

# HELPMATE-A Women Safety Device Using IoT and Machine Learning

Sreelakshmi G Nair<sup>1</sup>, Nandu Krishnan K M<sup>2</sup>, Vishnuraj R<sup>3</sup>, Gayathri R Krishna<sup>4</sup>

<sup>1</sup>Mangalam college of Engineering, Kottayam, India, sreelakshmidasnair1998@gmail.com

<sup>2</sup>Mangalam college of Engineering, Kottayam, India, nandukm1998@gmail.com

<sup>3</sup>Mangalam college of Engineering, Kottayam, India, vishnureghu1998@gmail.com

<sup>4</sup>Mangalam college of Engineering, Kottayam, India, gayathri.krishna@mangalam.in

## ABSTRACT

Nowadays women face various levels of threats from the society. Thus, women safety can be considered as an important issue that needs efficient solutions. Even though there exist some innovations towards this they are not much effective as they need human interaction to operate. From the previous experiences, we can see that a victim may not get any time or chance to operate any button or to switch on any application. Here we try to implement a device that can overcome these issues to a certain extent. This is a wearable device which has the ability to distinguish between a normal situation and dangerous situation by sensing the body temperature and heartbeats of women. When the device senses a dangerous situation, it will automatically call and send a message to the contacts which is already saved in the database along with the location details. It can also work in situations where there is no internet facility.

**Key words:** Arduino Board, Cloud Computing, GSM modem, GPS, Pulse Sensor, Temperature Sensor, ZigBee network.

## 1. INTRODUCTION

We are familiar with a numerous cases against women in these days. To avoid such crimes now exist many devices for women safety which helps to detect the location of the women and to alert authorities. Since these devices need some kind of human interaction to operate them, majority of time the user didn't get a chance to operate it. And also most of these devices need network facilities. So it cannot operate in remote areas. Hence in such situations the device becomes useless. Thus through this paper these devices are altered to operate without human interaction. For this a pulse rate sensor and a temperature sensor are added. Since there will be

difference in body temperature and pulse rate when a person become scared or while running, it is easy to detect emergency situations using these 2 readings. To detect danger automatically machine learning algorithm is used and Cloud is used for collection and computation. Data of non danger situation is initially saved in the cloud as a reference. Logistic progression is used Cloud for comparing the actual data with collected data to predict whether the situation is danger or not. If danger is detected it automatically sends alert with location. ZigBee network is used as a remedy for network unavailability. It helps the device to send data to multiple hop distance.

## 2. LITERATURE SURVEY

### 2.1 Suraksha"-A Women Safety

In this paper the women safety device is named as Suraksha. It gives a warning with an instant location of the distressed victim to the police station. Through this the incident can be prevented and the culprit can be arrested. This device can reduce the increasing crime against women. It is a simple and easy to carry device. It has a major role in CCTNS which contain all digitized police records over India. A small press of a switch sends location as well as a warning message transmitted module to police station and other registered mobile number via GSM module. [2]

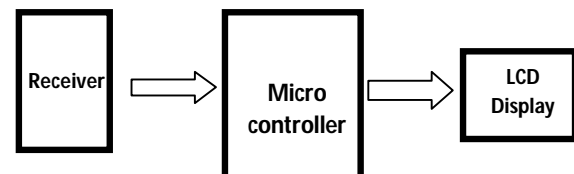
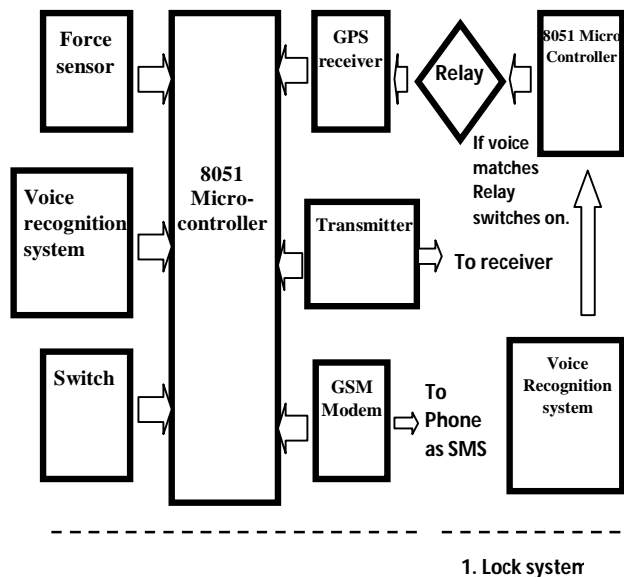


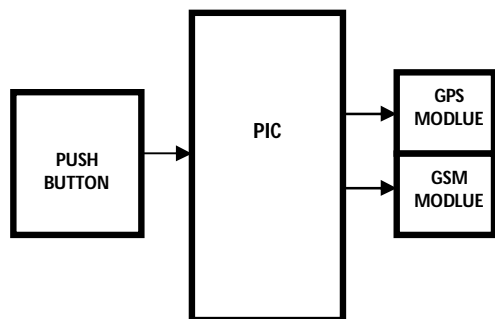
Figure 1: Conceptual design of receiver



**Figure 2:** Conceptual design of transmitter

### 2.2 One Touch Alarm System for Women’s Safety Using GSM

This paper introduces a one touch alarm system that ensuring women’s safety using GSM module. It helps to identify protect women from dangerous situations. When the victim sense abnormal situation, just press on the button of the device. This device includes a PIC microcontroller, GSM module, GPS modules. The system looks very similar to a normal watch which tracks the location of the women using GPS and sends emergency messages using GSM, to contacts and the police station. The main advantage of this device over the other existing systems is that the user does not require a Smartphone. The device ensures more accuracy and more reliability. The watch will leave no stone unturned to help the dupe in any kind of emergency situations.



**Figure 3:** Block diagram

This device has 16k bytes flash memory and 1024bytes RAM. Software, numbers and message to

inform friends, family and police are stored in the spot of PIC. A GSM module and a GPS module are linked to the controller. To communicate with GSM and GPS module, the Enhanced Universal Synchronous Asynchronous Receiver Transmitter (EUSART) module in the PIC is used. [3]

### 2.3 IoT based Smart System for Human

This paper describes a smart device, which contains multiple components, having a wearable Smart Device which continuously communicates with a smart phone through the Internet. The application is programmed and includes all the health related data of the user. This device generates a signal that is transmitted to the smart phone. The software or application has access to GPS and Messaging services which is pre programmed that whenever an emergency signal is received, it sends a help request to nearby police station, relatives and also to the people nearby having the application. With this action it helps the police to reach the victim more accurately. Sometime the people who has health related issues did not get proper medication on time and might leads towards the death that person if did not get help from any one. This led to the implementation of such a system. The proposed system makes it possible through a wearable band. It is integrated with some sort of sensors which will not only help in preventing the attack but also in medical issues. This device will generate an alert message with location and will send to nearest police station, nearest active peoples, relatives or nearest ambulance as per the situation. Based on the situation the alert will be send through the internet or SMS gateway. [4]

### 2.4 Smart Security Solution For Women Based On Internet Of Things (IOT)

This paper focuses on a security system that is designed to provide security to women. This system is an advanced system can be built that can detect the location and health condition of person. It includes electronic gadgets like GPS receiver, body temperature sensor, GSM, Pulse rate sensor. The heartbeat of a person in such situations will be normally higher which helps make decisions along with other sensors like motion sensors to detect the abnormal motion of the women. As compared with existing women security devices such as bulky belts, separate garments etc. it’s completely comfortable and easy to use and this is the idea behind this. It has

an added advantage so as to reduce the cost of the device and in reduced size. The GPS and the GSM are used of a smart phone. The watch can be installed with Bluetooth 4.0 BLE which comes in handy for several days on a single shot of charge. This also enables in reduced power use. [5]

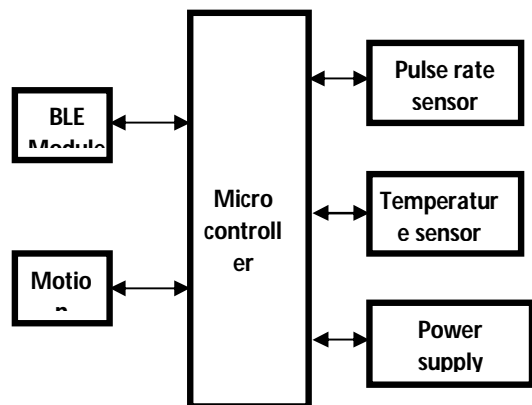


Figure 4: Smart Band Module

2.5 Women Self Defence Smart watch Prototype

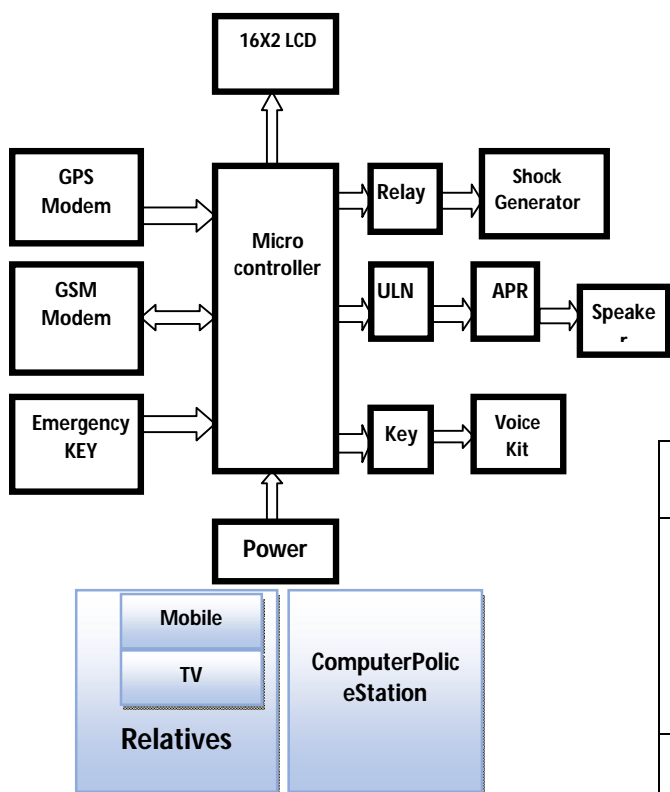


Figure 5: Self Defence module

This proposed system deals with situations where a woman can get help with the press of a button on the gadget. Self Defence module for women safety is like a Smart Watch for Women safety. This device contains technologies that are embedded into a compact device for women safety and protection.

When the user is in danger, it has a control button that will be used by women to inform nearby police. When the system is activated, the watch directly gets connected to the satellite through GPS. It contains a shock mechanism to produce an electric shock in emergency situations to resist the attack. In order to minimize risk there are many approaches that proposed electronic tele-monitoring systems aimed at tracking victims and aggressors. These approaches are based on data transmission and locating technologies such as GPS and GPRS. Then the location is transferred through a GSM modem. [6]

When the supply is given the device will turn on. GPS and GSM connected to ATMEGA also start working and it displays the current position of device. Then with the help of GPS the location (latitude and longitude) of the victim is detected and is displayed on the LCD. When the victim feels danger, he/she presses the first emergency key, the kit displays emergency situation and voice kit is enabled. Now the victim gives voice command and it is recognized by the kit. If the voice command matches with the one stored in database then the appropriate action takes place. For example if POLICE gets the voice command given by the victim, then a text message is sent to a number of police station and also an alarm is generated. Another emergency key is also provided in the kit and if it is pressed by the victim it generates an electric shock of around 12 V DC which can give severe shock to the person who is trying to mistreat.

Table 1: Literature review

| Sl.no | TITLE  | PROS   | CONS                                      |
|-------|--|--|---|
| 1     | Design and Development of "Suraksha"- A Women Safety | Intimidate instant location and a distress message to the cops and registered number | Voice command is needed start functioning |
| 2     | One touch alarm system for women's safety using GSM  | Technologically sound equipments and ideas are used                                  | Needs a human touch to start functioning  |
| 3     | IoT based Smart System for Human Safety              | Also help in medical Issues  | Needs internet access                     |

|   |  |  |   |
|---|--|--|---|
| 4 | Smart Security Solution For Women Based On Internet Of Things      | Automatically functioning System                                 | Need internet accessed smart phone          |
| 5 | Design And Development Of Women Self Defence Smart watch Prototype | Provides a shock mechanism to produce non-lethal electric shock. | Control button should be pressed to operate |

In this survey we just compared HELPMATE with other techniques used for women safety. In order to reduce its drawbacks, here adapt the merits of similar works by analysing the Literature review. The reason we come up with these idea is that, in situations like sudden unconsciousness and weakness due to fear or while sleeping, user may unable to resist an attack against her. This system also includes facility to transfer data to a large distance. Thus the effectiveness of the device becomes more.

### 3. MOTIVATION

The crimes against women increase day by day. The society is familiar with such news in each day. So, it is important to develop the technology towards this for assuring women safety. There exist some women safety devices but they are not much effective. These devices are not able to prevent the attacks in all the situations like sudden unconsciousness, while sleeping or weakness due to fear since they are non automated devices. On such situation we may not able to call others for help. But in every such situation our body temperature and pulse rate will show a noticeable difference. This is behind the idea. Remote areas may lack network facilities and to protect users in that area we need to provide extra facility. For that here use ZigBee network

### 4. SCOPE

By the implementation of such a system will help to avoid the crimes or attacks towards women by sharing the location of crime to the emergency contacts with an alert message and call. This system can also inform the nearby police station and thus the crime can be avoided as early as possible. Thus, by

implementing such a system with high accuracy and work without any delay will definitely ensure safety for the women without any fail.

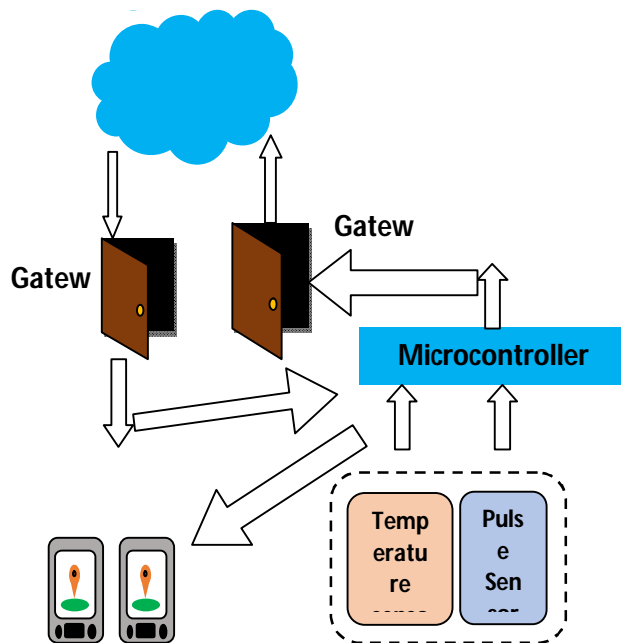
### 5. PROBLEM STATEMENT

The main problems in most of the women safety devices are not automatic. It needs a single touch or a voice command to unlock the system. It may not be possible at all situations. The individual may not get the time to operate the system due to many reasons. The objective of the device fails and the crime can't be identified. The device may also fail to function in remote areas since all the safety device needs internet access to transfer data. In remote areas where there is no signal the device become in dead state and the attack cannot be prevented. The solution to overcome these issues is to implement a device which is able to work automatically without any human interactions. And also the device should be able to function in remote areas without internet access. This implementation will lead to the creation of an effective women safety device.

### 6. PROPOSED MODEL

A system that can operate without any human interaction and automatically send alert message to emergency contact while women is in danger and even there is no internet connection. It also contains a push button for the cases in which the user is able to operate the system. The system contains a temperature sensor and a pulse rate sensor to collect the readings and send it to Arduino, which fixed in the system. Arduino send this data to Cloud through a gateway. Cloud compares the collected data with initially stored data. Readings in both danger and non danger situation are collected initially using mobile app and stored in cloud. Logistic progression algorithm is used as machine learning algorithm to compare collected readings with initial data. Prediction of danger is done by checking the match and mismatch of readings. The prediction is send from cloud to Arduino through a gateway. If prediction is danger then the GSM modem present in the system sends calls and messages along with the location of user detected using GPS that also fixed in the device. [1].

## 7. ARCHITECTURE



**Figure 6:** Architecture of the system

The architecture of this system begins from the sensors, a temperature sensor and a pulse sensor to collect readings from the body. A microcontroller unit (Arduino) is fixed in the device to collect the readings. These data sends to the gateway and then send to Cloud. To analyse the data machine learning is used in the cloud. After computing all the data on Cloud the situation is predicted as danger or not. The result is send to the microcontroller through a gateway. If the result tells danger then the GSM modem in the device sends messages and calls to the emergency contact. The location of the user is tracked using a GPS module connected to the device and send along with the message. For a user in remote areas the Internet connection may unavailable. Thus a ZigBee network module is added to escalate the information to a large distance by using its multiple hop communication facility. [1]

## 8. LOGISTIC REGRESSION ALGORITHM USING PYTHON

To analyse the data accurately and predict the danger Cloud use logistic regression as machine learning algorithm. By using the sensor value generated by the person who wearing the band and according to that danger and non danger situation is determined. Thus

based on the initial data danger can be predicted accurately using this logistic regression algorithm. It is a classification algorithm used to predict binary output by using dummy variables. The danger is indicated by the binary value Yes and non danger situation is indicated by No. The function of independent variables temperature and pulse rate is modelled as probability of danger (P). It is a nonlinear function that ranges from  $-\infty$  to  $+\infty$  where probability lies between 0 and 1. log odds is applied to the dependent variable that expressed aa linear function. [1]

### A. ADVANTAGES

- Can be used by women while travelling alone on roads, in public transport or even at workplaces.
- Helps us to analyse the severity of crimes against women and reduce sexual harassments.
- Completely automatic system
- Able to work without internet access.
- Human interaction is not needed.
- Location is shared accurately without any delay.

### B. DISADVANTAGES

- Pulse and temperature variations occurred due to some physical conditions may also be detected as an emergency situation.
- It requires a large storage space.

## 9. SYSTEM REQUIREMENTS

Here we need both software and hardware requirements in order for the implementation.

### C. SOFTWARE REQUIREMENTS

- Data collected by temperature and pulse rate sensor.
- Machine learning algorithm
- Logistic regression using python.
- Cloud for storage

### D. HARDWARE REQUIREMENTS

- Arduino ATmega328 Board.
- Temperature sensor LM35 series
- Pulse rate sensor
- GPS module
- GSM 30
- ZigBee S2C mmoduS2C

**10. TEST CASE**

**Table 2:** Test case

| <b>T<br/>C<br/>D</b> | <b>TEMP.<br/>VALUE</b> | <b>PULSE<br/>VALUE</b> | <b>EXPD.<br/>RESULT</b>                     | <b>ACTUAL<br/>RESULT</b>                    | <b>STATUS</b>     |
|----------------------|------------------------|------------------------|---|---|-------------------|
| <b>1</b>             | <b>37</b>              | <b>83</b>              | <b>Not<br/>emergency</b>                    | <b>Not<br/>emergency</b>                    | <b>Successful</b> |
| <b>2</b>             | <b>36</b>              | <b>138</b>             | <b>Not<br/>emergency</b>                    | <b>Not<br/>emergency</b>                    | <b>Successful</b> |
| <b>3</b>             | <b>40</b>              | <b>140</b>             | <b>Emergency<br/>Situation<br/>detected</b> | <b>Emergency<br/>Situation<br/>detected</b> | <b>Successful</b> |
| <b>4</b>             | <b>38</b>              | <b>85</b>              | <b>Not<br/>emergency</b>                    | <b>Not<br/>emergency</b>                    | <b>Successful</b> |
| <b>5</b>             | <b>41</b>              | <b>83</b>              | <b>Not<br/>emergency</b>                    | <b>Not<br/>emergency</b>                    | <b>Successful</b> |

**11. OUTPUT**

The system is able to predict danger based on the body conditions. Collected data is compared with initially stored data using logistic regression algorithm. When danger is detected emergency call and message will be send to the emergency contacts along with the location of user with high accuracy.

**12. CONCLUSION**

This system is implemented to ensure safety for women travelling alone in public transport, workplace, home or on road. This may help to reduce crimes and harassment to an extent. Since this device can also be operate in areas where internet is unavailable the effectiveness of the device increases. ZigBee mesh network provides multiple hop distance to transfer information to a large distance.

In order to reduce the drawbacks of the system advantages of related works are adapted after analysing the literature review. From the Literature review it can be analysed that the main demerit of these systems are it cannot be operated automatically without any human interaction. Thus user can't operate the system if the attack occurs when she becomes unconscious or weak due to fear or when the user is sleeping. And also these systems cannot use in remote areas. By overcoming such drawbacks

this system is implemented in such a way to provide accurate predictions and efficient security without any fail.

**13. FUTURE SCOPE**

In future this system can add on a feature that the location can be shared as a pop-up notification instead of a message. Also the system can send the alert message also to the nearby police station by tracking with GPS. These future changes can increase the effectiveness of the device and thus it can ensure women safety.

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