WOMEN'S SMART SAFETY DEVICE USING RASPBERRY PI

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WOMEN'S SMART SAFETY DEVICE USING RASPBERRY PI

A Project report

submitted in partial fulfillment of the requirements

for the award of the degree of

Bachelor of Technology

in

Electronics & Communication Engineering

by

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MAY 2023

DECLARATION

We certify that

a. The work contained in this report is original and has been done by me under the guidance of my supervisor(s)
b. The work has not been submitted to any other Institute for any degree or diploma
c. We have followed the guidelines provided by the Institute in preparing the report
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CERTIFICATE

This is to certify that the project report entitled **Women's Smart Safety Device Using Raspberry Pi** submitted by **Ms**. **Sneha Saipriya Tulluri, Ms. Bolla Sathvika, Mr. Goregottu Siddanth** to the Institute of Aeronautical Engineering, Hyderabad in partial fulfillment of the requirements for the award of the Degree Bachelor of Technology **Electronics & Communication Engineering** is bonafide in record of work carried out by him/her under my/our guidance and supervision. The content of this report, in full or parts, have not been submitted to any other Institute for the award of any Degree.

Supervisor	**Head of the Department**
Dr. V. Kishen Ajay Kumar	**Dr. P Munaswamy**
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Date:

APPROVAL SHEET

This project report entitled **Women's Smart Safety Device Using Raspberry Pi** by **Ms. Sneha Saipriya Tulluri, Ms. Bolla Sathvika, Mr. Goregottu Siddanth** is approved for the award of the Degree Bachelor of Technology in Electronics & Communication Engineering.

Examiner(s)

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Place:

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ABSTRACT

Although there are numerous women's safety systems on the market, a more complex system is still required to guarantee greater safety and security. Thus, in this project, an alternate way for women's security is offered, which may serve as a superior option to the rest of the available security measures via a ladies safety gadget. Here the system is designed Raspberry Pi uses GPS, GSM and IOT technology. This device provides more security and safety for women.

IOT is used for sending mail, mail consists of images along with location. GPS technology is used to track the live location of the women. Pi camera will capture the images. GSM is uses to sending the alert SMS to the predefine mobile number. Sound sensor is uses to detects the sound when she screamed. This system consists of TASER for Self-Defense.

The project was designed a Raspberry pi based women safety device. GPS, GSM, pi camera, sound sensor, LCD display, relay along with taser and panic switch is interfaced to the raspberry pi. When the women press the panic button/sound sensor detect the sound, it will send the mail and sending the alert message though GSM also activate the taser for self-defense though relay. The status of the project will display on LCD. To achieve this task raspberry pi program written in python language.

Keywords- Raspberry Pi, GSM,GPS, Self Defense, Pi camera, Taser, Sound Sensor, LCD display, Raspian, Python language.

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LIST OF ABBREVIATIONS

RPi	Raspberry Pi
GPS	Global Positioning System
GSM	Global System for Mobile Communication
LCD	Liquid Crystal Display
PCB	Printed Circuit Board
OS	Operating System
IOT	Internet of Things
GPIO	General Purpose Input Output Pins
UART	Universal Asynchronous receiver-transmitter
SMPS	Simple Mode Power Supply
CDMA	Code Division Multiple Access
TCP/IP	Transmission Control Protocol/Internet Protocol
CAD	Computer Aided Design
OSMC	Open Source Media Center
NAS	Network Attached Storage
NOOBS	New Out of the Box Storage
HTPC	Home Theatre PC (Personal Computer)

CHAPTER-1
INTRODUCTION

An embedded system requires hardware and software to perform a specific task. Microprocessors and microcontrollers are prevalent types of embedded electronics. Because they merely accept input, process it, and output the results, microprocessors are known as general-purpose processors. A microcontroller, on the other hand, accepts data as input and morphs it, it can interface with other devices, regulate it, and creates the output. The project "Women Safety Device Using Raspberry Pi" is an exclusive project that may provide for women security applications using GSM, GPS, and IoT technologies. [1].

Embedded systems are commonly present in machinery that necessitates uninterrupted operation over extended periods without any malfunctions. In certain cases, these systems are designed to recover from errors. Consequently, the software utilized in these systems undergoes thorough development and testing compared to software used in personal computers. Additionally, components prone to instability, such as disc drives, switches, or buttons, are excluded from embedded systems. Ensuring dependability becomes crucial, as these systems may face challenges like the inability to be completely and securely shut down for maintenance or difficulties in accessing them for repairs. Some instances of embedded systems include aerospace systems, undersea cables, nautical beacons, bore-hole systems, and vehicles.

Maintaining operational status of the equipment is crucial for safety purposes. The presence of "limp modes" can be quite bothersome. Operators frequently opt for backups in various scenarios, such as airplane navigation, nuclear control systems, hazardous chemical facility controls, railway signals, and single-engine aircraft motors. If the system is shut down, significant revenue loss is expected in areas like telephone toggles, industrial controls, bridge and elevator controls, fund transfers, marketplaces, and automated marketing maintenance. To recover from faults, a combination of mechanisms is employed, addressing software issues like memory leaks and soft hardware errors. One such mechanism is a watchdog timer that resets the computer if the program fails to notify it at regular intervals. Additionally, subsystems incorporate redundant replacements that can be switched to "limp modes," offering only minimal service levels. [2].

An Embedded Hypervisor can securely encapsulate any subsystem component, guaranteeing that a hacked software part is not interfering with any other subsystems or privileged-level system software. This encapsulation keeps errors from propagating from one subsystem to another, which improves reliability. In the event of a fault, this may also allow a subsystem to be promptly shut down and restarted.

In general, Raspberry Pi is configured to solve certain problems or achieve specific objectives. Because there are numerous ways, it is critical to determine the gap and the appropriate technology required. Following the installation of the device, a periodical inspection is required to evaluate its performance and results.

1.1Existing Method

The existing method is a Women's safety device that uses Raspberry Pi that is a safety model which sends the location and if the person is in danger. The most essential parameters to enable the persons location and status via email or SMS by using GSM and GPS module, Raspberry Pi module. This system comprises of a taser, relay,and touch sensor which helps to obtain data and send it to an emergency contact using GSM and GPS. Programmed through Python, using Raspbian OS and Virtual Machine. The results obtained are through the push button which is an indication that the person is in danger. Once, the push button is pressed it will sound a buzzer which alerts nearby people and send an email or SMS to emergency contacts.

1.2Proposed Method

In this project, we proposed a method for a self-defense mechanism that ensures the safety of the person before help arrives. This is done by implementing a Taser which has a relay. This taser can turn on once the push button is pressed. We have also implemented a LCD Display which displays the coordinates of your location and emergency contact information. This can be used for the persons safety against the intruder and to also be informed about the emergency contact that has been addressed.

This method can help ensure the safety of the human if there is no help around, we can also control the Pi camera and various componenets connected to the Raspberry Pi using Raspcontroller application.

CHAPTER-2

LITERATURE SURVEY

There are numerous women's safety systems on the market; nevertheless, for more safety and security, a more sophisticated system is required. Thus, an alternate way for women's security is proposed in this project, which may serve as a superior option to the rest of the available security measures via a lady’s safety gadget. The system is built around GPS, GSM, and IoT technology. This device improves the security and safety of women.

IOT is used to send mail, which includes images as well as a location. GPS technology is used to track the women's current location. The Pi camera will be responsible for capturing the images. Alert SMS messages will be sent to a predefined mobile number via GSM. The sound sensor detects the sound produced when a person screams. This system consists of TASERs for self-defense. The project involves the design of a Raspberry Pi-based safety device specifically for women. The Raspberry Pi is connected to various components including GPS, GSM, a Pi camera, a sound sensor, an LCD display, a relay, a TASER, and a panic switch. When a woman presses the panic button or when the sound sensor detects a sound, an email and alert message are sent through GSM, and the TASER for self-defense is activated using the relay. The status of the project is displayed on the LCD. Python programming is used to develop the Raspberry Pi program for this task.

Embedded electronics are primarily comprised of microprocessors and controllers, which are two prominent types. In the 1930s and 1940s, computers were often dedicated to single tasks, but they were too large and expensive for the majority of tasks performed by modern embedded systems. Over time, programmable controllers evolved from electromechanical sequencers to solid-state electronics and eventually computer technology.

That sounds like an interesting project aimed at enhancing women's safety and security. Combining GPS, GSM, and IoT technologies can indeed provide a comprehensive system for monitoring and responding to potential threats. The integration of various components like the Raspberry Pi, GPS, GSM, Pi camera, sound sensor, LCD display, relay, TASER, and panic switch allows for a multi-functional and responsive device.

Using GPS technology enables the tracking of a woman's current location, while the GSM module enables the sending of alert SMS messages to a predefined mobile number. The Pi camera can capture images, which can be included in the email sent via IoT. The sound sensor adds an additional layer of security by detecting screams or other suspicious sounds.

The TASERs for self-defense provide a physical deterrent and protection measure. By activating the TASER using the relay, it can potentially provide a means of incapacitating an attacker and giving the woman time to escape or seek help.

The LCD display serves as a status indicator, providing real-time feedback on the system's operation. And using Python programming for the Raspberry Pi program allows for flexibility and customization in implementing the desired functionalities. The evolution of microprocessors and controllers is also correct. In the early days, computers were dedicated to specific tasks and were large and expensive. However, with advancements in technology, embedded systems have become more compact, affordable, and capable of performing a wide range of functions.

The Apollo Guidance Computer, developed by Charles Stark Draper of the MIT Instrumentation Laboratory, is one of the earliest examples of a modern embedded system. The Apollo navigation system was considered the riskiest component of the Apollo mission due to its use of newly designed monolithic integrated circuits to minimize size and weight. Another early embedded system was the Autonetics D-17 navigation computer used in the Minuteman missile, which was launched in 1961. It utilized transistor logic and had an internal disk for main memory. When the Minuteman II went into production in 1966, the D-17 computer was replaced with a new one that incorporated integrated circuits on a larger scale [3].

Because they merely accept input, process it, and output the results, microprocessors are also known as general-purpose processors. The project "Women Safety Device Using Raspberry Pi" is a unique project that may deliver women security applications using GSM, GPS, and other technologies.

Overall, it combines different technologies and components to create a device that can provide real-time monitoring, alerting, and self-defense capabilities.

CHAPTER-3

METHODOLOGY

3.1 Block Diagram

When the system is powered on, the Raspberry Pi, GPS and GSM modules are initialized as shown in figure 3.1. When the user finds a trouble, push button will be pressed or the sensor is activated. As soon as the panic button is pressed or sensor detects the noise, GPS location is read by the Pi, the user location link is sent to the emergency contact using the GSM module. Alongside this the Taser is activated which can be seen in figure 3.1 as the relay and shock which enables the individual to have a self-defence weapon which saves them from dangerous situations [5].

Also, the Pi camera captures the image of the assaulter and the surroundings and sends the images as an email to the emergency mail, along with the location link which can be opened in Google maps. This alert and security system can thus help in saving the victim.

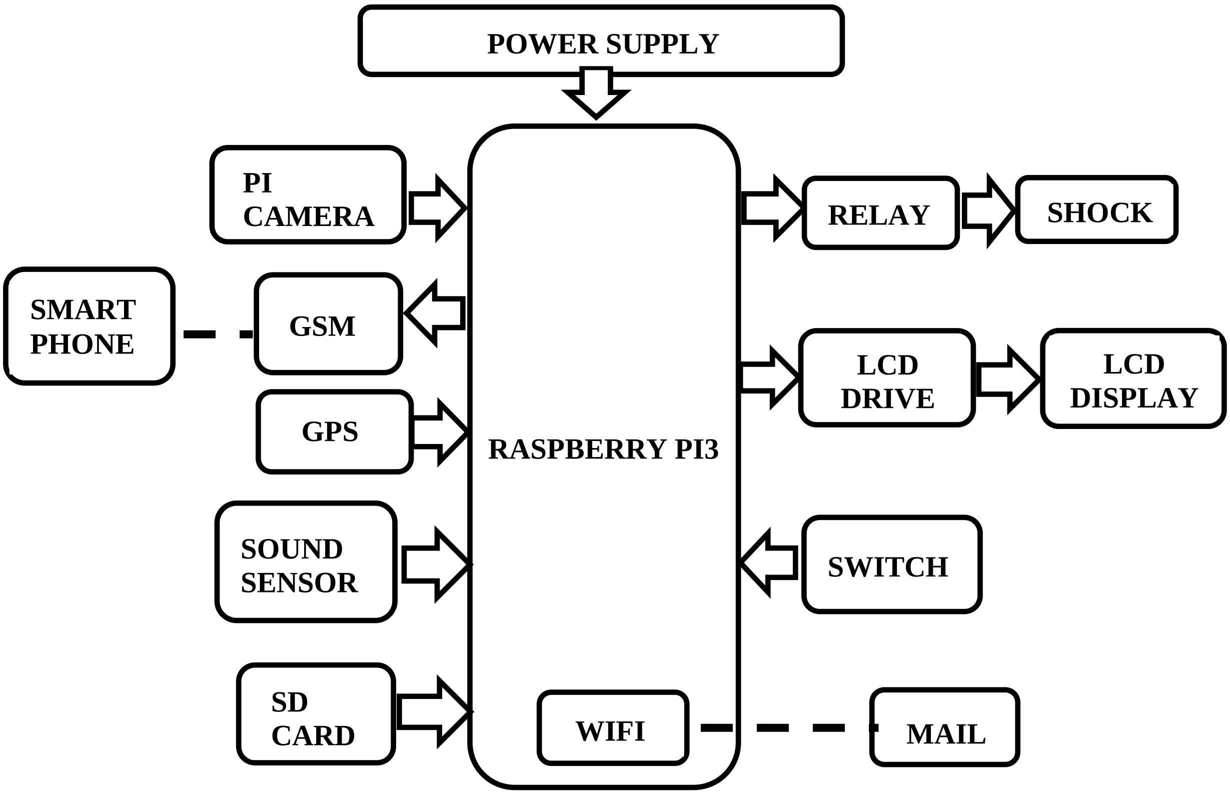

Figure: 3.1 Raspberry Pi Interfacing

3.2 Hardware Components:

We utilized the following components in this project:

- Raspberry pi3.
- Regulated Power Supply.
- Pi camera.
- Panic switch.
- GPS.
- GSM.
- Relay with taser.
- Sound sensor.
- LCD display.

3.3 Raspberry Pi 3:

Raspberry Pi is a one-board computer that is thoroughly used in IoT applications. It has a range of GPIO (General Purpose Input Output) pins that can be used to connect to various sensors and devices. Raspberry Pi's working principle involves executing code on a microcontroller that processes input data from various sensors and sends output signals to other devices over a network. It is a credit card-sized computer that can perform various computing tasks.

It uses a small and efficient ARM processor and runs on various operating systems. As seen in figure 3.2 it has multiple interfaces like USB, HDMI, Ethernet, GPIO, and more that can be used to connect various devices and peripherals. The USB interface can be used to connect external storage devices, keyboards, and mice. HDMI interface is used to connect the Raspberry Pi to a display or TV. The Ethernet interface is used to connect to the internet or a local network. The GPIO (General Purpose Input/Output) interface is a set of pins that can be used to connect various sensors and other devices like LED lights, motors, and more.

The Raspberry Pi is a mini linear-board computer originated in the United Kingdom by the Raspberry Pi Foundation, which promoted the teaching in educational institutions. Most businesses sell the Raspberry Pi on the internet. Egoman manufactures had distribution only to China and Taiwan, where their component was identified compared to other Pis by its specific red colouring and absence of FCC certifications. Every manufacturer uses the same hardware.

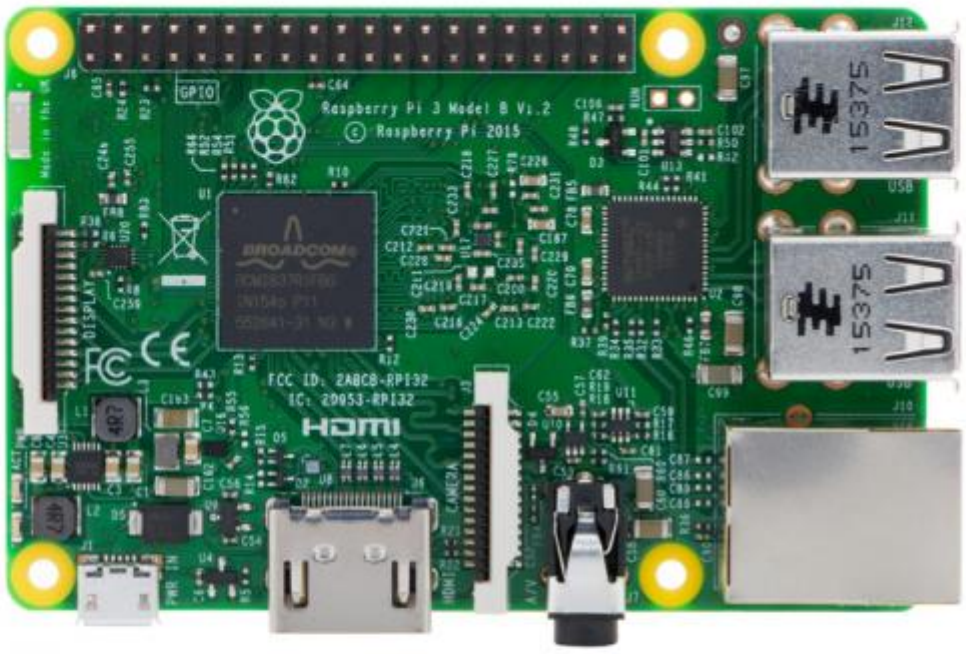

Fig 3.2: Raspberry pi

Other interfaces include the camera interface, which is used to connect a camera module to the Raspberry Pi, and the audio interface, which is used to connect audio devices. These interfaces make the Raspberry Pi a versatile platform for various projects, from home automation to robotics and more.

Raspberry Pi is based on the ARM architecture, which is commonly used in mobile phones and tablets. Raspberry Pi runs on various operating systems such as Linux, Windows 10 IoT Core, and others. The operating system is stored on an SD card, which is inserted into the SD card slot on the Raspberry Pi. Once the Raspberry Pi is powered on, it boots up the operating system from the SD card.

The Model of Raspberry pi configures about the Broadcom system on chip which consists of Processor and General Processing Unit and Random-Access Memory. The ARM11 processor is clocked at 700 MHz and is capable of running at a maximum speed of 1 GHz. The GPU is capable of playing 1080p video and rendering 3D graphics. The Raspberry Pi also has 512 MB of RAM, which can be increased in the newer models. The Raspberry Pi has a USB port, which can be used to connect various peripherals such as a keyboard, mouse, Wi-Fi dongle, and much more. It also has an HDMI port, which can be used to connect a monitor or TV. It also has an Ethernet port, which can be used to connect to the internet. It has a GPIO (General Purpose Input

Output) header, which consists of 40 pins. These pins can be used to connect various sensors, actuators, and other electronic components. The GPIO pins are programmable, which means that they can be controlled by software running on the Raspberry Pi.

Pin Configuration of Raspberry Pi:

The Raspberry Pi utilizes the widely adopted ARM architecture, commonly found in mobile phones and tablets. It offers compatibility with multiple operating systems, including Linux, Windows 10 IoT Core, and others. The operating system itself is stored on an SD card, which is inserted into the designated slot on the Raspberry Pi. Upon powering on the device, the Raspberry Pi initiates the boot process, loading the operating system from the SD card.

The Raspberry Pi has 40 pins to represent the GPIO header, which are numbered from 1 to 40(Figure 3.3). These pins are divided into several groups, which are explained below:

- Power Pins: The first two pins (pin 1 and pin 2) on the GPIO header are power pins. Pin 1 is 3.3V power supply, and pin 2 is the 5V power supply.
- Ground Pins: The next two pins (pin 3 and pin 4) on the GPIO header are ground pins. These pins are used as a reference point for the electrical circuits connected to the Raspberry Pi.
- GPIO Pins: The next 26 pins (pin 5 to pin 28) on the GPIO header are GPIO pins which can be seen in figure 3.3. These pins can be used to connect various sensors, actuators, and other electronic components. These pins can be configured as inputs or outputs and can be controlled by software running on the Raspberry Pi.
- SPI Pins: The next four pins (pin 19 to pin 22) on the GPIO header are SPI pins. These pins are used to connect devices that communicate using the Serial Peripheral Interface (SPI) protocol.
- I2C Pins: The next two pins (pin 3 and pin 5) on the GPIO header are I2C pins. These pins are used to connect devices that communicate using the Inter-Integrated Circuit (I2C) protocol.
- UART Pins: The next two pins (pin 8 and pin 10) on the GPIO header are UART pins. These pins are used to connect devices that communicate using the Universal Asynchronous Receiver Transmitter (UART) protocol.

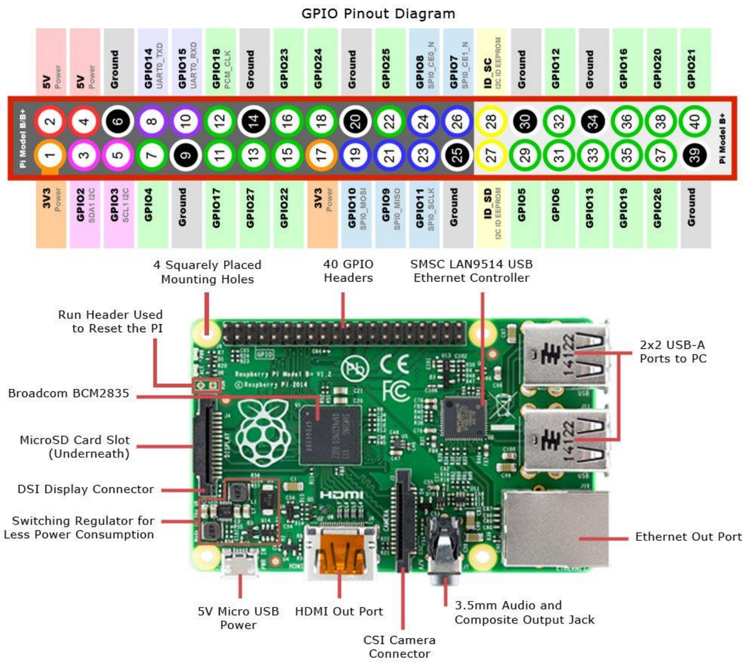

Figure 3.3: Raspberry Pi 3 and Pin description

3.4 Regulated Power Supply:

Adapter

An AC connector is an external power supply typically enclosed in a housing that resembles an AC plug. It is commonly referred to by various names, such as plug pack, plug-in adapter, adapter block, domestic mains adapter, line power adapter, wall wart, and power adapter. The AC adapter is shown in Figure 3.4 and is utilized by electrical devices that require power but lack the internal components necessary to directly access optimal power and voltage from the main power source. The internal circuitry of an external power supply is similar to that of an integrated or internal power source.

Figure 3.4 Adapter

External sources of power are used with both equipment that does not have other sources for energy and battery-powered equipment; when plugged in, the power source charges the battery as well as powering the gadget [5].

Operation:

Initially, most AC/DC adapters were linear power supplies that transforms the primary power voltage to a lower voltage, a rectifier to transform it to oscillating DC, and an equaliser that smoothed and brought out the remaining wave deviations that didn't affect the device. The transformer as seen in figure 3.5 determines the size and weight of the gadget, which was governed by output power and the main frequency. The output voltage of the adapters varied drastically with a load; single voltage regulator circuitry was added for equipment that required a more stable value. Losses in the linear regulator and the transformer.

Figure 3.5 Charger

SMPSs (simple mode power supplies) were widespread for this function in the early twenty-first century. Main voltage creates a switching circuit that incorporates a converter. High-frequency ripple is easier to filter than main-frequency ripple. As a result, the device is substantially more efficient, smaller, and lighter. As with the earlier linear circuit, safety is maintained by the presence of a transformer that electrically seperates the output from the mains.

But due to complicated circuitry and the usage of semiconductors, alternating adapters are prone to produce failure than previous types unless very properly constructed and using suitable components. The adapters can be readily corrupted by overloads, even transient ones.

Description:

Efficiency:

The issue of some power supply' inefficiency has gained widespread attention since US President George W. Bush called such gadgets "Energy Vampires" in 2001. To lessen the amount of energy wasted by some of these gadgets, laws are being passed in the EU and certain U.S. states. The One Watt Initiative and standby power are two examples of such programmes.

Others, however, have stated that even if these less preferred devices are low powered, such as those used for small battery chargers, their energy waste is less than 1% of the amount of electricity consumed by households.

The earlier main-frequency singular transformer-based current supply was found to have efficiencies from 20–75% and to have significant energy loss even while powered up but not supplying power in a 2002 report on the overall efficiency of power supplies for tiny electronic component. The efficiency of switched-mode power supply (SMPSs) is significantly higher; a proper design can achieve 80–90% efficiency and is also significantly smaller and lighter [6].

In addition to supplies built into some equipment, the majority of external plug-in "wall wart" current adapters routinely. When not in use, external supplies are typically still plugged in and utilise between a few and 35 watts of electricity. The study found that replacing all single current supplies, which have a mean efficiency of alternating designs, which have an efficiency of 80–90%, replacing older alternating supplies with an efficiency less than 70% with advanced component designs.

SMPSs have significantly displaced singular supplies—even in warts walls. According to the 2002 research, 6% of the electricity used in the US "flows through" power supply (not including just wall warts). Despite the widespread use of SMPSs, the report's website stated in 2010 that "today's current supplies consume at least 2% of all U.S. electricity production." That usage could be reduced in half by more effective power supply designs.

An inefficient power supply, wastes electricity and is hot to the touch because squandered electrical energy is discharged as heat. In hot weather, this waste heat has its own challenges because it may necessitate the use of extra cooling systems.

3.5 Pi Camera:

The Camera Module can take both still photos and high-definition video. It supports still photography as well as the graphic codecs 1080p30, 720p60, and VGA90. It is connected to the Raspberry Pi's CSI port via a 15-centimetre ribbon cable.

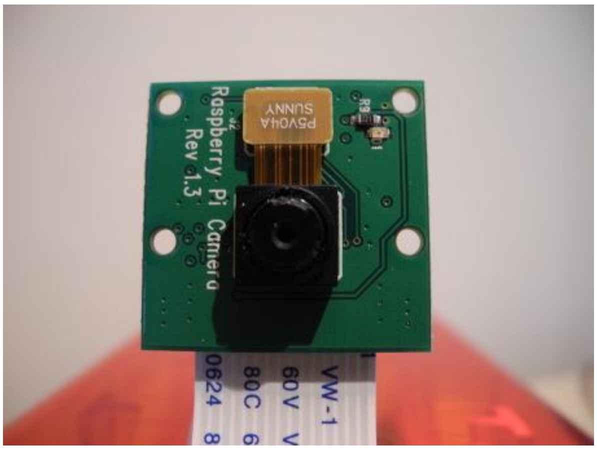

Figure 3.6 Pi camera

The cameras dimensions is a thin (25mm by 20mm by 9mm) circuit board connected to the Raspberry Pi's Camera Serial Interface (CSI) network socket by a flexible ribbon wire which can be visible in Figure 3.6. The image sensor on the camera has a constant focal lens and a native resolution of five megapixels. The camera's software supports 1080p30, 720p60, and 640x480p60/90 video resolutions, as well as full definition still photos up to 2592x1944.

3.6 Global Positioning System:

Neo-6 AGPS Receiver:

The powerful u-blox 6 position engine is used in the NEO-6 module series of standalone GPS receivers. The NEO-6 module is shown in Figure 3.7 attached with a copper wire. In a compact 16 x 12.2 x 2.4 mm dimension, these versatile and moderately priced receivers offer an extensive selection of connectivity options. Due to its two million correlators, the specially designed acquisition engine can perform massive simultaneous time/frequency universe searches and find satellites immediately. Because to their revolutionary engineering and advanced technology that eliminates jamming, NEO-6 GPS receivers perform wonderfully in navigation even in the most severe conditions.

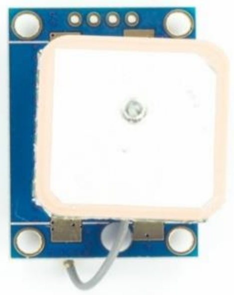

Figure 3.7 GPS Module

Specifications:

Voltage range: 2.7 to 3.6V

67 mA is the supply current.

Gain of the antenna: 50 dB

Temperature range: -40 to 85°C

Antenna types include passive and active antennas.

UART, USB, SPI, and DDC are examples of interfaces.

3.7. Global System for Mobile Communication:

The Global System for Mobile Communications (GSM), often referred to as GSM, is the most widely used cell phone technology worldwide, and its significance cannot be overstated. Cell phones connect to the GSM network of a mobile service provider by searching for nearby cell phone towers. GSM is a globally recognized standard for digital cellular communication, serving as a foundation for mobile communication systems.

The GSM module is shown in Figure 3.8 which consists of an antenna and SIM card slot for transfer of necessary messages. The standardization group responsible for developing standards for a pan-European cellular radio system operating at 900 MHz was established in 1982. This group, known as GSM, aimed to create a unified framework for mobile communication. While initially focused on Europe, the collaboration expanded, and many countries outside of Europe also adopted GSM as their preferred cell phone technology.

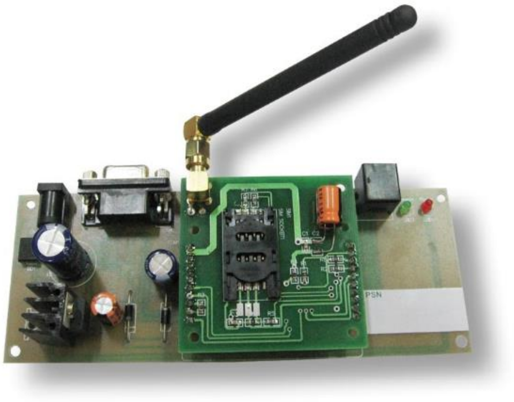

Figure 3.8 GSM Module

Modem Specifications:

A comprehensive Tri-band GSM solution in a small plug-in module is the SIM900.The SIM900 offers GSM/GPRS900/1800/1900Mhz performance for voice, SMS, data, and fax in a small form and with low current consumption. It has an industry-standard interface.

The advanced capabilities of the SIM300 enable it to work with a wide range of applications, including WLL (Fixed Cellular Terminal), M2M, handheld devices, and many more.

GSM/GPRS tri-band module measuring 40x33x2.85
Support for customised MMI and keypad/IR OBSTACLE SENSOR
Based on a stable and field-proven platform, an inbuilt robust TCP/IP protocol stack is supported by support service from definition to design and manufacturing.

Advantages of GSM:

- With over 450 million users, GSM is now widely utilised, and subscribers can use one phone in Western Europe thanks to international roaming. While France, Germany, the U.K., and other well-known European countries do not support CDMA, Asia does.
- GSM has advanced since its inception in the mid-'80s. A more stable network with solid features results from this maturity. The network for CDMA is still being built.
- Due to the maturity of GSM, engineers developed an ingrained affinity for the technology.

3.8 Relay with Taser

Relays are switches that run on electricity. Although different working theories are also utilised, an electromagnet is commonly used in relays to drive a switching mechanism. When a low-power signal is necessary to operate a circuits go through a linear signal, this is referred to as a low-power signal. The switching drive mechanism can be described through a Schematic diagram in Figure 3.9.

The first relays were used to replicate and transmit data from one circuit to another in long-distance telegraph connections. Relays were widely used during the initial computers and telephone networks to carry out logical commands.

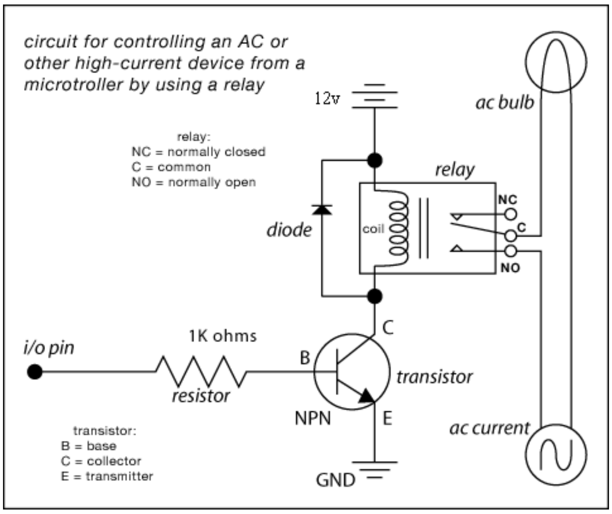

Figure 3.9. Circuit Diagram of Relay

1. Simple electromechanical relay:

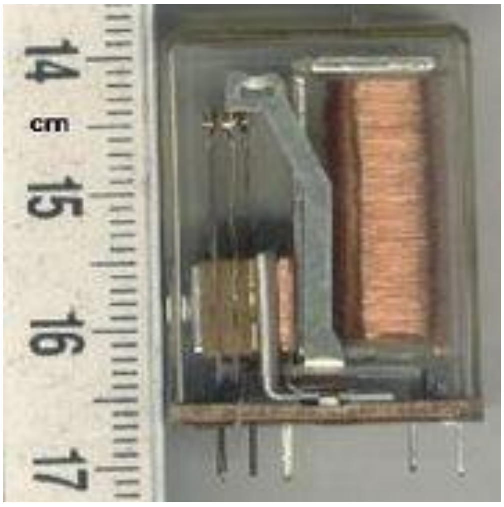

Figure 3.10. Simple Electromechanical Relay

An electromagnet can be transformed into a basic electromagnetic relay, similar to the one depicted in the first image, by incorporating specific components. The relay consists of an iron yoke that provides a path of low reluctance for the magnetic flux. Inside this yoke, there is an iron coil that surrounds a soft iron core. Additionally, there is a movable metal armature and one or more sets of fixed or movable contacts, as seen in the relay pictured (two sets of contacts are present).

The armature shown in Figure 3.10 is attached to the yoke and is mechanically linked to a sliding contact or contacts. When the relay is not energized, a spring holds the armature in position, creating an air gap within the magnetic field of the circuit. As a result, only one of the two sets of connections in the relay is closed, while the other set of contacts remains open.

Different relay might include multiple or fewer sets of connections based on how they are used. The relay in the illustration also has a wire connecting its armature to the lever. This ensures circuit integrity among the contact surfaces that move on the frame and the circuit track via the yoke, which is attached to the printed electronics board.

2. Basic design and operation:

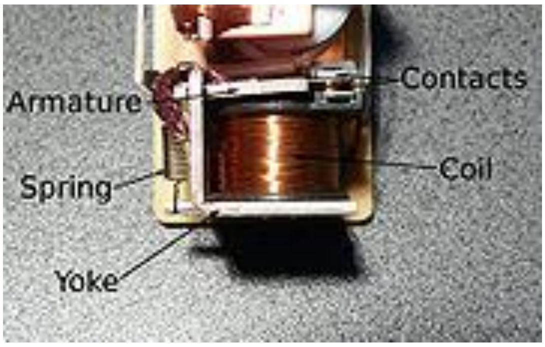

Figure 3.11 Simple Electromechanical Relay basic design

Figure 3.11 is a basic relay hardware design where when a current of electricity passes through the coil, produces a field of magnets that pull the armature, a link among a movable contact or contact and a fixed connection is created or severed.

Springs are commonly utilized in industrial motor starters to generate the required force instead of relying solely on gravity. The majority of relays are designed for swift operation and find application in low voltage scenarios.

To prevent voltage spikes that may harm circuit components when the magnetic field collapses upon deactivation, a diode is typically connected across the coil when it is energized with DC. Some automotive relays contain a diode within their relay case. Another method to absorb surges involves using a contact protection network comprising a capacitor and resistor connected in series. In cases where the coil is powered by AC, a small copper ring.

Solid-state relays can be created by employing a thermistor or other solid-state switching devices, emulating the operations of the original electromagnetic devices. Electrical isolation can be achieved using an opt coupler. Such smaller relays find applications in the field of electronics.

Relay Driver:

Since most chips (op-amps, etc.) cannot supply the current required to operate the relay coil, a transisto typically required, as illustrated in the image below(Figure 3.12).
Use BC109C or anything comparable. Most likely, a resistor in the range of 4k7 will work fine. The diode is required to break the high voltage "back emf" that is created when the current through the coil is abruptly turned off.

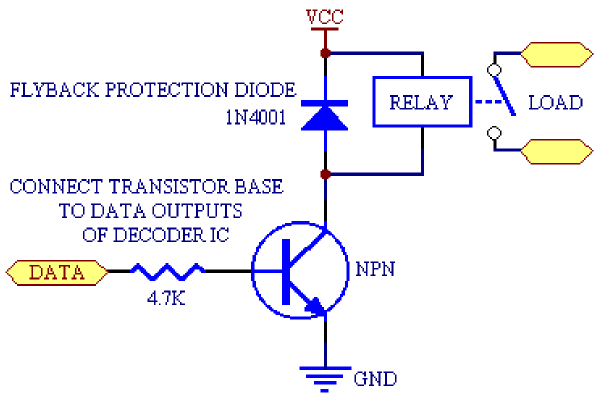

Figure 3.12. Relay Driver

3.9. LCD Display:

LCD stands for" Liquid Crystal Display". It's a type of flat- panel display that's generally used in electronic bias similar as boxes, computer observers, and smartphones. LCDs use liquid chargers to manipulate the polarization of light passing through the display in order to produce an image. They're known for their energy effectiveness, thin profile, and capability to display high- quality images with good color delicacy. TV technology has been extensively espoused in the consumer electronics assiduity due to its low cost and high trustability.

The liquid crystals utilized in an lcd are made from long, thin molecules which can be arranged in a specific sample. Whilst an electric powered area is applied to these molecules, they rotate and change the way that light passes thru them. The liquid crystals are sandwiched between two layers of polarizing fabric, which permits them to selectively clear out the mild passing via the display.

The fundamental shape of an lcd includes numerous layers. The first layer is the backlight, which affords the source of mild for the display. The second one layer is the polarizing layer, which polarizes the mild passing thru the display. The third layer is the liquid crystal layer, which incorporates the liquid crystals that manage the polarization of the light. The fourth layer is every other polarizing layer, which selectively filters the mild passing through the liquid crystal layer. Eventually, there may be a layer of coloration filters, which upload color to the image.

LCD term refers to the display of liquid crystal. It's one type of electronic display module used in many applications, such as mobile phones, computers, computers, TV set and so on. It is an extensive range of applications. These displays are chosen mainly for light emitting diode in multi-segment and for 7 segments. The main advantages of using this module are low-cost; simply programmable, animations and custom characters, animations and so on are not limitations on displaying them. Fig-3 shows the LCD image.

3.10. Software Used

Software used in this project:

- Express PCB – for designing circuit
- Raspbian OS
- Visual Studio Code
- Python Code

3.11 Express PCB:

- Breadboards offer tremendous flexibility for prototyping equipment, allowing for easy modifications to a design when needed. However, for the final output of a project, it is preferable to have a tidy printed circuit board (PCB) with fewer cables, ensuring durability and the ability to withstand a shake test. A well-designed PCB not only looks neater but also eliminates the risk of loose connections caused by unsecured cables.
- Express PCB is a software program exclusively available from the company Express PCB, and it is specifically designed for PCB design. While it is user-friendly, it does have certain limitations. Some users find its interface more reminiscent of a toy rather than a professional computer-aided design (CAD) program. The software has a limited part library, although there are workarounds available to address this issue.
- Despite its limitations, Express PCB has been successfully utilized for designing layered and surface-mount PCBs. However, one common drawback of Express PCB is its subpar print layout. Here, we will explain how to create designs in Express PCB and provide tips on optimizing the patterns for accurate printing.

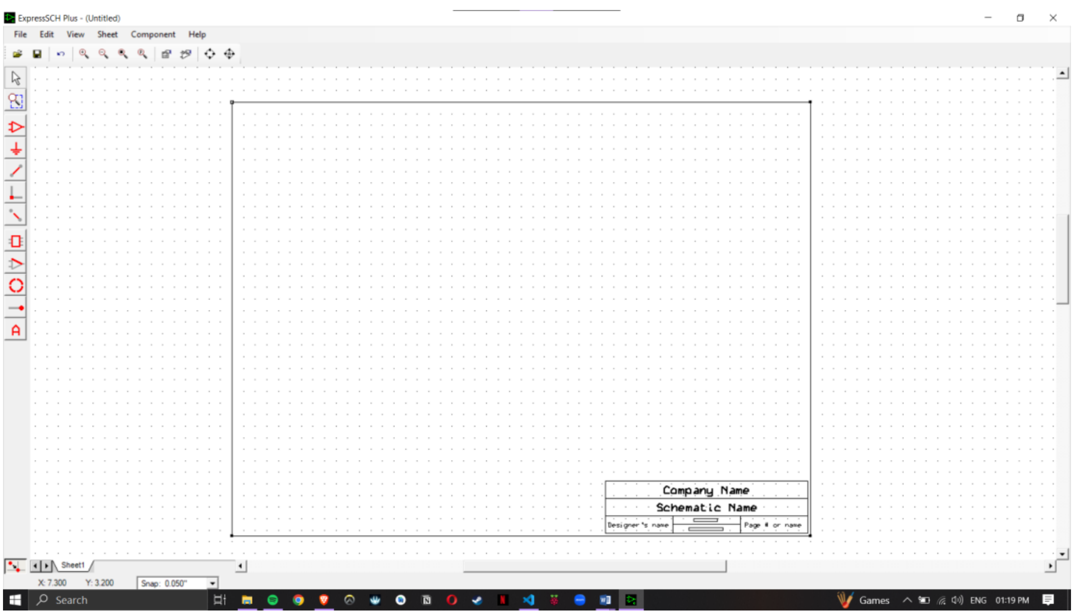

Figure 3.13 User interface of Express PCB Schematic Plus

3.11. Preparing Express PCB for First Use:

- The available parts library in Express PCB may be limited, but you can enhance it by downloading additional parts from Audio logic. Prior to starting any project, visit Sound logic and download the supplementary parts.
- To configure the workspace, navigate to View -> Options as shown in Figure 3.14. In the options menu, choose your preferred unit of measurement, either "mm" or "in". Additionally, select the option to "see through the top copper layer" located at the bottom. While the conventional color combination of red and green is commonly used, many find the combination of red and blue more visually appealing.

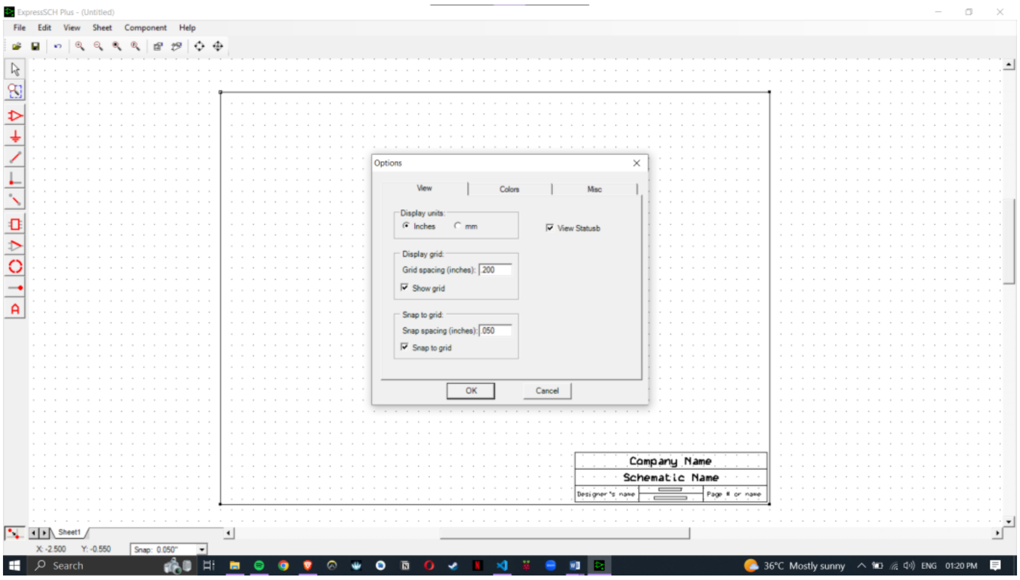

Figure 3.14 View -> Options in Express PCB Schematic Plus

3.11. The Interface:

- When starting a project in Express PCB, you will notice a yellow outline indicating the dimensions of the PCB. But, if you have specific size constraints for your board, it is advisable to crop the PCB to the required size before you begin designing. This ensures that your design aligns with the intended dimensions from the outset.

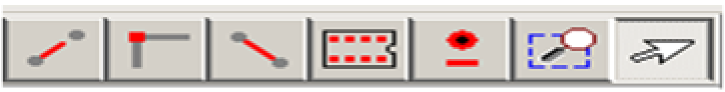

Figure: 3.15 show the toolbar in which the each button has the following functions and Tool bar necessary for the interface.

- **The select tool:** This tool allows you to move and manipulate components on the board. When selected, the top will display buttons as shown in figure 3.15 for moving the traces to the top or bottom copper layer, as well as rotating buttons for adjusting the orientation of components.
- **The place pad button:** This tool consists of pads that are useful for the board connections or when a specific part is not available in the part library but you have the dimensions. The top toolbar associated with this tool provides a variety of options.
- **The place component tool:** With this tool, selection of a component can be done on the top and place it on the workspace by clicking the buttons next to the component list.
- **The put trace tool:** This tool allows you to sketch solid traces of a wide range of thicknesses on the board.
- **The insert corner in trace button:** When selected, this tool allows you to insert a corner in a trace. This corner can be modified to map other components and provide more flexibility in the design.
- **The remove a trace button:** This button is not necessary as you can achieve the same result by using the delete key on your keyboard to remove a trace.
- **Virtual Instrumentation:** The software includes a range of virtual instruments such as oscilloscopes, function generators, and mustimeters. These instruments can be connected to the circuit for real-time monitoring and measurements during simulation, providing valuable insights into circuit performance. Virtual instrumentation is a powerful concept that has revolutionized the field of electronics and circuit design, particularly in the context of software tools like Express PCB. Express PCB provides a comprehensive platform for virtual instrumentation, enabling engineers and designers to simulate and test their electronic circuits in a virtual environment. With virtual instrumentation in Express PCB, users can create and design complex circuits, simulate their behavior, and analyze the results without the need for physical components. This allows for rapid prototyping, cost-saving, and efficient testing of various electronic systems.
- Express PCB offers a wide range of virtual instruments such as oscilloscopes, function generators, logic analyzers, and spectrum analyzers, which can be used to visualize and analyze the signals within the simulated circuits. These virtual

instruments provide valuable insights into the behavior and performance of the circuits, allowing for accurate troubleshooting and optimization. Virtual instrumentation in Express PCB empowers engineers to explore and experiment with different circuit configurations, test various scenarios, and validate their designs before moving to physical implementation. Overall, virtual instrumentation in Express PCB enhances the efficiency, flexibility, and accuracy of electronic circuit design and analysis, making it an invaluable tool for professionals in the field.

- Express PCB offers an advanced PCB design module that allows users to convert their circuit designs into professional printed circuit board layouts. It supports various design rules, auto routing, and 3D visualization, enabling efficient and accurate PCB development. PCB layout in Express PCB is a crucial step in the electronic design process. Express PCB offers a comprehensive set of tools and features to create accurate and efficient PCB layouts. With Express PCB, designers can easily place and route components, define the board shape and size, and establish clear connections between different circuit elements. The software provides a user-friendly interface that allows for seamless navigation and manipulation of components on the PCB. Designers can also take advantage of advanced features such as auto-routing and design rule checks to ensure proper signal integrity and avoid potential errors. Express PCB supports various design constraints, such as spacing rules, trace widths, and solder mask clearances, enabling designers to create PCB layouts that meet industry standards and specifications. Additionally, the software provides 3D visualization capabilities, allowing designers to examine the board from different perspectives and identify potential mechanical conflicts. Overall, Express PCB serves as a powerful tool for creating well-optimized and reliable PCB layouts, facilitating the development of high-quality electronic systems.

3.11. Design Considerations:

- Before beginning a project we can observe numerous approaches to produce a PCB design.

- When creating a PCB, gives you the option to create a single or double sided board. Single-sided boards are less expensive to create and easier to etch, but they are significantly more difficult to design for large applications. If several parts are employed in a short space, making a single-sided board without jumpering over traces with a cable may be challenging. While there is nothing technically incorrect with this, it should be avoided if the signal going via the traces is sensitive (for example, audio signals).

- A double-side board is more costly and difficult to build professionally and to etch on a DIY board, but it allows for much smaller and easier component layout as shown in Figure 3.16. It should be noted that if a trace runs on the top layer, check with the components to ensure that you can access its pins with a soldering iron.
- In the case of large capacitors, relays, and similar components that do not have axial leads, it is not possible to have traces on the top layer of the PCB unless the boards undergo professional plating. These components typically require a dedicated bottom layer for their connection since they cannot be directly mounted on the top layer of the board. Professional plating involves adding a conductive layer to the board surface, allowing for proper connection to these elements.
- When working with a double-sided circuit board, it is important to consider the placement of traces on each side. As a general guideline, it is advisable to position power traces on the top side of the board and route them to the bottom side only if necessary, such as for components that cannot be soldered onto the top plane (e.g., relays). Conversely, other traces can be placed on the bottom side.
- Certain applications, such as power supplies or amplifiers, can benefit from having a solid plane dedicated as a ground plane. This helps to reduce noise in power supplies and minimizes the distance between components and their ground connections in amplifiers, resulting in a simpler and more efficient ground signal. However, caution is required when dealing with complex chips like TI's TPA6120 amplifier, as specific considerations may need to be taken into account during the layout process.
- According to the TPA6120 datasheet, it is recommended not to have a ground plane running beneath the pins of the chip or the signal traces. This caution is mentioned because the presence of a ground plane in that area could create capacitance, which may have a negative impact on the performance of the chip.

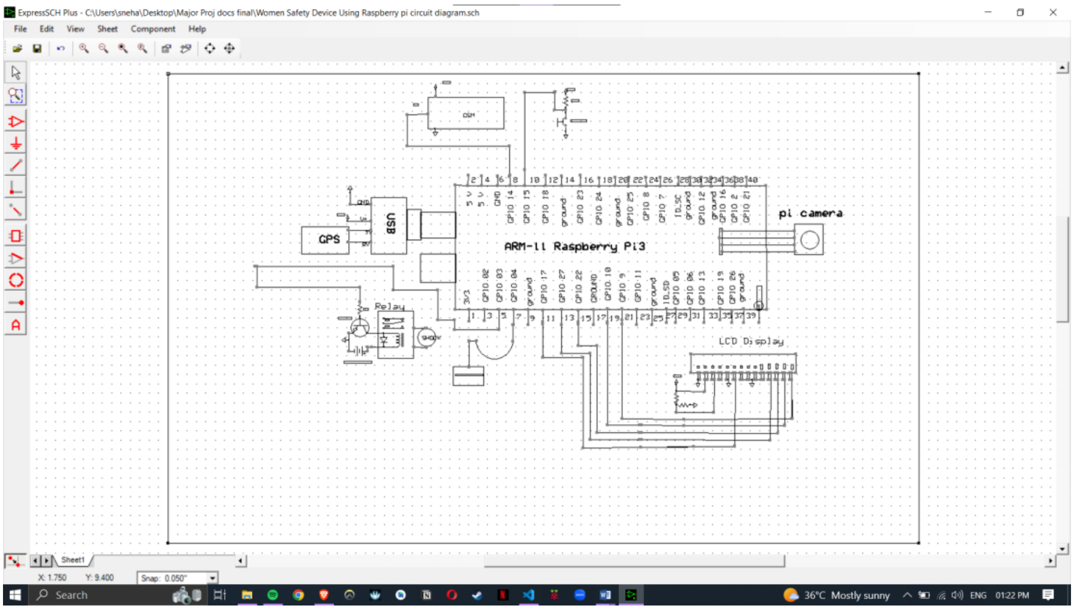

Figure 3.16 Schematic Diagram designed in Express PCB

3.12. Raspberry Pi Imager:

- The Raspberry Pi Imager is a convenient tool developed by the Raspberry Pi Foundation, designed to simplify the process of installing operating systems on a Raspberry Pi. The user interface is shown in Figure 3.17, It offers a straightforward step-by-step approach, making it easy for users to download their desired operating system, configure it, format the SD card, and write the OS onto it. All you need is an SD card reader, which is commonly included in most modern PCs.

- The Raspberry Pi Imager provides a wide range of operating system options for installation. This includes the recommended Raspbian Desktop, which is a Debian-based Linux operating system specifically designed for Raspberry Pi. Additionally, users can choose from other popular options such as Raspberry Pi OS Lite, Ubuntu Mate, OSMC, and Retro Pie. Raspbian Desktop serves as the official primary operating system for Raspberry Pi, and the Raspberry Pi Imager also allows users to utilize custom images obtained from the internet.

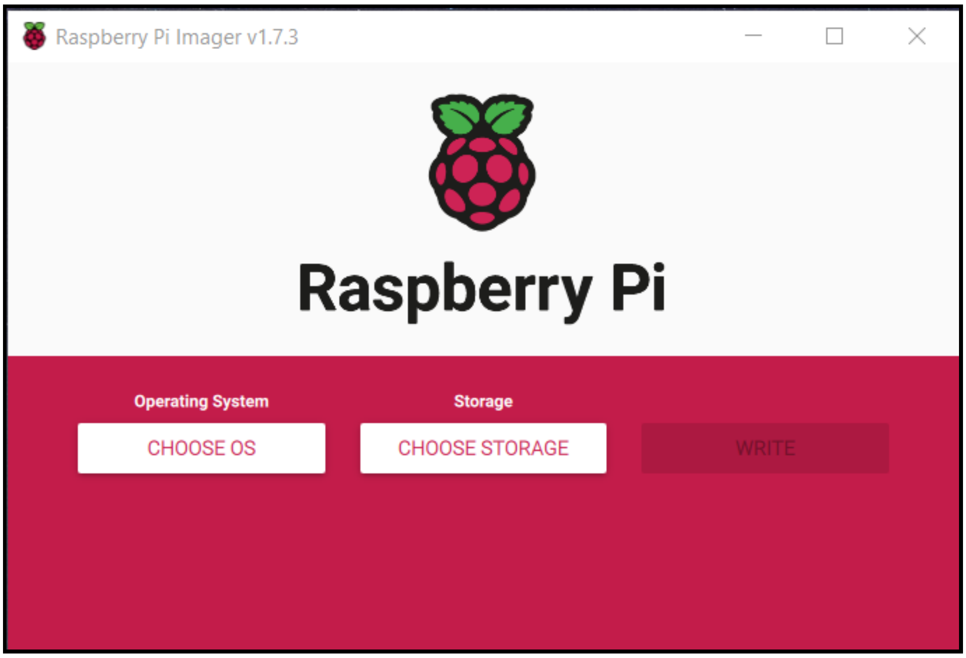

Figure 3.17 Rapberry Pi Imager to flash the micro SD card

3.13. Raspbian Operating System:

- Raspberry Pi OS is a freely available operating system that is based on Debian. It is specifically designed to be used with Raspberry Pi boards, but it is also compatible with several other ARM-based single-board computers. The initial version of the operating system, previously known as Raspbian, was introduced in 2013. In 2015, the Raspberry Pi Foundation officially adopted Raspbian as one of their endorsed distributions. Initially, Raspbian was developed by Peter Green and Mike Thompson as a side project.

- To install Raspbian Operating system on a monitor, we must install the Raspberry Pi Imager which can be used to flash the software onto the micro SD card. The user interface of the Raspbian OS is shown in Figure 3.18.

- One significant change in Pi OS is its support for both 32-bit and 64-bit images. This aligns with other Linux distributions for Raspberry Pi, like Ubuntu, which offer installers for both 64-bit and 32-bit systems. Raspberry Pi OS has been evolving over time, incorporating various features and enhancements, with a particular focus on desktop usage. This complements the hardware upgrades, such as increased RAM, faster processors, and more powerful software, resulting in a more capable computing experience. Whether used as a desktop computer, network-attached storage (NAS) device, cluster, or in other applications, the combination of improved hardware and software provides enhanced functionality.

- Raspberry Pi has included programming resources as part of its offering. To improve visibility, especially for smaller on-screen elements, there is a Magnifier app available in the Universal Access section, enhancing accessibility for all users.
- Raspberry Pi OS is an excellent choice for regular desktop usage. When combined with an 8GB or even a 4GB Pi board, the 64-bit version showcases the multitasking and general computing capabilities of this credit card-sized maker board. As Raspberry Pi OS is based on Linux, it can be easily customized to suit specific use cases. For example, you can set it up as a Raspberry Pi NAS by installing media server software like Plex, Emby, or Subsonic. Alternatively, you can transform it into a home theatre PC (HTPC) by installing Kodi and VLC. It is also well-suited for workplace productivity, such as image or audio processing and programming tasks.

Figure 3.18 Raspbian Operating System

3.14. Properties of Raspbian OS:

Raspbian OS Pros:

- Raspbian OS is free: The software can be downloaded for free from the Internet. There are no registration fees, no user fees, free updates, and publicly available source code if you want to modify the behaviour of your system.

- Raspbian OS is secure and versatile: Raspbian OS assures the confidentiality and safety of the user's data because it is connected to the same Ethernet network, which allows for point-to-point encryption and data transfer.
- Why Because the Raspbian operating system has been developed and tested by thousands of individuals, errors and people to solve them are usually discovered rapidly. It is not uncommon for only a few hours to elapse between the discovery and resolution of an issue.

Raspbian OS Cons:

- The commands that must be entered into the terminal to access a few options can be difficult to remember. To enable or activate the feature, the command must be written correctly.
- Raspbian OS is difficult to operate and complicated for beginners: It should be noted that Raspbian OS, at least the core system, is less user-friendly than MS Windows and far more difficult to operate than Mac OS. Given its success, significant effort has been done to make Raspbian OS even easier to use, particularly for beginning users.

3.15. Visual Studio Code:

- Visual Studio (VS) Code is a popular open-source code editor widely utilized for debugging and fixing coding issues in cloud and web applications. It was developed by Microsoft and is compatible with macOS, Linux, and Windows operating systems. The extensive set of tools available in VS Code enhances the functionality of written, making it a valuable asset for developers.
- Built on the Electron platform and utilizing the same editing component as Azure DevOps, VS Code offers a powerful and customizable environment for coding tasks. One notable feature is the ability to synchronize code between the server and the editor without requiring additional software. This is achieved through the use of various FTP extensions, allowing for seamless collaboration and efficient code management within the editor..
- The project's code was initially developed in visual studio code as shown in figure 3.18, giving us the ability to change the python code as needed.

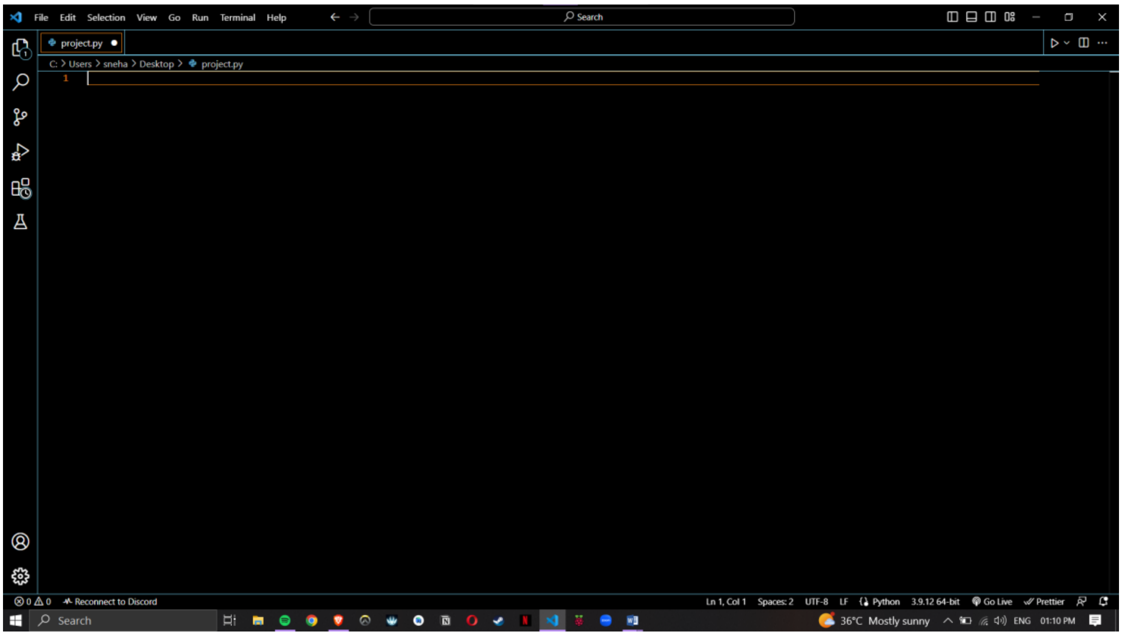

Figure 3.18 Visual Studio Code User Interface

3.16. Software Implementation:

The following software and coding languages have been used in this project:

- Raspbian OS
- NOOB's Installation
- Python 3
- Visual Studio Code

NOOB's:

NOOBS (New Out Of the Box Software) is an easy-to-use software package designed for beginners and first-time users of Raspberry Pi. It provides a simple and user-friendly way to install different operating systems onto your Raspberry Pi.

Instead of manually downloading and flashing an operating system onto an SD card, NOOBS simplifies the process by providing a pre-packaged software bundle. When you insert an SD card with NOOBS into your Raspberry Pi and power it on, you will be presented with a selection of operating systems to install.

NOOBS allows you to choose from a range of operating systems, including the official Raspberry Pi OS (previously known as Raspbian) and other third-party distributions such as Ubuntu, LibreELEC, and RetroPie. Each operating system has its own unique features and applications, catering to different needs and interests.

By using NOOBS, you can easily try out different operating systems without the hassle of manually downloading and flashing them one by one. It provides a convenient way to experiment with various software options and find the one that best suits your requirements.

Additionally, NOOBS includes recovery options in case something goes wrong during the installation or if you want to start fresh with a clean installation. It provides a user-friendly interface that simplifies the entire process, making it more accessible for beginners and those unfamiliar with the Raspberry Pi ecosystem.

Overall, NOOBS is a beginner-friendly tool that makes it easier to install and switch between different operating systems on your Raspberry Pi, enabling you to explore and utilize the full potential of your device.

Python Language:

Python is a programming language renowned for its simplicity and readability. Created by Guido van Rossum and introduced in 1991, Python prioritizes clear code syntax and easy comprehension. Compared to other programming languages, Python allows developers to express concepts in fewer lines of code.

It is a versatile language that supports various programming paradigms such as procedural, object-oriented, and functional programming. Python provides a vast standard library, encompassing a wide range of modules and functions to streamline common tasks.

With cross-platform compatibility, Python can be used on multiple operating systems. The language benefits from an extensive community of developers, ensuring abundant resources, libraries, and online support. Python's ecosystem includes third-party libraries and frameworks that extend its capabilities for specialized applications such as scientific computing, data analysis, web development, and machine learning. Python's scalability, integration capabilities, and diverse application domains contribute to its widespread adoption and popularity in the programming community.

Simulation:

The operating system used in order to program the component is the Raspbian Operating System which is accessed by the Raspberry Pi imager. The Operating system is first flashed into the micro SD card along with NOOB's files. The SD card can be inserted into the Raspberry Pi component and interfaced with your Laptop or Monitor with an HDMI cable.

Once the Raspberry Pi is interfaced, Raspbian OS will boot up and be installed. We have written the code in Python 3 language in Visual Studio code and ran the program in Raspberry Pi's OS terminal window.

With this, we have inserted the code into the micro SD card and it can further perform the tasks that we have programmed.

CHAPTER-4
RESULTS & DISCUSSION

4.1 Hardware Design:

Constructed the hardware design for our project as shown in Figure 4.1. Including Raspberry Pi, GSM, GPS, Sound Sensor, Push Button, Taser and LCD display. We used Express PCB to design the circuit diagram of our model and implemented the same connections for the hardware design.

The Circuit Diagram is shown below:

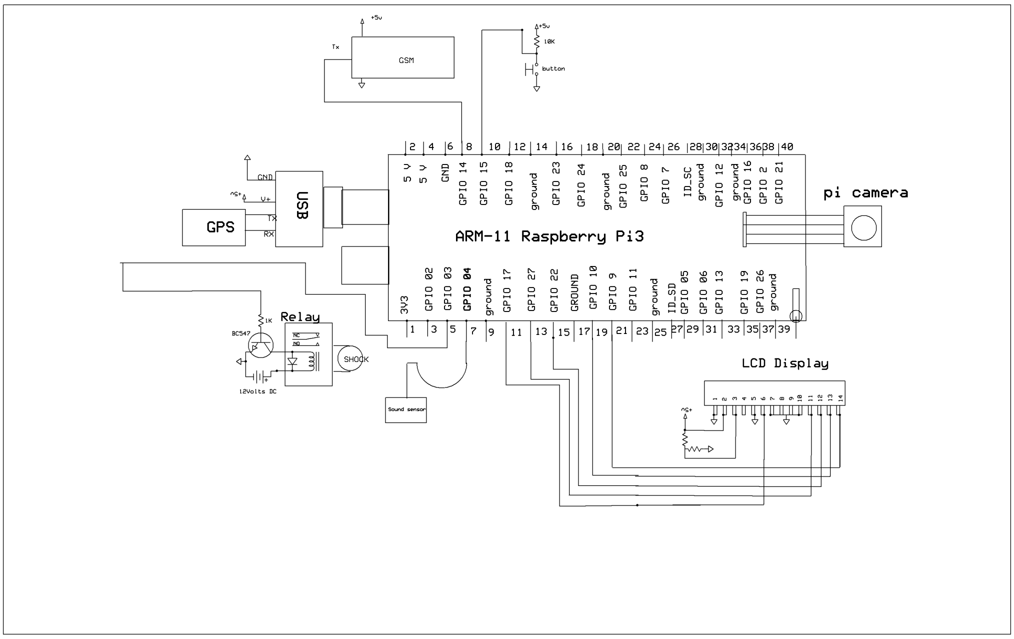

Figure 4.1 Hardware Circuit Design on Express PCB

4.2 Hardware Setup:

Designed the hardware setup for the project based on the circuit diagram created in Express PCB software. Connected Raspberry Pi 3, GSM, GPS, Pi camera, LCD display, Sound Sensor, Push Button, Taser, Relay and Adapter which can be visible in Figure 4.2.

Upon pressing the Push button, the Raspberry Pi component is activated and turns on the GSM, Buzzer and GPS or the sound sensor detects screams from the person who is in danger and turns on the kit. Once the kit is turned on the location of the person is traced based on the GPS. We can view the latitude and longitude coordinates on the

LCD display from the GPS module. Alongside this, a picture of the assaulter will be taken and send to the emergency contact or email along with the coordinates of the victim. With the help of this kit we can save any human in danger from a assaulter or intruder. The functioning of this model can be very useful for the protection of the human being from dangerous situations. The Taser seen in Figure 4.3 acts as a self-defense weapon to help the victim during dangerous situations and to give them a window to escape.

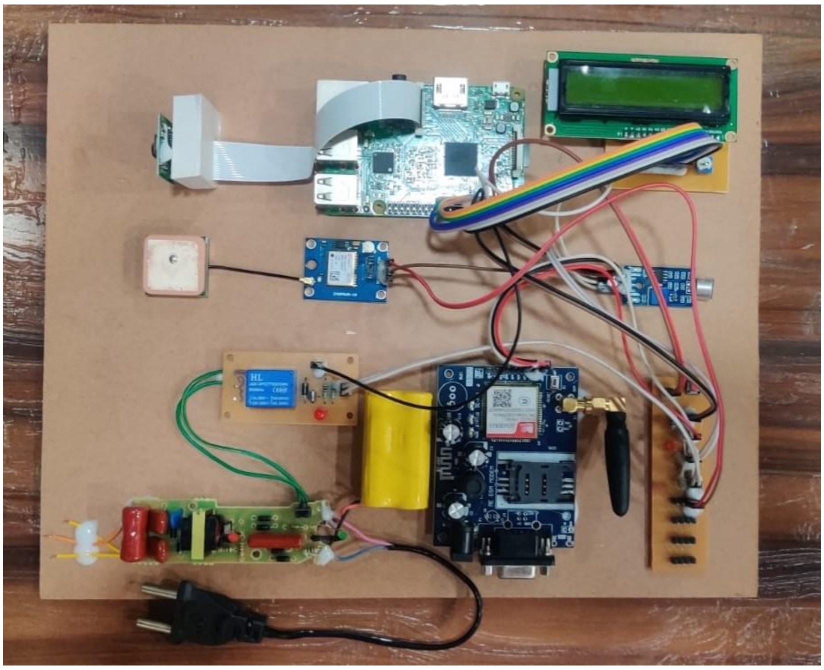

Figure 4.2 Hardware Design of the project

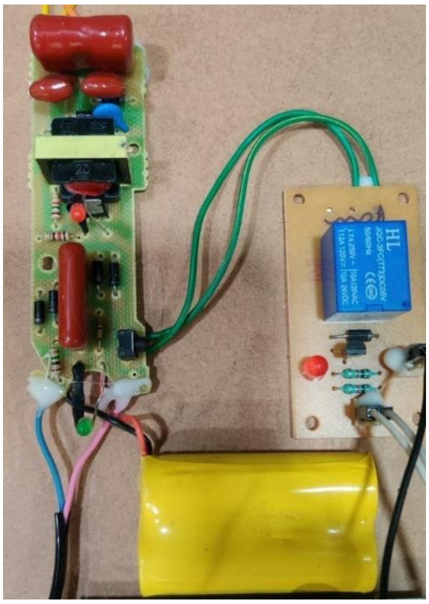

Figure 4.4 Taser with Relay

4.3 Results Obtained:

The activation of sending an alert to emergency SMS and Email can be done as soon as the victim presses the push button or his/her voice can be detected with the sound sensor and enable the GPS and GSM Modules.

Result on LCD Display:

Once the Hotspot of the mobile phone is turned and connected with the Raspberry Pi device, a message such as 'Welcome To Women's Safety' will be displayed on the LCD (Figure 4.7) as commanded in the source code of the project.

Figure 4.4 Display of 'Welcome to Women's Safety' on the LCD display

Activation of Satellite System:

The Satellite message on the LCD shown in Figure 4.5 shows us that the GPS is searching for a satellite inorder to detect the location of the victim. There are two ways to activate the alert system for the kit, one is through the sound sensor which has a specific frequency to detect any loud screams by the victim and another is by pressing the emergency push button which activates the alert system. We can observe the 'ALERT' message on the LCD. Based on this we can confirm that the kit is detecting the coordinates of the victim and will soon start to send emergency messages to the number and email written in the source code.

Figure 4.5 GPS is Searching for a satellite to detect the coordinates of the victim

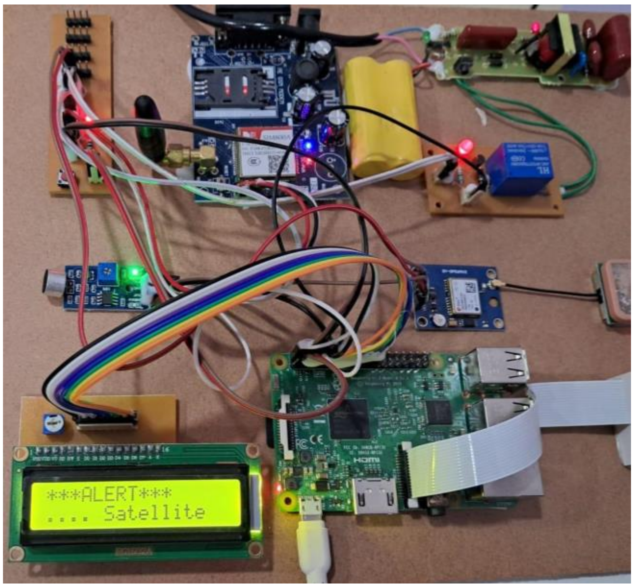

Figure 4.6 The alert system and sending alerts via sms and email have been activated

Sending Emergency Message:

The LCD Display shows that an email has been sent (Figure 4.7) to the emergency contact that has been pre inserted in the code. The email consists of the location of the victim and an image of the assaulter captured by the Pi camera(Figure 4.8 and 4.9).

Figure 4.7 LCD display shows that the email has been sent to the emergency contact

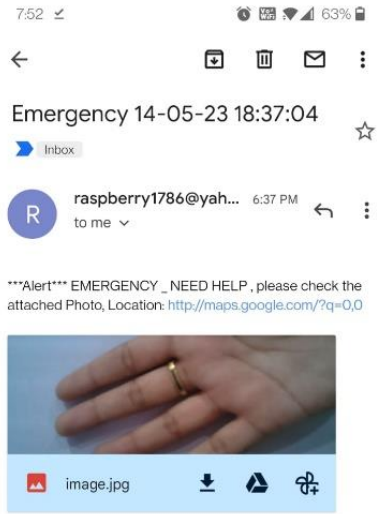

Figure 4.8 Emergency email with location and image

4.9 Image captured by the Pi camera

SMS To Emergency Contact:

An alert message has been sent to the emergency contact along with the coordinates of the victims location (Figure 4.10).

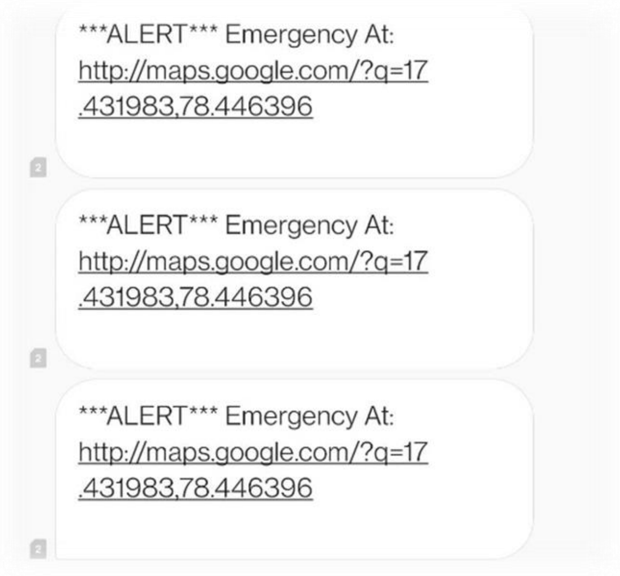

Figure 4.10 Alert SMS to Emergency Contact

CHAPTER-5

CONCLUSION & FUTURE SCOPE

5.1. Conclusion:

In our current society, we can see many aberrations towards safety devices for women in remote areas. It is necessary for them to avail the best equipment for their own safety. The various applications of embedded systems for safety devices have many applications in ones own daily life. This system has a high functionality of GSM to enable sending messages to alert the people around them. The taser is also a self defense tool which helps the individual protect themselves in dangerous moments. Therefore, this project focuses on the many ways on how safety for humans from many dangerous situations they encounter.

5.2. Future Scope:

This device can be very useful for any person who is in the window of danger. We can help to reduce such tragedies we see in our country. The Raspberry Pi module is way ahead of its time, there will not be much of a change in the microprocessor. In the mere future, this device can be improved with many other self-defence devices and more advanced technology as the world is growing rapidly. However, with this base, many more amazing applications can be created to ensure the safety of Women, Children and Men all over the world.

REFERENCES

[1] Dr.C K Gomathy, “An Effective Innovation Technology In Enhancing Teaching And Learning Of Knowledge Using Ict Methods, International Journal Of Contemporary Research In Computer Science And Technology (Ijcrcst)” *E*-Issn: 2395-5325 Volume3, Issue 4,P.No-10-13, April’2017

[2] Dr.C K Gomathy, “A Semantic Quality of Web Service Information Retrieval Techniques Using Bin Rank, International Journal of Scientific Research in Computer Science Engineering and Information Technology (IJSRCSEIT)” Volume 3 | Issue 1 | ISSN : 2456-3307, P.No:1563-1578, February-2018

[3] B.Vijaylashmi, Renuka.S, Pooja Chennur, Sharangowda.Patil ” Self[3] B.Vijaylashmi, Renuka.S, Pooja Chennur, Sharangowda.Patil ” Self defence system for women safety with location Tracking and SMS alerting through GSM network”. IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308

[4] Dr.C K Gomathy, “A Study on the Effect of Digital Literacy and information Management, IAETSD Journal For Advanced Research In Applied Sciences”, Volume 7 Issue 3, P.No-51-57, ISSN NO: 2279-543X,Mar/2018

[5] A.Priyadarshini,R.Thiyagarajan,V.Kumar,T.Radhu,"WomenEmpowerment towards developing India", IEEE Conference in Humanitarian Technology Conference,21-23 Dec 2016, Agra, India,pp.1-6.

[6] Dr.C K Gomathy, “Supply chain-Impact of importance and Technology in Software Release Management, International Journal of Scientific Research in Computer Science Engineering and Information Technology (IJSRCSEIT)” Volume 3 | Issue 6 | ISSN : 2456-3307, P.No:1-4, July-2018