS receiver, GSM module, MPU6050 sensor, buzzer, relay, and a push button at the controller. Each module has a different purpose: the camera captures images/videos; GPS fetches real-time location data, and the GSM module is used to send an emergency alert. The diagram also includes power supply lines, which deliver regulated supply voltages to all modules, ensuring their optimum working conditions.

The input part of this whole system is controlled by 2 main triggers, i.e., the push button and an MPU6050 sensor. These 2 inputs are given to the system pursuant to either a manual push or sudden movement, after which the whole system is triggered by the internal processing of the Raspberry Pi, and emergency actions are performed immediately based on the entry condition triggered. The first action is to turn on the recording of the USB camera, while simultaneously the GPS module calculates the present coordinates. The GSM module will transfer these coordinates as an SMS carrying a Google Maps link to emergency contacts for locating the user's position. Simultaneously, the outputs are modulated by the Raspberry Pi, which would be the buzzer that will give out loud alarm sounds to warn nearby people and the relay that switches on a shock circuit for physical self-defense. Thus, both immediate protection and remote assistance are achieved together very well with these activities.

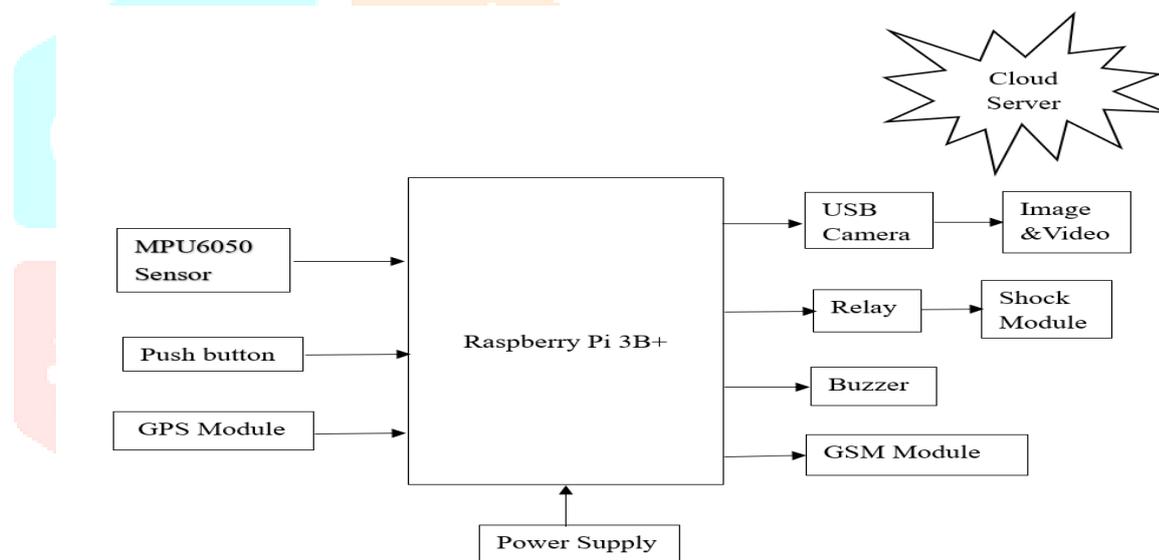


Fig 2.1 Block Diagram of smart women safety system

The Smart Women Safety and Defense System flowchart denotes the step-by-step sequence of operations, the initialization of a system to an emergency response and system reset. First, the Raspberry Pi powers up and keeps all connected modules in standby mode and is constantly checking inputs to the push button and the MPU6050 sensor. If it detects abnormal motion or a button press, the system immediately enters into emergency mode. At this stage, the USB camera takes a snapshot and begins recording a video, the GPS module locks onto the user's location, and the GSM module sends an SMS with a location link to emergency contacts stored in memory. In the meantime, a loud buzzer is activated to attract the attention of people nearby, while a relay actuates a shock mechanism to physically deter any potential aggressors. When finished with these actions, the system awaits manual reset or will return to monitoring mode after a timeout, remaining alert for any further threats.

The flow chart is as shown below,

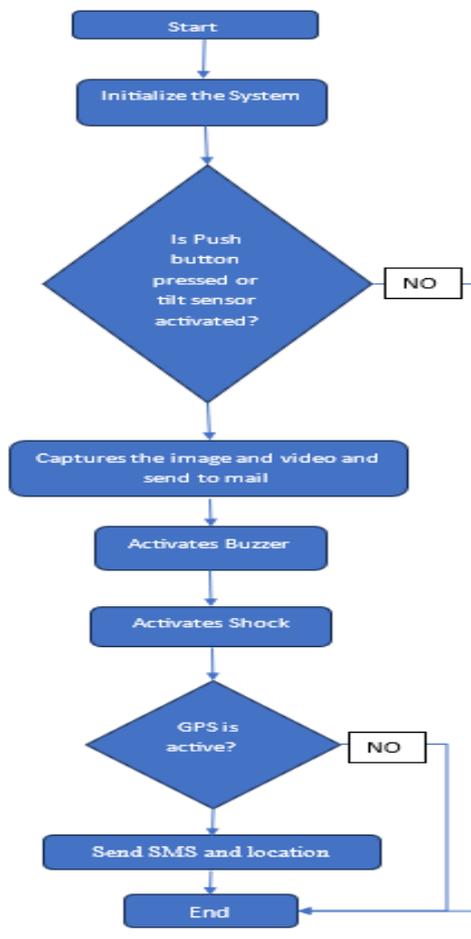


Fig 2.2 Flow Chart of Smart Safety System

3. Hardware Implementation

3.1 Raspberry Pi 3B+

The Raspberry Pi 3B+ is the main hub at which all operations of this system are coordinated via input and output functionality in addition to initializing and monitoring peripheral modules such as the USB camera, GPS, GSM, MPU6050, and buzzers. This unit controls hardware via GPIO pins, executing the Python-based control code which manages emergency detection, alert trigger, evidence capture, and activation of self-defense shock firing.

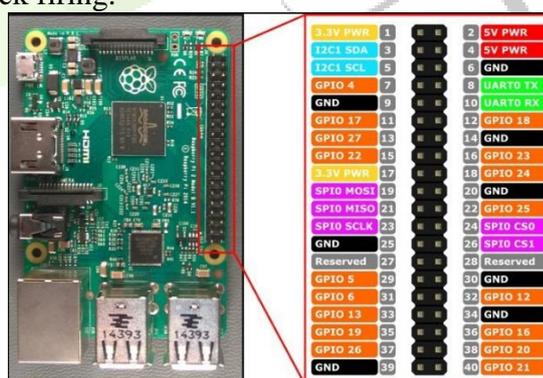


Fig. 3.1 Raspberry Pi 3B+

3.2 USB Camera

The USB camera is a necessary requirement during emergency visual monitoring. It takes still images and captures short clips of activity after it is turned on. These media files are real-time evidence that get automatically posted to a registered ID through the Raspberry Pi for evaluation by remote stakeholders in urgent situations.



Fig.3.2 USB camera

3.3 MPU6050 Sensor

The MPU6050 is a sensor that throws in an accelerometer as well as a gyroscope, and it is meant for both motion and fall detection. It keeps sensing movements and changes in users' orientation. It detects when there is a sudden jerk or a fall or abnormal position tilt, and then a signal gets sent to Raspberry Pi, activating the entire emergency response system. This will allow the user to do nothing and will probably get saved even if he does not press the panic button by hand.

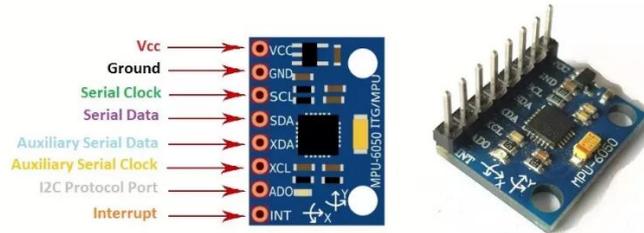


Fig. 3.3 MPU6050 Sensor

3.4 GSM Module (SIM800L)

The GSM module consists of sending SMS alerts and emergency calls to the contact saved. The Raspberry Pi collects the GPS location, which is generated by the GSM module in the form of a Google Maps link. This is to ensure that the emergency responder or family members will immediately know where the victim is located, even without an internet connection.

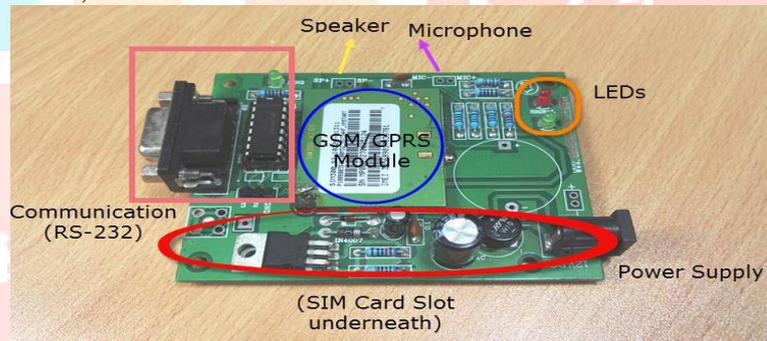


Fig 3.4 GSM module

3.5 Relay

The relay module in the system is an electrically controlled switchover that determines whether or not to engage the shock mechanism in an emergency situation. It monitors the emergency event detection by powering the relay from the Raspberry Pi and closing the circuit to a non-lethal shock device. This gives the user a temporary self-defense tool to delay an attacker until help arrives.

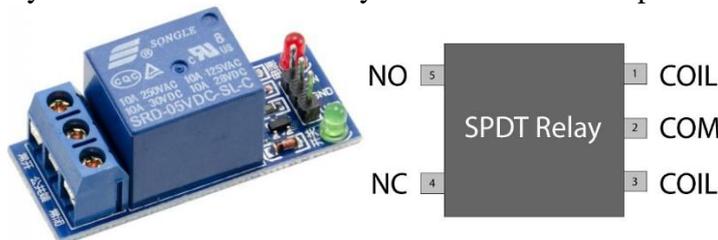


Fig 3.5 Relay Module

3.6 Push Button

The push button has been designed specifically to provide easier manual activation of the system by the user in an emergency. Instantaneously, it activates all safety protocols such as camera activation, GPS location, buzzer sound, and shock defense. This means that an individual in a panic or pressured situation can activate the system almost instantly with a single press of a button.



Fig 3.6 Push button

3.7 GPS Module (NEO-6M)

The GPS Module keeps track of the location of the user at the time of emergency. This information is collected and processed by the Raspberry Pi to a clickable Google Maps link, which is sent to the registered mobile numbers via the GSM module, aiding the rescuers to locate the user easily and quickly.



Fig 3.7 GPS module (NEO-6M)

3.8 Buzzer

The buzzer is an important component used for immediate audible alert generation. When the system is triggered, the buzzer is activated to produce a loud, continuous sound to attract attention from nearby individuals and potentially scare off an attacker. Controlled through a GPIO pin, the buzzer acts as the system's first line of public defense by drawing instant notice in emergency situations.



Fig 3.8 Buzzer

4. Working

The Smart Women Safety and Defense System combines several modules linked together through a Raspberry Pi 3B+ that will be the main controller, continuously monitoring the manual and automatic triggers. The first trigger is a panic button for the user to activate the system manually, while the second trigger is based on an MPU6050 sensor detecting sudden motion or falls to automatically trigger emergency procedures. When activated, the Raspberry Pi commands a USB camera to snap a picture of the surrounding and record a 20-second video, which is later sent to an email specified by the user. At the same time, the NEO-6M GPS module locates the user's position in real time, and the SIM800L GSM module sends an SMS alert with the link to the location to emergency contacts so that immediate remote awareness can be ensured.

The system additionally activates local safety methods to deter attackers and garner attention. A loud buzzer alarm is triggered, thus attracting the attention of passersby, while the relay-based shocking method is turned on for providing non-lethal physical defense against the attackers. The actions of alerting the surroundings and providing self-defensive action are combined moments within the milliseconds of detecting a threat, allowing for a fast response, high deterrent effect, and reliable communication. After an emergency response, the system resets itself for the next activation or waits for a manual reset, ensuring it is always on standby for

the next incident. This project takes a layered approach toward enhancing personal security to offer a sturdy solution to women's safety.

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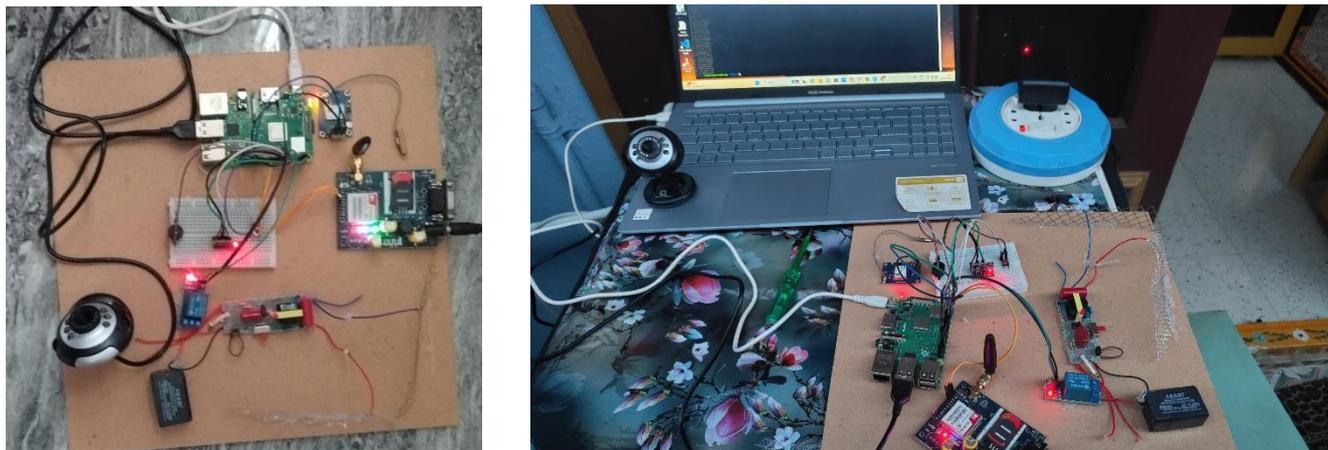


Fig 4.1 Hardware Kit

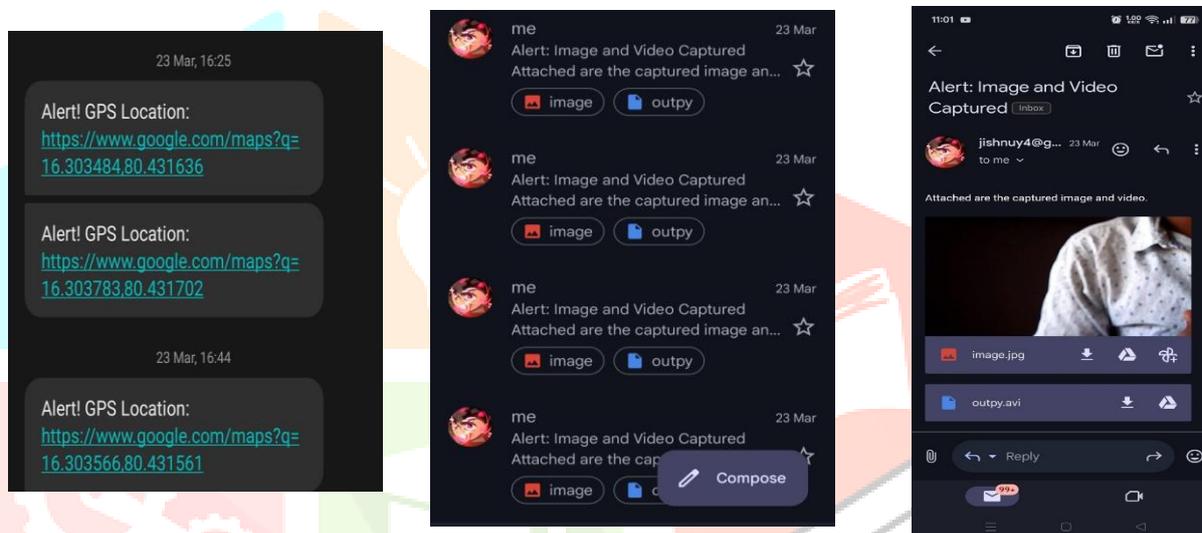


Fig 4.2 Output

5. CONCLUSION

The project on Smart Women Safety & Defense System developed using technologies of IoT and Raspberry Pi aims to provide comprehensive real-time security solutions for women. A range of sensors, communication, and defense mechanisms therefore combines a compact system with interactive potential to ward off acute risks.

Exploration of manual as well as spontaneous sensors, video and image captures for identification, GPS location tracking, SMS alerting, and physical defense supports the user to seek help in all conditions where even in high stress or unconsciousness could come in support.

In conclusion, this project achieves an advantageous stride towards impelling women forward on technology-driven security solutions. It serves as an instance of integrative engineering-driven technologies in electronics, communications, and programming, which set to catalyze significant innovations in public safety. Further refinement, mass production, and community embracement could potentially assist in tackling threat environments and increase an atmosphere and assurance to women throughout the world.

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