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# Wearable Women Safety Device Using IoT And Machine Learning

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# ABSTRACT

With advent of technology and applied sciences in every field, the growing problem of women harassment should be brought a solution. Recently, National Women's Parliament 2021 supported by MIT- School of Government was organized to talk about women empowerment and discuss issues that women have constantly faced in the society. One of the major widespread issues that women face is Sexual Harassment and abuse at different spaces they find themselves at. From workplace to homes, there is no real space where a woman is at her safest. Recent reports have brought to our attention that there is 54% increase in women assault cases and rapes every year and it was recorded that there are approximately 87 rape cases every day in India. Experts say that one woman is raped every 16minutes in India. With enhancement of the #METOO movement and support of Women Parliaments and like-minded noble women, awareness has been spread across the nation about women safety. There are still increasing problems in the lane, and with an active role of technology in every minor aspect of human lives, this paper is hereby proposed to suggest a model where zero human intervention is required to trigger the system. Enhanced concepts of IOT are amalgamated with relevant machine learning algorithms to detect high pressure on the victim.

Keywords : IOT, Women Safety, Machine Learning

# I. INTRODUCTION

Women safety is one of the major concerns across the world, specifically in India - where population is constantly increasing with each day. While there have consistent attempts by various women committees, parliaments and women police departments and likewise groups of men and women trying to overcome this catastrophe by procuring teams to teach self defence to women, enriching men and their mindset with proper sex education from an early age, women have still never felt safe totally. Hence, the core of our project is to provide a safe zone for women to be able to live life without repetitive concern of getting raped and being the victim of malicious crimes and higher level concern their families, thereby hindering for their development and growth. Our representation of the proposed solution is to validate the recurrent crimes against women and try and stop them with the advancement and approach of technology. Machine Learning Algorithms are used to predict the crime with accuracy and emergency contacts to the nearest police stations and crime branches are set to notify them with the victim's location details. This project as a whole shows full support to the safety of an individual and with the use of collection of sensors and datasets to improve the accuracy of Machine

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Learning algorithms, this model can be tweaked and tuned to perfection.

### II. LITERATURE REVIEW

The issue of women safety is global and has attracted researchers to find varied solutions with efficiency and accuracy. The researchers reviewed number of research papers to know of the risks and the drawbacks of the existing solutions. The papers describe and discuss the problems faced by women on a daily basis. The bias that women face at workplaces and in their families is visibly clear. Various statistics have been mentioned conveying how women not only face verbal abuse and harassment but also deal with domestic abuse and sexual harassment.

These devices are triggered through heartbeat and blood pressure. Most of the systems proposed talk about huge hardware integrated with the system as a part of their prototype model. Hand gloves are made to trigger the system which might not be very comfortable and feasible to be worn by individuals on a daily basis. Cables and wires are connected inside the glove material which make the hand look larger which would not be preferred by most women. Moreover, these systems use Wi-Fi modules which might not be available necessarily at the time of the accident. It uses internet connectivity which makes the system complex and yet inefficient. Some of the solutions also center around electric shock wave technology which can also be dangerous for the victim itself. The processors and modules used in the systems are high priced. These systems use switches which are triggered using a gesture or are triggered through gestures of the skin such as sweat which does not necessarily only occur at the time of an accident. Some even require human intervention as a part of their trigger module.

The proposed paper investigates and innovates a solution that is triggered through various catch phrases and through the implementation of Word detection to alert nearest crime branches and also alerts the registered contact details that are provided by the user at the time of registration. The device created works independent of the wifi module and hence can be used even at the time of no available network. The device can easily be worn by the user without seeking any inessential attention. It is cost effective and is smaller in size which makes it easier to use. Implementation of a wearable device which can be embarked into an accessory or can be worn directly as a necklace or any such accessories that are worn either on the back or torso which will alert the nearest crime branches and registered contacts when the user says the trigger phrase. The device will be connected with an app by implementing various concepts of Internet of Things where the user can also add three emergency contacts to get in touch with at the time of urgency.

### III. PROPOSED MODEL

The proposed solution is an IoT based GPS enabled device - a security system specially designed for women in distress. It is a simple and easy to carry device with magnanimous functionality. The basic approach is to intimidate instant location and a distress message to the cops and registered number, so that unfortunate incidents would be averted and to provide real time evidence for swift action against the perpetrators of crime against women. Currently the work is under process to miniaturize it so that it could be embedded in jewelries, mobile phones etc in order to make it a versatile instrument for masses. It can play a major role in the upcoming projects such as CCTNS (crime and criminal tracking network and system) in which all the police records all over India are digitized and all the police station throughout the country will be integrated. It allows women to be

safe at every corner across the country. The device works coherently in context with the location. Any mode of action or a danger word can be set to the device for it to activate. As soon as th device is triggered, a signal is sent of the accurate location of the crime to the nearest crime resolution station – police stations/crime branches and the like.

The stations are allowed to track the location of the victim and hence the chances of reduced number of cases increase.



# NODE MICRO CONTROLLER UNIT

NodeMCU firmware comes with ESP8266 Development board/kit. Since NodeMCU is open source platform, their hardware design is open for edit/modify/build.

### Features

- Open-source
- Interactive
- Programmable
- Low cost
- Simple
- Smart

# Specification:

- Voltage: 3.3V.
- Current consumption: 10uA~170mA.
- Flash memory attachable: 16MB max (512K normal).
- Integrated TCP/IP protocol stack.
- Processor: Tensilica L106 32-bit.
- Processor speed: 80~160MHz.

- RAM: 32K + 80K.
- GPIOs: 17 (multiplexed with other functions).
- Analog to Digital: 1 input with 1024 step resolution.
- +19.5dBm output power in 802.11b mode
- 802.11 support: b/g/n.
- Maximum concurrent TCP connections: 5.

### **GPS MODULE**

# GPS(G702-001UB)

It consists of six wires out of which three wires are used for connection. The blue wire is the transmitter wire which is connected to the 15th pin of the microcontroller. Voltage supply is about 3.3V to 5V. When trigger button is pressed, GPS starts receiving signals from 8 satellites out of the 24 satellites in the orbit . Once if the connection is established the latitude and longitude values of the current location are obtained. The GPS acts as a transmitter. The 5V supply is given to the GPS from the microcontroller. Features of G702-001UB

- Received bandwidth is about 1575.42MHz.
- 50 tracking channels are available.
- Accuracy in terms of time is about 1 us.
- The maximum altitude is about 18000 m.
- Maximum speed is about 500 m/s.
- Sensitivity of tracking is about 162dBm.
- Operating temperature is about 30 degree to 80degree.

### **GSM MODULE**

- GSM(SIM 900A)
- RS 232/interface DB port.
- Low cost.
- Voice communication port.

# AUDIO SENSOR

The typical audio sensor used in most devices is a standard microphone. Microphones convert sound to electrical signals and are prevalent in many applications ranging from the typical public addressing systems to movies to laptops to mobile, wearable, and IoT devices.

Most of the microphones used in these devices are MEMS (microelectromechanical systems) sensors and are likely to be analog or digital. The output of the microphone is typically pulse-density modulated (PDM) or pulse code modulated (PCM) and data is captured from 4-bit to 64-bit and can be tuned for signal-to-noise ratio and quality of the capture.

### VOICE RECOGNIZER

Voice Recognition Module is a compact easy-control speaking recognition board. It is a speaker-dependent module and supports up to 80 voice commands. Any sound could be trained as command. Users need to train the module first before recognizing any voice command. Voice commands are stored in one large group like a library. Any 7 voice commands in the library could be imported into recognizer. It means 7 commands are effective at the same time.

This board has 2 controlling ways: Serial Port (full function), General Input Pins (part of function). General Output Pins on the board could generate several kinds of waves while corresponding voice command was recognized.

### Specifications:

- Voltage: 4.5-5.5V
- Current: <40mA
- Digital Interface: 5V TTL level UART interface
- Analog Interface: 3.5mm mono-channel microphone connector + microphone pin interface
- Recognition accuracy: 99% (under ideal environment)
- Support maximum 80 voice commands, with each voice 1500ms
- Maximum 7 voice commands effective at same time
- Easy Control: UART/GPIO

# IV. BRIEF INTRODUCTION OF THE TECHNOLOGIES USED IN THE MAKING OF THE SYSTEM

### **INTERNET OF THINGS**

IoT describes a system where items in the physical world, and sensors within or attached to these items, are connected to the Internet via wireless and wired Internet connections. These sensors can use various types of local area connections such as RFID, NFC, Wi-Fi, Bluetooth, and ZigBee. Sensors can also have wide area connectivity such as GSM, GPRS, 3G, and LTE.

### **KEYWORD RECOGNITION**

Keyword recognition is probably the simplest form of speech recognition where the focus is to ensure whether a particular word was uttered. Keyword recognition can be speaker-dependent (trained for a particular speaker) or speaker-independent (generally applicable for all).

# AUDIO CLASSIFICATION

Machine Learning is used to build a system that can recognize when a particular sound is happening—a task known as audio classification. The system will be able to recognize the voice even in the presence of other background noise. Once the data is collected, signal processing is used to extract the most important information, and train a deep neural network that can tell you whether the voice can be heard in a given clip of audio.

#### **GSM MODULE**

Global System for Mobile Communication (GSM) SIM card is a device to send the location obtained through GPS. The GSM SIM card number is registered with the system. In this proposed device the GSM acts as a receiver while the GPS acts as a transmitter. The received values from the transmitter are sent as an SMS to the few predefined emergency numbers. The receiver pin of GSM is interfaced with 16<sup>th</sup> pin of the microcontroller. The supply voltage is about 3.4V which is supplied from the voltage regulator circuit.

### **GPS MODULE**

It is a tool used for navigation and accurate positioning. It records the location in the form of longitude and latitude. The GPS receiver gets a signal from each GPS satellite. The satellites transmit the exact time the signals are sent. By subtracting the time the signal was transmitted from the time it was received, the GPS can tell how far it is from each satellite.

### V. WORKING OF THE MODEL

Women are not safe anywhere across the world and are especially at stake when they are alone or in deserted area. Observing the ongoings across the globe, not only women safety but safety at individual level is becoming important with each passing hour. The existing devices which have scope to solve rational problems require human intervention to trigger and enable the device. The given disadvantages of these existing systems are brought to an end point to come for a better and an optimum solution to solve the provided problem statement.

A wearable device will be created and integrated with an application to protect not only women but individuals at a larger scale. The device will be trained consistently with machine learning algorithms to protect and act on the spot, at the spur of the moment. The constant increase in the usage of the device and implementation of related modules will allow us to improve the accuracy of the produced results. It

comprises of hardware components such as Node Microcontroller Unit, GPS Module, GSM Module,

Voltage Regulator Circuit and a buzzer and Audio Sensor to activate the services. It is activated by the victim by clicking the button or by using a trigger word set at the time of setting up by the user. Upon clicking or as soon as the device is triggered, the current location of the victim is fetched and the information is sent to the nearest crime branches and police stations. Moreover, this information is also sent to the emergency contacts that have been set up by the user itself. This enables the user to select proper contacts to get in touch with at the time of an unprecedented event.

Mobile application is designed with features using various modules utilized in order to implement the given module such as - GSM/GPS module, communication modules to transfer data from the wearable device to the application - it can be Wi-Fi or Bluetooth. Once activated, the GPS location is sent to the predefined contacts and police control rooms. Another utility of the proposed solution is that the mobile app will be used for women safety where safe locations from victim's current location - the location of the assault will be shown on the map so that women can herself reach the safe place from her current location. Machine Learning Algorithms are used to make the system dynamic and reliable for users as it gets trained constantly with the ongoing of events.

### ADVANTAGES OF THE PROPOSED DEVICE

- Can be used for the safety of women.
- Can be used for the safety of children.
- Can be used for the safety of elderly aged people.
- Can be used for the safety of physically challenged people.
- Can be used as a legal evidence of crime with exact location information for prosecution.

# APPLICATIONS OF THE PROPOSED DEVICE

- Compact in size.
- Wireless connectivity.
- Easy and fast to install.
- Easy Maintenance
- Low cost with high performance.
- Works round the clock

# VI. FUTURE SCOPE AND ENHANCEMENT

As a mark of first-hand security and reaction of trigger, shockwave technology can be inbuilt directly in the device to protect the security of women at individual level. A more optimized version of the device can be built in order to protect every individual, not just confined to women. A module which detects handheld cameras can also be added to protect individuals from violation without their knowledge. A spy camera can be used to record the culprit which can also further be used for prosecution.

### VII. CONCLUSION

Women safety has always been an issue even in these modern times with so much advancement in technology. Women are not safe anywhere and are most vulnerable when traveling alone into lonely roads and deserted places. Even in crowded places, women often find themselves at risk. Especially in a country like India where the crime rate increases at a greater ratio than the population growth rate, it is becoming extremely important each day to keep personal check for our own safety. Existing hand held safety devices for women require human intervention for activating the device such as pressing the button or shake the device etc after sensing the danger. The current paper proposes a solution which will try to overcome the disadvantages of the existing systems and also aim at

providing fool proof safety to women. The proposed work aims at designing an IoT based safety device that relies on providing security to women by fingerprint-based method of connectivity to the device and alerting nearby people and police when a woman is not safe.

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