Voice-Controlled Tool for Anytime Safety of Women

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Abstract:
The 21st century is the era of women empowerment; this includes not just financial safety but social security as well. Women are actively participating in moulding a new society in every way but when it comes to security against sexual assaults, acid attacks, rape, and murders, the scenario is utterly shameful. According to Georgetown University's Institute for Women, Peace, and Security (GIWPS) which evaluated 167 countries in the world released its second report in November 2019 on Women, Peace, and Security Index, , Out of 167 countries India stood at 133rd position on women safety holding index score of 0.625, which makes India one of the most dangerous country with respect to women and child safety [22]. This situation should be taken seriously by government authorities and all the citizens of India to make this place safe for women to live in. Women in the workplace feel vulnerable and insecure because of the environment and no means to defend themselves from a difficult situation. They have to bear various verbal and physical harassments, most of such complaints are not registered or acknowledged. Many such devices women safety have been launched in the market and almost all of them are manually driven like pressing button or access through a mobile app, However, such heinous crimes happen suddenly and thus the victim never gets enough time to escape hence these devices fail to ensure maximum safety in all possible ways, here arises the need of advance protective system to tackle with as many vulnerable situations possible. To overcome such problems Voice-controlled smart band for women is built. This survey paper covers the statistics and details of increase crime rate against women and minors along with design, working and implementation of " Voice-controlled smart band for women" 1) This device gets activated by the voice of the victim and it starts tracking the location of the victim using the GPS module of the device, whenever voice command matches, an alert message is sent to the pre-registered contact number. 2) The mobile phone GPS is used to trace the nearest location and send a call or SMS to the nearest police location mentioning the victim's location and an alert message wrist band for women is implemented. 3) An attacking circuit is attached along to keep oneself safe and escape to some safe place.

Keywords **- Global Positioning System (GPS), Global System for Mobile (GSM), Bluetooth Low Energy (BLE), Arduino, Voice Recognition, defending system**

I. INTRODUCTION

Day by day increase of cruelty bullies and assaults on people walking in streets, public places, workplaces have increased fear among people. This situation cries for huge demand for protective gadgets for their safety. Although there are many ways to record criminal activities like installation of CCTV cameras in streets and work areas, introducing street lights etc however in such situations the attack is sudden and victim has no means to ask for help and defend themselves. According to recent study there are lot of under reported cases of crimes against women, minors and people with disabilities. In this COVID pandemic time tremendous increase in distress calls from domestic violence victims and other minors and women have been recorded, this data is released by National Commission for Women (NCW). This highlights the point that women feel helpless when it comes to defend themselves from physical abuse. A rapid help and one tap attacking system could be a smart way to tackle the situation and help themselves even if guardians/ police are far. As per the NCRB report released in 2019, In India 37% increase of rape cases against Scheduled Castes women is been recorded and 20% increase in assaults and these are just reported statistics many cases are never reported. The data of Crime in India 2019 report says Rape made nearly 8% of crimes against women in India in 2019, a total of 32,316 registered cases (including 283 incidents of murder with rape and rape of girls).[22]

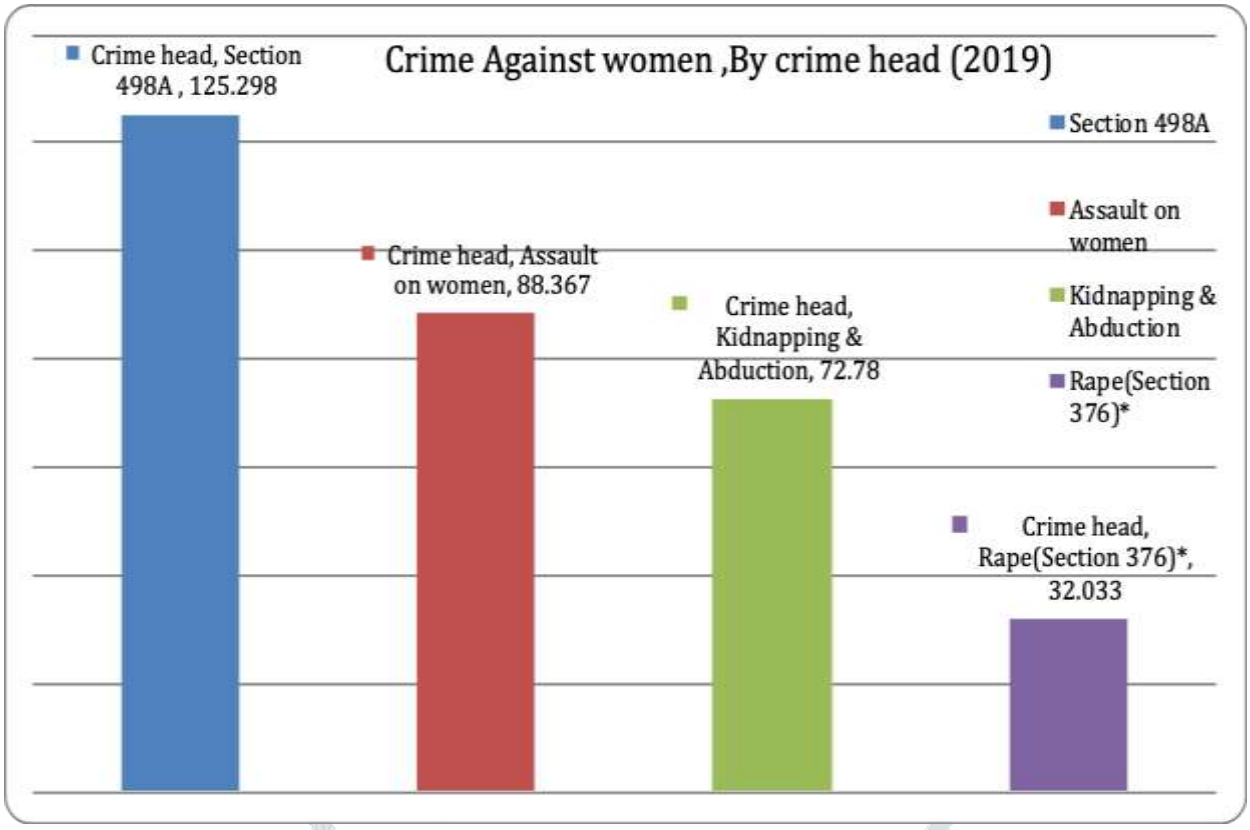

Figure 1. Crime in India report 2019, National Crime Records Bureau. Note: *Data do not include cases of murder with rape. Source: https://scroll.in/article/975362/in-just-four-years-crimes-against-women-increased-in-uttar-pradesh-by-over-66

The report says 80% of rape survivors/victims are adult women, in the age group of 18 to 45 years of age, 60% are in the age group of 18-30 years. The below table suggests the number of registered cases in the various police stations of major states in India. Assaults against minors have also increased [22].

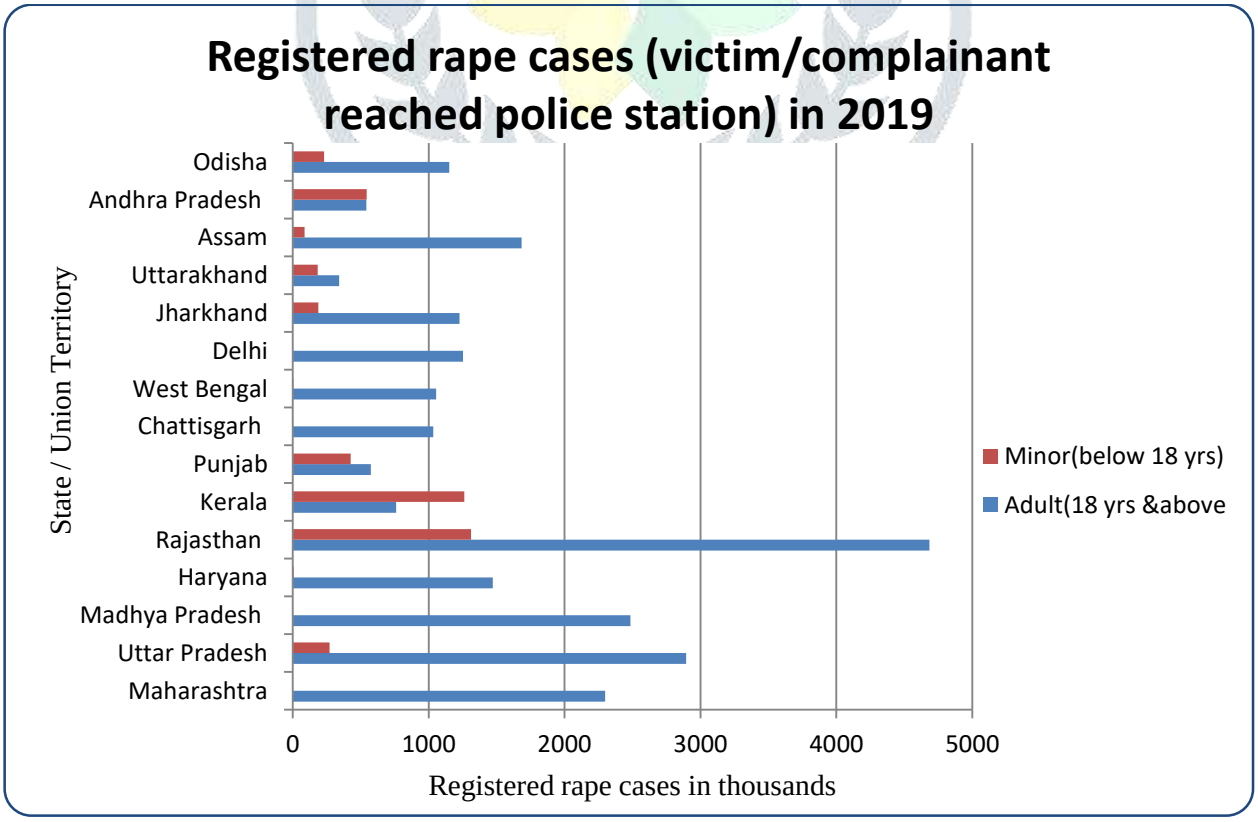

Figure 2. Registered rape cases in various states. These data cover the record of crime against adult and minors Source: https://en.wikipedia.org/wiki/Rape_in_India

The report says Rajasthan accounts for the highest number of cases against women and minors. There are many apps like the VithU app and SHE app which were developed keeping women's safety as their prime motive however those apps confiscate the data of the user and the phone has to be on all the time for the app to work. Our idea is to introduce a device that ensures all-in-one protection to women, children, and elder people. It is an independent portable hardware device that has easy functioning and whenever any dangerous situation occurs one can instantly connect with people and ask for help. The entire functioning happens such that when the victim shouts or asks for help, the location of the victim in the form of a message is sent to the pre-registered numbers. The device that the victim will have will be a band that will have GPS and GSM module attached along with Arduino. A defending system that produces electric shock is also attached so that victims could attack the culprit and flee from the danger. As observed women having disabilities also go through a lot of harassment which is mostly never reported Our system will be easy to operate and is wearable. The device is connected with the mobile app using a Bluetooth module and provides multiple ways to provide input for the system to activate and do the functioning. So even if the user is a minor (below 18 years of age), adult, or any women who are disabled she would be able to operate the device without any difficulty.

For the paper writing and the components the authors have referred papers [12, 13, 24].

II. PROBLEM IDENTIFICATION

Existing women security systems can take action only when the victim presses the device or puts some pressure on the device. This system is helpful, but not in every situation. It will fail in the following scenarios: -

If the victim's hands are tied or his/her hands are in the control of the criminal.

If the victim's relatives are not able to take necessary action on time due to far distance

So, With the help of voice, the victim can activate the device when they are not able to activate the device with hands. As soon as the device is activated the location will be sent to the relatives as well as the nearest police stion.

III. REVIEW OF COMPARATIVE TECHNOLOGIES UTILISED FOR WOMEN SAFETY

Smart Girls Security System: - The system emphasizes providing security to women with the sole purpose that women should always feel safe and they never feel helpless while facing any such issue. This system comprises modules such as GSM (SIM 900A), Arduino ATMega328 board, GPS(GYGPS6MV2), buzzer alarm (APR 9600), pressure sensors, and a power supply unit. If pressure sensor in the devices crosses the threshold level, then the device is automatically activated and then location of the victim is sent to the relatives and police control system [11]

Women safety system using GPS and Wi-Fi with live location tracking: - This system has the potential to detect the condition and location of the victim. Accordingly, then necessary actions are taken. Then based on the heartbeat and temperature of the victim necessary actions are taken. The system also consists of the button which when pressed, sends the location information to the police and relatives. The limitation of the device is that if the Wi-Fi connection is lost then the entire system will fail. [12,14,15,19,20,24,25]

Smart Security Solution for Women based on Internet of Things (IoT): - It is a smart wrist band device that can continuously communicate with the smartphone has a proper internet connection. The smartphone application is pre-programmed and it contains human behavior and reactions according to the different situations. The signal generated from the hardware system is transmitted to the smartphone application. Once the application receives the signal it sends the necessary information like location to the nearest police station and family members. The limitation of this device is that both the parties that are the victim and the family members and police station need to have the application installed. Hence for successfully sending and receiving the location both need to have a proper network connection else the device will fail to cater to the needs.[13]

VithU application: - It is an emergency software application which came into the market by the crime series named “Gumrah". If the power button of the smartphone is pressed consecutively two times then it sends the location of the victim to the family member at every 2-minute interval. The limitation of the device Is that it will fail if the smartphone discharges.

Smart Belt: -It is easy to carry a device that is similar to a daily wear belt. The belt comprises modules like Arduino, screaming alarm, and pressure sensor. As soon as the threshold level of the pressure sensor crosses the device will be automatically activated and the screaming alarm will start making noise. The limitation of this device is that it needs to be charged always. If the device discharges it will not function anymore. So, it can have an alternative to send the location via a smartphone application as well.[14]

ILA security: - It consists of three alarms that can give shock and disorient the attacker. The alarms were developed by Mc Given, James Philips, and Neil Munn.

Women Safety System Based on IOT technology – This device comprises of ATMega2560, GSM(SIM900), GPS(Neo-6M), IOT module (ESP-12E), trigger, Neuro Stimulator, Buzzer, and a vibrating sensor. If the user senses a danger, she needs to press the trigger of the device. Then the device activates, it will start tracking the location and message will be sent using GSM to the pre-registered mobile numbers and nearest police station. IoT module tracks the location continuously and does the required updations.[15]

Design and Implementation of Women Safety System Based On IoT Technology --- The device comprises of trigger, microcontroller (ATmega2560), GSM module (SIM900), GPS module (Neo-6M), IoT module (ESP-12E), Neuro Stimulator, Buzzer, and Vibrating Sensor. If a woman senses danger she has to press the ON the trigger of the device. Once the device is activated, it tracks for the current location using GPS (Global Positioning System) and will send an emergency message using

GSM (Global System for Mobile communication) to the registered mobile number and nearby police station. IoT module is used to track the location continuously and update the webpage.[5]

IV. SYSTEM IMPLEMENTATION

The primary objective of our project work is to build a system which is an all-in-one security system for the user. It is developed to cater to the security need of women of all the age-groups. This will help to reduce the crime rates happening against women and it will also help in taking necessary action against the criminals.

Principle of Working

The principle of the Voice-Controlled Security System for women is to take the voice input from the user when they are in danger. This voice input of the victim is then recognized by the device which in turn activates the device and then the location of the victim is shared with the nearby police station and family members. Until help arrives, the victim also has the option to press the switch to activate the siren and the shock generator to give the shock to the perpetrator.

A. Functional Working of system

The device has 2 input controls. The first input is the Manual Input control and the second input is the Speech input. These both the inputs are given to the Arduino Uno. The Arduino Uno is working as the central processor in the project. The programming code is written in the C language and is fed into the Arduino. The GPS and GSM connected to the Arduino are used for sending the location to the pre-registered numbers of the family members and the nearby police station. The Neurostimulator connected to the Arduino will generate electric shocks to keep the perpetrator away for some time. BLE(Bluetooth Low Energy) module connected to the Arduino is used for the wireless serial communication which will be done with the mobile application. To check suitability of processor authors have referred papers [16, 17, 18, 21]

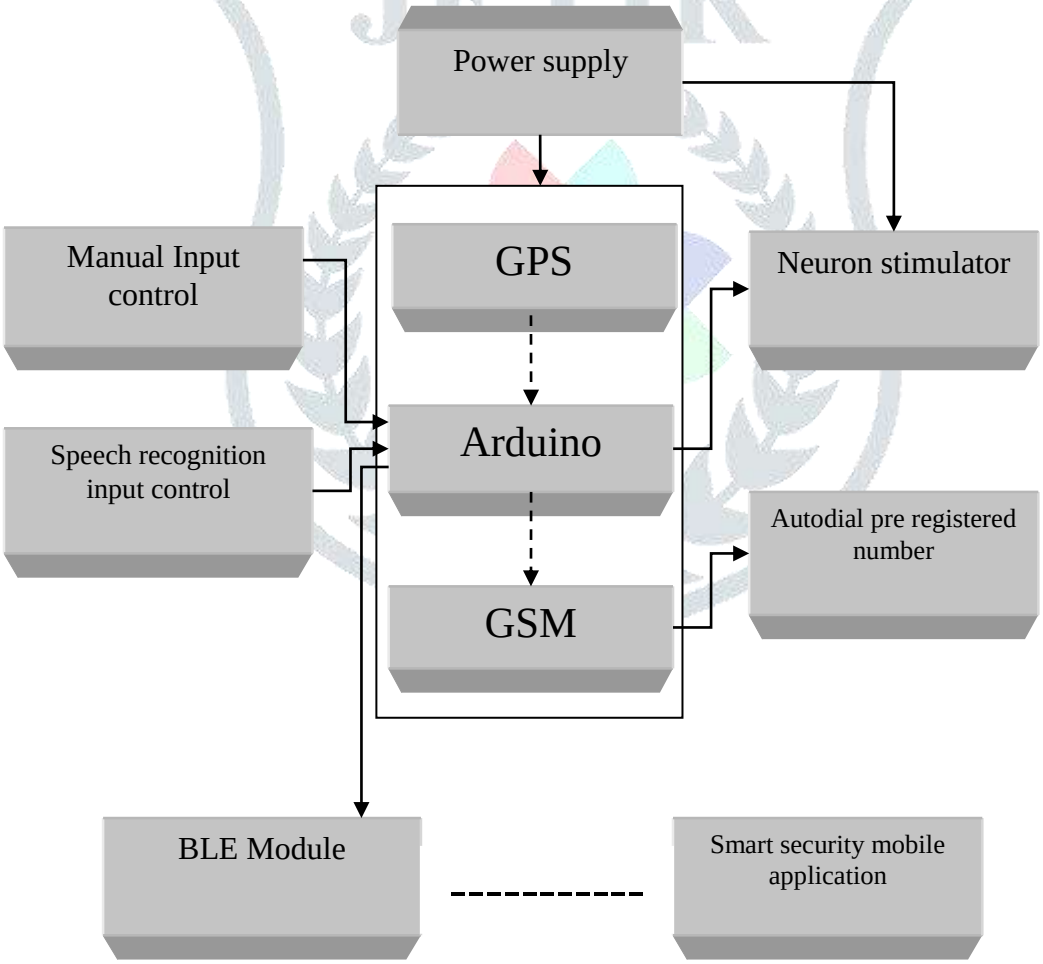

Figure 3. System Hardware requirements and block schematic

HARDWARE REQUIREMENTS

Arduino ATMega328 board: - Arduino ATMega328P board is a hardware device that consists of 14 digital input-output pins. Out of the 14 I/O pins, 6 pins are available for the use of PWM output. It also consists of 6 Analog Inputs. There is a 16MHz quartz crystal, a power jack, reset button, ICSP header, and a power jack. We can simply connect it with a USB cable or we can

power it up with an AC-to-DC adapter or with a battery to start the Arduino. It is a low-power CMOS 8-bit microcontroller having enhanced RISC (Reduced Instruction Set Computer). To increase the performance of the Arduino, the AVR uses Harvard architecture.

GPS (Global positioning system) module: - A satellite-based navigation system that is made up of at least 24 satellites. It has the potential to work anywhere with any weather condition. It transmits 2 low-power radio signals. The signals travel through the line of sight. For connecting GPS with Arduino, the ground pin (GND) of GPS is connected with the ground pin (GND) of Arduino. The transmitter pin (TXD) which is used for serial communication is connected with the digital pin(D3) of Arduino. The receiver pin (RX) which is also used for serial communication is connected with the digital pin (D4) of Arduino. The VCC pin is used for supplying power to the module. It can be directly connected to the 5V pin of the Arduino.

BLE (Bluetooth Low Energy module): - It consists of a serial/UART layer with the help of which it can interface with various microcontrollers. The purpose of the BLE module is to create simple connections with applications. It is controlled via the AT commands which are sent over the Serial UART connection. BLE module is connected with Arduino by connecting its VCC pin to the 3.3V or Arduino. The ground (GND) pin of BLE is connected with the ground (GND) of Arduino. The receiver of BLE is connected with a digital pin(D8) of Arduino. The transmitter pin of BLE is connected with the digital pin(d7) of Arduino.

Shock Generator Circuit: - We have used a shock generator circuit to provide extra security to women. She can use this option to give an electric current shock to the perpetrator. We are using the shock generator circuit which is present inside the mosquito bat for our project. Whenever the user presses the button of the circuit it will give a shock. This circuit consists of a charging circuit, high voltage generator circuit, voltage multiplier circuit. The charging circuit unit is for charging the shock generator circuit. A high voltage generator circuit is one of the important parts of this entire circuit. The purpose of this circuit is to convert the low DC voltage to high AC voltage. A voltage multiplier circuit is used for stepping up the voltage.

GSM (Global System for Mobile Communication): - We are using the SIM900A module which allows users to transmit data over GPRS. It allows sending/receive SMS and calls. It uses USART communication for communicating with the microcontroller. To configure this module is different modes and to perform various functions like calling, sending SMS, posting data to a site. Firstly we need to insert the SIM card into the GSM module and lock it. To give power to GSM, connect it with the 5V pin of Arduino and the ground (GND) pin of Arduino. Connect GSM's 5VT pin to the D9 pin of Arduino. The 5VR pin of GSM is connected to the D10 of Arduino. This is done to achieve serial communication between Arduino and GSM.

Voice Recognition module: - The voice recognition module in our device is used for matching the voice input given by the user and to activate the device.

Table 1. Processor Comparison

Sr.no.	Parameters	Arduino	8051 microcontrollers	PIC	ARM
1.	General	Arduino Uno is a board and not any microcontroller. The heart of Arduino is AVR Atmega328 microcontroller. It is built on modified Harvard Architecture and follows Reduced instruction set computing (RISC).	It is an 8 bit microcontroller and is built on Von-Newman Architecture and follows Complex Instruction Set Computer (CISC). It comes in dual inline package (DIP) having 40 pins with 2 Timers and 1 serial port.	PIC stands for Peripheral Interface Controller/Programmable Intelligent Computer. They are available as 8/16/32 bit microcontrollers. It is built on Harvard Architecture and follows RISC (Reduced Instruction Set Computer). it easily interfaces with other peripherals like RFID scanner microSD card etc. Its PIC family includes PIC16, PIC17, PIC18, PIC24, PIC32 etc.	An ARM processor is 16 bit /32 bit /64 bit processor and it is based on Harvard bus architecture and follows RISC (reduced instruction set computer) .Back in 2008, ARM processors were used as processor in mobile phones. LPC2148, ARM Cortex-M0 - ARM Cortex-M7 are some common ARM processor

2.	Power Supply	The Arduino operates between the range of 6V and 20V (recommended range 7V-12V). The power supply can be given by direct current barrel, 12V battery or into the Vin pin. 5V and 3.3V built in regulators are available to protect the device from damage.	This Intel 8051 operates at a voltage range between 5 volts or above to a maximum of 6.6 volts. To maintain the proper functioning of the device, a constant power supply regulator or diode is must.	It operates on 5v to 6.6V. PIC micro-controller responds faster as compared to 8051 microcontroller.	Less power consumption. Battery life is good as compared to other processors
3.	Memory	The Arduino Uno has only 32K bytes of flash memory and 2K bytes of SRAM. It also uses another form of memory, the EEPROM to store long-term information but is slower than SRAM.	It contains 128 bytes of RAM which are assigned addresses 00 to 7FH.It has 4 Kilobytes of ROM It contains external memory up to 64K bytes. It does not have EEPROM in it.	It uses FLASH memory, SRAM. It works on 4 clock per instruction cycle and due to the lengthy programming, it consumes more memory than other processors.	It uses EEPROM, Flash, SDRAM memory. ARM executes almost all the instruction in only one cycle. It performs high speed operation but the space complexity of the programming is more.
4.	Cost	It is bit costly than 8051 microcontroller with respect to hardware. However the software Arduino IDE is open source platform is free. Arduino's hardware and software altogether is inexpensive.	The 8051 microcontroller chip is cheap, however the keil software comes with special features which comes in licensed version which makes the overall processor costly	The cost of hardware is less than other processors but the licensed version of software is costly. Many features are not available in freewares.	They are cheaper as compared to other processors.
5.	Programming	Programming in Arduino is written and compiled on Arduino Integrated development environment and the language of code is C and C++, it makes it easy to code and understand the programming. Code is been uploaded on the Arduino board using the USB cable which connects the board and PC on which IDE is installed.	To code for 8051 microcontroller we need to know keil Uvision Integrated development environment .one must know pin and registers definitions and how to call sub functions. It is embedded programming which makes it difficult to program.• 8051 micro controller takes more than one cycles in almost all the instruction except register transfer	MPLAB X is used for the development of the PIC. The code program is lengthy. Extra plug-in is used to connect with peripheral hardware devices. Special programs are needed for execution of simple actions. One need to specific address to the banks. Arduino is comparatively easier to program	ARM processor's clock frequencies limit the speed and memory bandwidth. Instruction scheduling makes debugging difficult. One operation is performed at one time.
6.	Communication Protocols.	USART, (special purpose AVR support CAN, USB etc) UART, SPI, I2C	I2C, USART, UART, SPI	USART, UART, CAN,LIN, Ethernet, SPI, I2S	UART, DSP, USART, LIN, SAI(serial audio interface) I2C, SPI, IrDA, CAN, USB, Ethernet, I2S,

SOFTWARE REQUIREMENTS

Eclipse/ Android Studio: - Eclipse and Android Studio are two different integrated development environment which provides various tools for android application. Eclipse is java IDE but supports other languages as well Android Studio on the other hand is an official integrated development environment (IDE) of google.
In our case, we are using android studio. It contains various layouts according to the size of the device screen and helps in building files that are needed for android development. XML files are created to build an interface for an app. Android Studio contains various app components like activity, broadcast receivers, and services after the creation of the interface Java file is created to perform input and output functions. So, this can be done by setting the Content view of the java file to XML layout. The Android Emulator in the android studio is used for simulating android devices with computers and is used for testing your android application. Data transfer rate through Emulator is faster than the USB connected to a device. In our case, we need to make sure our women's safety app is compatible with all the android devices available. This saves our time for checking user experience in every physical device.

Arduino Integrated Development Environment: - Arduino Software (IDE) is free open-source software. It is used to upload code in various Arduino boards. It is a cross-platform application and compatible with windows, Mac OS and Linux. The code in Arduino IDE is written in C, C++, and java language. The wiring project supplies a software library to perform procedures like input-output on different ports. The sketch is another name of code written in Arduino programming language. ino extension is used to save the sketch. A sketch has two functions one is called setup () which is called once and the other is the loop () which is called often according to the requirement of the program. Just like C programming we use various sub-functions and constants and upload them on the board which performs the task as the function is invoked. Some function include pinMode(), delay() and digitalWrite(). There are some built-in constants in the Arduino programming language that is High (used for high voltage, here for Arduino Uno it is 3V- 5V) and LOW (used for Low voltage). The sketch is compiled in the integrated environment and is uploaded to the board using the cable. Then power supply is given to the board and now all the pins have some tasks like taking input or output or connection with some other peripheral devices and then Arduino does the task line by line according to the sketch written and compiled.

Altium: -The features are built into Altium Designer's unified design environment. With Altium Designer, you can quickly create and evaluate schematics for intricate electronics**.** Set the rules, constraints that are required for the design upfront as you create the schematic. The schematic editor in Altium Designer is easy to use and integrates with other important design features, including a SPICE simulator and a schematic capture feature.

B. System Flowchart:

The flowchart depicts the entire working of the system. The system will start sending location to the nearest police station and family members once the voice input given by the user matches to the already fed input in the voice recognition circuit. We have given priority to voice input as in any danger situation the victim will always try to shout for help, and this shouting voice will trigger our device hence making it more efficient to use. As voice of the user will turn the system on, this will make the system more efficient, flexible and faster.

The performance of the system as compared to other similar systems is enhanced in terms of taking input, which in turn helps in taking faster actions to save the victim.

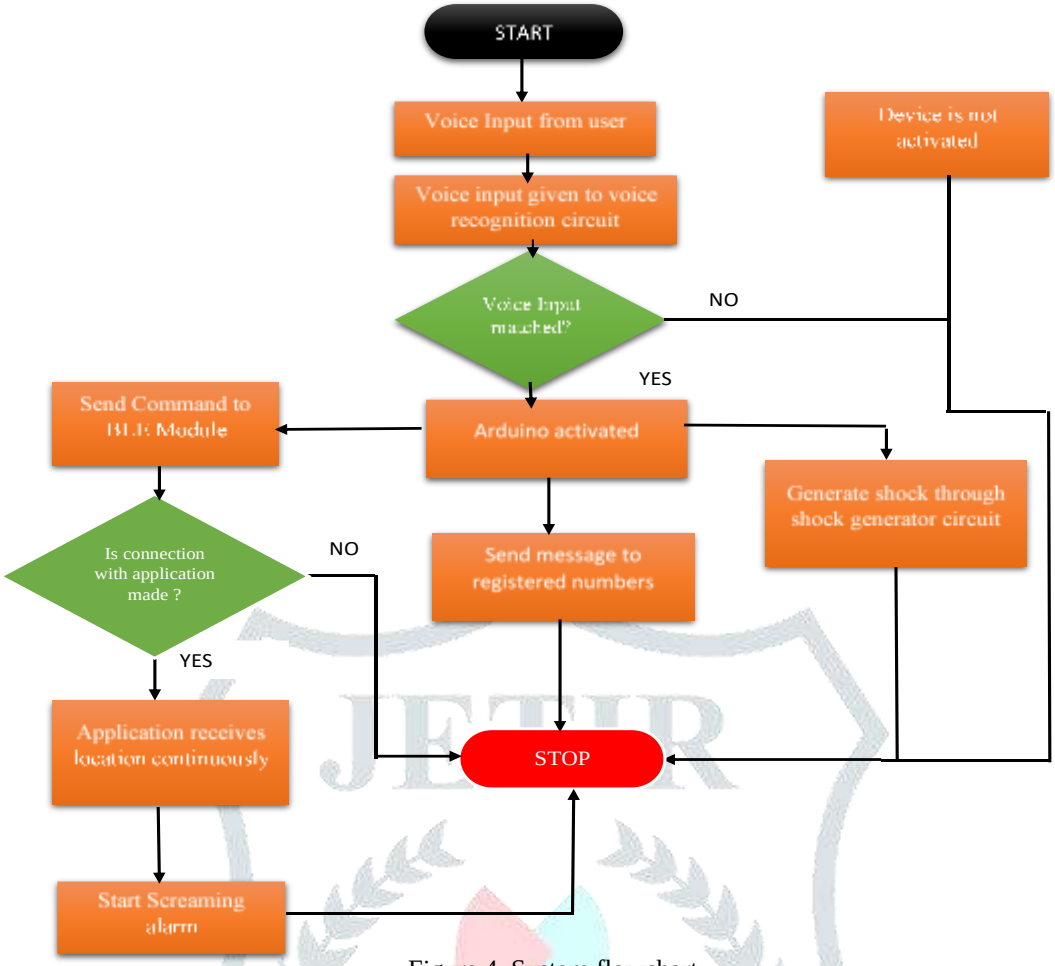

Figure 4. System flowchart

V. SCOPE OF THE PROJECT

A pressure sensor, a temperature sensor module can be used so that the device is activated automatically and hence it will improve the functioning of the device. To make sure that the device can function for a longer duration a backup power supply for the battery could be introduced so that the user can use it for a larger duration. To make the device more flexible we can make use of machine learning to recognize the words that a person will use for help in dangerous situations. This will make the device work for any voice input given by the user. We can make use of Artificial Intelligence to detect the facial expressions of the user and accordingly the device will be triggered/activated to take necessary actions. The attacking system can be advanced with some additional features.

VI. DISCUSSION

The advantage of the Voice-controlled security system for women is that it does not need physical contact with the device for activating it, it will automatically be activated once the voice recognition circuit matches the voice. There are multiple ways of taking input from the user such as voice, manual input control by pressing the switch. The device consists of an attacking system which is a shock generator. This shock generator will be helpful to protect the victim for some time until the help arrives. It can send the call/message to the pre-registered number and the nearest police station. Its disadvantage is that it needs a continuous power supply, if discharged it will not work and the voice recognition circuit will match the voice if only if the word spoken by the user matches the pre-fed word in the circuit. If it does not match the device will not work.

VII. CONCLUSION

The proposed women's safety device aims at proving complete security to women in current scenarios. The speech recognition system is used so that whenever the women shout for help, the device is triggered and it sends the location to the nearest police station and the relatives. In case a woman feels the need for self-defense she can make use of a shockwave generator to temporarily incapacitate the perpetrator. Besides, the hardware-based design, an android application is developed to provided additional safety features like sending group messages, audio recording, and identifying the nearby safe location on the map. It can be concluded that the system helps t by providing a safe environment to women in society, and allows them to work till late at night. Anyone before doing any crime against the women will be deterred and it helps to reduce the crime rate against the women.

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