A Major Project Report on

HELPMATE-A Women Safety Device Using IoT and Machine Learning

Submitted in partial fulfillment of the requirement for the award of the Degree of

BACHELOR OF TECHNOLOGY

in

COMPUTER SCIENCE AND ENGINEERING

By

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G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY (Autonomous)

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CERTIFICATE

HELPMATE-A Women Safety Device Using IoT and Machine Learning

This is to certify that the Major Project report Entitled

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in partial fulfillment for the course of BACHELOR OF TECHNOLOGY in COMPUTER SCIENCE AND ENGINEERING to the Jawaharlal Nehru Technological University Anantapur, Andhra Pradesh.

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With gratitude,

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CONTENTS

ABSTRACT

Women's safety is a critical issue that requires efficient, intelligent, and real-time solutions. Traditional safety devices often require manual activation, which may not be feasible in emergencies. To address this, we propose HELPMATE – A Women Safety Device Using IoT and Machine Learning, a wearable, automated system that can detect danger and send alerts without user intervention .The system integrates physiological sensors (pulse rate, body temperature, motion sensors) with machine learning algorithms (logistic regression, decision tree) to differentiate between normal and distress situations. When a threat is detected, the device automatically triggers an emergency alert, sending real-time location data via GSM, GPS, and ZigBee communication to pre-configured contacts, law enforcement, and nearby users. The multi-hop communication feature ensures message delivery even in low-network areas, making the device highly reliable.The use of cloud-based machine learning enhances predictive accuracy by analysing historical and real-time data. Additionally, encryption techniques ensure the security and privacy of the user's information. The HELPMATE system provides a proactive, smart, and scalable safety solution, empowering women with a real-time, intelligent, and autonomous protection mechanism.

Keywords : Arduino Board, LCD, Alarm, LEDs, GSM modem, GPS, Touch sensor, SOS button • Software: Arduino IDE, Advanced Embedded C. Python • Data collected by sensor, SOS • Machine learning algorithm • Logistic regression using python

1.OBJECTIVE : HELPMATE-A Women Safety Device Using IoT and Machine Learning

These days singular prosperity has become a huge disadvantage for everybody, particularly for women. A new review made by UN organization demonstrates 35% of women are worldwide confronting some sort of misuse and actual brutality. As of now there's no sensible answer for the current circumstance. As they have a lot of human mediation to run, the current programming and contraptions don't seem, by all accounts, to be a store of plentiful execution. The proposed answer for address such conditions is to foster a wearable device that can go about as a watchman for women for minimal price. The proposed wearable women monitor gadget precisely sweeps and produce designs like temperature and indispensable sign so it closes out the verge for creating caution. In the event that the readings square measures past the limit, it decisively sends message and the important move is made. We utilized temperature and heartbeat sensors which can sense the movement of women and these data's are shipped off the cloud where an AI/ML framework is smeared to research the data created. The data is first assembled by sensors at safe circumstances to prepare the AI/ML framework. Then, at that point at the hour of peculiar sensor readings, it is being contrasted and the prepared framework. It produces caution and afterward sends the alarm messages and calls through the web for salvage of the ladies at issue.

2.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.

3.LITERATURE SURVEY:

- “Suraksha” – A Women Safety Device Authors: N. Bhardwaj and N. Aggarwal Publication: International Journal of Information & Computation Technology, 2014

Key Features:

- Uses GSM technology to send emergency alerts.
- Sends instant location details of the victim to the nearest police station and emergency contacts.
- Works with CCTNS (Crime and Criminal Tracking Network System) to help law enforcement.
- Requires manual activation (pressing a button) to send distress messages.

- One-Touch Alarm System for Women’s Safety Using GSM

  Authors: Premkumar P., Cibi Chakkaravarthi R., Keerthana M.,

  Ravi Varma R., Sharmila T. Publication: International Journal of Science, Technology & Management, 2015

Key Features:

- A wearable watch-like device that sends emergency alerts when a button is pressed.
- Integrated with GPS and GSM modules to transmit real-time location data.
- No smartphone required, making it more independent.

4.Existing system :

- There are some apps named “tell tail”,” women security”,” security alert app” and many all these require internet connection to trace the location by using GPS.

- These are available to the educated women and only in android mobiles. The women may not get much time to unlock her mobile, open the app and press the SOS button. so they have many drawbacks.

- Requires network availability – Relies on GSM signals, making it less effective in areas with poor connectivity.

- Uses a mobile application that automatically sends alerts to police, family, and nearby users in case of emergency.

- A wearable smart device that continuously communicates with a smartphone via the internet.

- The system has a pre-programmed application that sends emergency alerts to police, relatives, and nearby users with the same app.

- Reliance on Internet Connectivity: Some systems use smartphone applications or cloud-based communication, making them ineffective in areas with poor or no internet access.

5.DisAdvantages of Existing model :

- **Dependence on Internet or GSM Network :** Many systems require internet connectivity or GSM signals to send alerts. In remote or poor network areas, these devices may fail.
- **No Continuous Monitoring :** many system are not there continuous monitoring
- **Limited Alert Mechanisms :** Most systems only send messages or calls to predefined contacts. They do not offer alternative ways to notify emergency responders efficiently.
- **Inability to Handle Multiple Threat Scenarios :** The user may not always be in immediate danger but still needs help in certain suspicious situations.
- **No Real-Time Response or Prevention Measures**
- **Mobile application Mechanisms :** Devices fail to provide reliable protection in situations where phone battery drains, internet is unavailable, or surroundings interfere with GPS signals.

.

6.Proposed System:

- A system that can operate with any human interaction and automatically send alert message to emergency contact while women is in danger and even there is no internet connection.

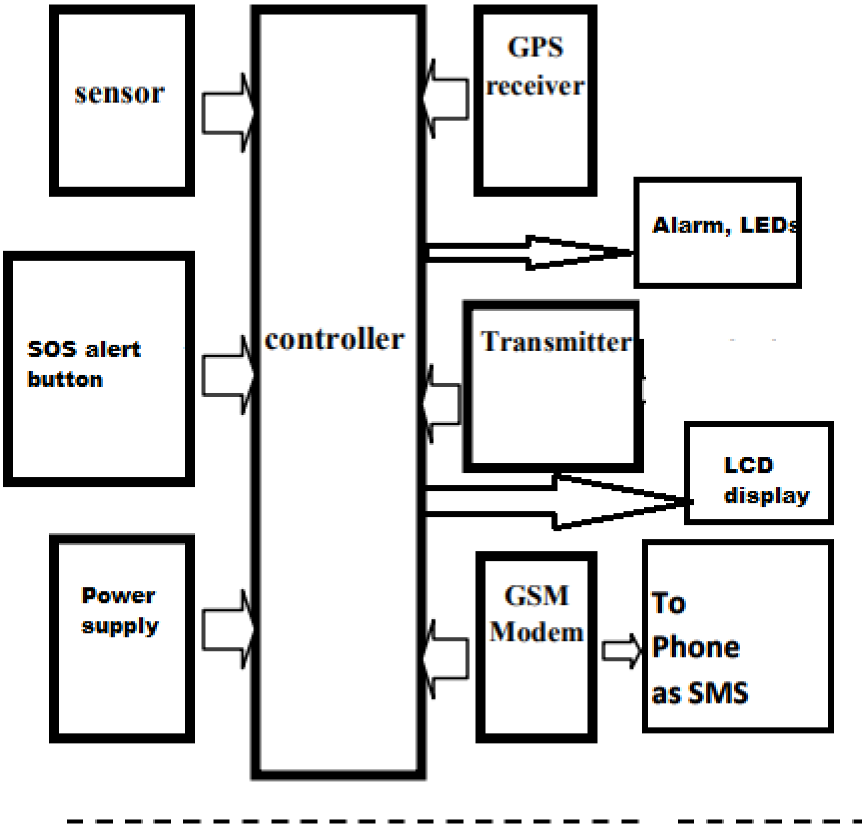
- It also contains a push button for the cases in which the user is able to operate the system. The system contains a temperature sensor and a pulse rate sensor to collect the readings and send it to Arduino, which fixed in the system.

- 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. 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.

- Logistic regression algorithm is used to analyze sensor data and predict threats based on previously collected data.

7.Proposed block diagram:



8.ADVANTAGES:

- Reliable Message Transmission in Remote Areas.
- Provides flexibility to carry at any where.
- Real-time monitoring location Tracking without internet.
- Secure and Tamper-Proof Design.
- Works Without Internet or Smartphone Dependency
- Emergency Alert with Location Tracking.

9.Modules:

- **Sensor Module (Data Collection) :**

This module is responsible for **collecting real-time physiological data** from the user. It includes:

- Pulse Rate Sensor – Measures the user's heart rate to detect signs of distress.
- Temperature Sensor – Monitors changes in body temperature that may indicate stress or fear.
- Touch Sensor – Detects physical interactions (e.g., when a user presses the SOS button).
- Motion Sensor (Accelerometer/Gyroscope) – Identifies sudden movements, falls, or forced movement.

- **Microcontroller Module (Data Processing & Decision Making)**

This module processes sensor data and makes decisions based on predefined conditions and machine learning models.

- Uses an Arduino microcontroller to collect, filter, and transmit data.
- Implements machine learning (logistic regression) to analyze variations in heart rate and temperature.
- Determines if the user is in normal or danger mode.

- **Loud & IoT Module (Machine Learning & Data Storage)**

This module uses cloud-based storage and computation to enhance the system's intelligence.

- Stores pre-collected normal and danger state data for comparison.
- Uses logistic regression algorithm in Python to classify situations as "Safe" or "Danger."
- Continuously improves prediction accuracy by learning from new data.
- Synchronizes with the Alert Module when a dangerous situation is detected.

- **Alert & Communication Module (Emergency Notification System)**

  Once a danger situation is detected, this module sends emergency alerts and calls using multiple communication technologies.

- GSM Module: Sends SMS alerts and makes automatic emergency calls to pre-configured contacts.
- GPS Module: Fetches the user's exact location and shares it with emergency contacts.
- ZigBee Communication: Ensures message delivery in poor network areas by relaying data through multiple devices.
- Loud Alarm & LED Flashing Lights: Alerts nearby people to the danger.

- **SOS Manual Trigger Module (User-Controlled Activation)**

  This module allows the user to manually trigger an emergency alert if they are conscious and able to act.

- Includes an SOS button for instant distress signal activation.
- Works as a backup mechanism in case the automatic system fails.

- **Location Tracking Module (Real-Time GPS Monitoring)**

  This module continuously tracks the user's location and updates emergency contacts when a distress signal is sent.

- Uses a GPS module for real-time location tracking.
- Sends location at regular intervals until help arrives.

- **Multi-Hop Communication Module (For Low Network Areas)**

Ensures emergency messages are delivered even in areas with no GSM coverage by using a ZigBee network for data relaying.

10.Methodology:

- **Problem Identification & Requirement Analysis :**

- Identify the limitations of existing women safety devices that require manual activation and network dependency.
- Analyse the need for an automated safety device that can detect emergencies using physiological data and machine learning.
- Define the hardware and software requirements, including sensors, IoT modules, and cloud storage.

- **System Design & Architecture:**

Wearable Device Selection: Develop a wristband or pendant-based device for easy and continuous use.

Hardware Integration:

- Sensors: Pulse Rate Sensor, Temperature Sensor, Accelerometer, SOS Button.
- Microcontroller: Arduino for data processing.
- Communication Modules: GSM, GPS, ZigBee for connectivity.

Software & Machine Learning Integration:

- Python-based Logistic Regression Algorithm to classify danger and non-danger situations.
- Cloud Storage & IoT Processing for storing and comparing sensor readings.

➢ Data Collection & Preprocessing:

- Collect **normal and distress condition sensor readings** (heart rate, body temperature, motion data) from volunteers.
- Store **initial reference data** in the **cloud** to train the machine learning model.
- Apply **preprocessing techniques** to remove noise and standardize sensor values.

➢ Machine Learning-Based Danger Detection:

Use Logistic Regression Algorithm classify real-time sensor reading into:

- Safe Condition (No Action Needed)
- Danger Condition (Trigger Emergency Alert)

Apply real-time comparisons of collected data with pre-stored normal values.

Predict danger situations based on:

- Sudden increase in heart rate and body temperature.
- Rapid or forced movement (detected via accelerometer).
- SOS button press (manual activation).

➢ Real-Time Communication & Alert System:

If a dangerous situation is detected, the system automatically sends alerts.

Emergency Alert Process:

- GPS Module: Fetches the user's location.
- GSM Module: Sends an SMS and initiates an automatic emergency call to predefined contacts.
- ZigBee Communication: Relays alerts in low-network areas.

- **Implementation & Testing :**
  - Hardware Testing: Ensure sensors, GPS, GSM, and ZigBee modules function correctly.
  - Software Testing: Evaluate machine learning model accuracy using test data.
  - Network Testing: Assess GSM and ZigBee communication efficiency in different locations.
  - User Acceptance Testing (UAT): Test the system with volunteers in real-world scenarios to ensure usability and reliability.

11.Algorithms:

- Logistic Regression (Machine Learning for Threat Detection Predicting whether the user is in danger). ▯ Used for: Predicting whether the user is in danger based on physiological sensor data (heart rate, temperature, motion).Why used? It provides a binary classification (Safe = 0, Danger = 1), making it ideal for determining emergency situations.

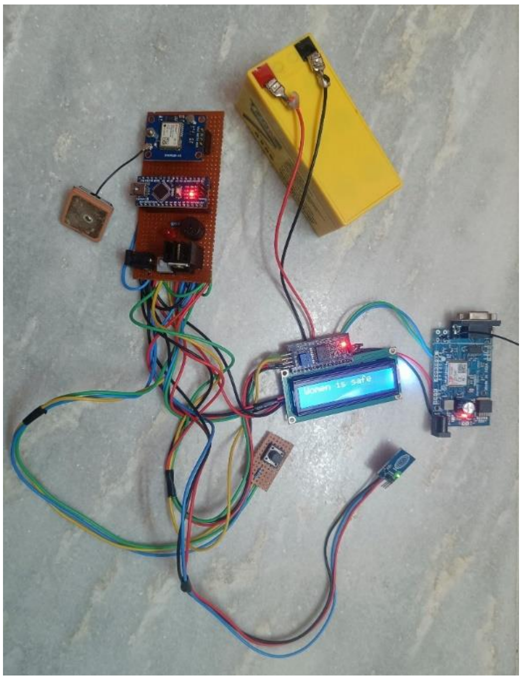
- KNN(Emergency Pattern Recognition Matching real-time sensor readings with previously recorded emergency patterns.).

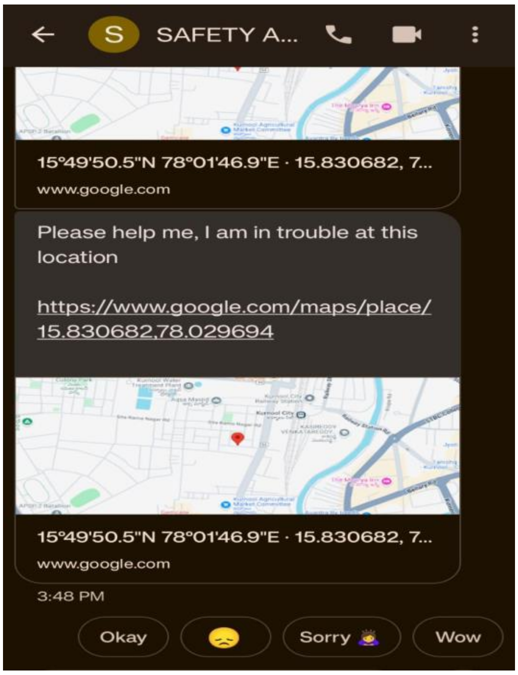
- Multi-Hop Communication Algorithm (no GSM/internet Ensures message delivery even in low-network areas using multi-hop relay nodes).

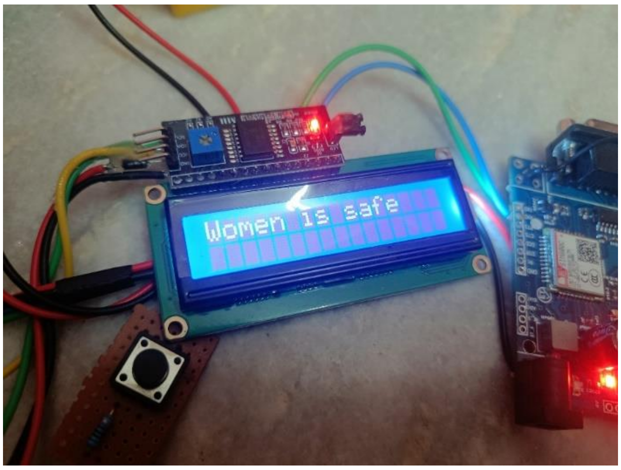
12.Technology used:

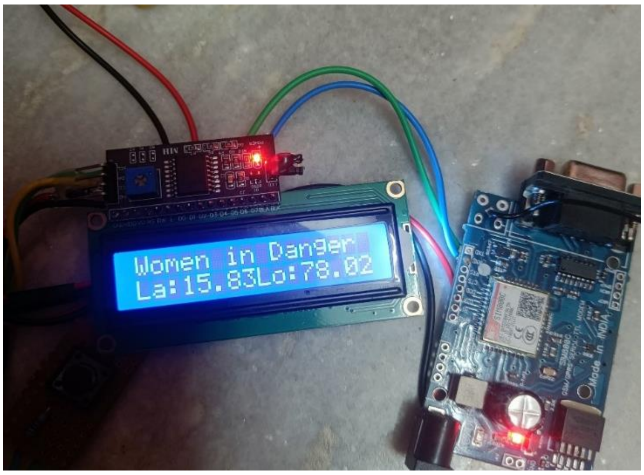
- Hard Ware components : Arduino Board, LCD, Alarm ,LEDs , GSM modem, GPS, Touch sensor, SOS button.
- Operating system : Arduino IDE.
- Coding Language : Python. Advanced Embedded C.

13. OUTPUT:




SAFETY A...
15°49'50.5"N 78°01'46.9"E · 15.830682, 7...
www.google.com
Please help me, I am in trouble at this location
https://www.google.com/maps/place/15.830682,78.029694
15°49'50.5"N 78°01'46.9"E · 15.830682, 7...
www.google.com
3:48 PM
Okay
Sorry
Wow


Women is safe


Women in Danger
La:15.83Lo:78.02

14.Code:

```
#include <TinyGPS++.h>
#include <SoftwareSerial.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 16, 2);

TinyGPSPlus gps;
SoftwareSerial SerialGPS(6, 5);

float Latitude, Longitude;
int year, month, date, hour, minute, second;
String DateString, TimeString, LatitudeString, LongitudeString;
String lati, longi;

SoftwareSerial sim(3, 4);  // TX, RX
int _timeout;
String _buffer;
const int buzzer = 9;
const int button = 7;
const int touch = 8;

void setup() {
  Serial.begin(9600);
  Serial.println();
  pinMode(button, INPUT);
  pinMode(buzzer, OUTPUT);
  pinMode(touch, INPUT);
  digitalWrite(buzzer, LOW);
  _buffer.reserve(50);
  Serial.println("System Started...");
  sim.begin(9600);
  SerialGPS.begin(9600);
  lcd.begin();
  lcd.backlight();
  lcd.setCursor(0, 0);
  lcd.print("WOMEN SECURITY");
  delay(1000);
  Serial.println("Type s to send an SMS, r to receive an SMS, and c to make a Call");
  delay(2000);
}
```

```
void loop() {
  int buttonValue = digitalRead(button);
  int touchValue = digitalRead(touch);
  Serial.println("value:");
  Serial.println(touchValue);
  digitalWrite(buzzer, LOW);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Women is safe");
  // lcd.setCursor(0, 1);
  // lcd.print("normal");
  // delay(1000);
  if (buttonValue == 1) {
    digitalWrite(buzzer, HIGH);
    lati = LatitudeString;
    longi = LongitudeString;
    lcd.clear();
    //         lcd.setCursor(0, 0);
    //         lcd.print("Help me, trouble at");
    lcd.setCursor(0, 1);
    lcd.print("La:");
    lcd.setCursor(3, 1);
    lcd.print(lati);
    lcd.setCursor(8, 1);
    lcd.print("Lo:");
    lcd.setCursor(11, 1);
    lcd.print(longi);
    lcd.setCursor(0, 0);
    lcd.print("Women in Danger");
    delay(1000);
    latLongStart(LatitudeString, LongitudeString);
    if (sim.available() > 0)
      Serial.write(sim.read());
    delay(3000);
  }
```

```
  if (touchValue == 1) {
    digitalWrite(buzzer, HIGH);
    lati = LatitudeString;
    longi = LongitudeString;
    lcd.clear();
    //        lcd.setCursor(0, 0);
    //        lcd.print("Help me, trouble at");
    lcd.setCursor(0, 1);
    lcd.print("La:");
    lcd.setCursor(3, 1);
    lcd.print(lati);
    lcd.setCursor(8, 1);
    lcd.print("Lo:");
    lcd.setCursor(11, 1);
    lcd.print(longi);
    lcd.setCursor(0, 0);
    lcd.print("Women in Danger");
    delay(1000);
    latLongStart(LatitudeString, LongitudeString);
    if (sim.available() > 0)
      Serial.write(sim.read());
    delay(3000);
  }
//library(caTools)
library(caret)
library(e1071)
#DATA-PREPROCESSING
#DATA-SPLITING
set.seed(123)
split = sample.split(datasets$Class,SplitRatio = 0.75)
training_set = subset(datasets,split==TRUE)
test_set = subset(datasets,split==FALSE)
#SCALING TO BRING DATA TO COMMON RANGE
training_set[-9]=scale(training_set[-9])
test_set[-9]=scale(test_set[-9])
#PCA MODEL GENERATION
pca = preProcess(x=training_set[-9],method = "pca",pcaComp = 2)
#PREDICTING THE TEST AND TRAINING SETS WITH THE GENERATED PCA MODEL
training_pca_set = predict(pca,training_set)
training_pca_set = training_pca_set[c(2,3,1)]
test_pca_set = predict(pca,test_set)
//test_pca_set = test_pca_set[c(2,3,1)]
library(caTools)
library(ggplot2)
library(caret)

#DATA-PREPROCESSING
#The dataset consists of categorical data which cannot be fed into any mathematical equations
#So, the categorical data are given unique numerical value using the factor function
datasets$Area=factor(datasets$Area,levels = c("Ramapuram","West Mambalam","Adyar"),labels = c(1,2,3))
datasets$Zone = factor(datasets$Zone,levels = c("Aanandam Nagar","Ambal Nagar","Amman Nagar","Chidambaram Nagar","Easwaran Nagar","Gokulam Colony","Moogambigai Nagar","Mullai Nagar","Royala Nagar","Sakthi Nagar","Suresh Nagar","Tamil Nagar","Thiru Nagar","Venkateshwara Nagar","Postal Colony","RamaKrishnapuram","Vivekanandapuram","Moovendar Colony","Kasi Viswanathar Colony","Pannerselvam Nagar","Shastri Nagar","Subramaniam Nagar","Baktavatsalm Nagar","Venkateshwar Nagar","Teachers Colony","South Kesavaperumalpuram"),labels = c(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26))
datasets$Time = factor(datasets$Time,levels = c("Morning","Afternoon","Evening","Night"),labels = c(1,2,3,4))
datasets$People.Frequency = factor(datasets$People.Frequency,levels = c("Low","Medium","High"),labels = c(1,2,3))
datasets$Is.Police_Station = factor(datasets$Is.Police_Station,levels = c("Yes","No"),labels = c(1,2))
datasets$Is.Bar = factor(datasets$Is.Bar,levels = c("Yes","No"),labels = c(1,2))
datasets$Tier = factor(datasets$Tier,levels = c("Inner","Middle","Outer"),labels = c(1,2,3))
datasets$Residence.Level = factor(datasets$Residence.Level,levels = c("Low","Medium","High"),c(1,2,3))
datasets$Class = factor(datasets$Class,levels = c("Safe","Unsafe"),labels = c(1,2))

#DATA-SEPARATION
#The whole dataset is splited in a ratio of 0.75 for training and test sets
#The set.seed function generates random numbers based on the given parameter which helps to split the dataset
set.seed(123)
#sample.split function actually provides TRUE/FALSE values for all data in the dataset based on the seed
split = sample.split(datasets$Class,SplitRatio = 0.75)
#Then using the split table, TRUE are seperated into training sets and FLASE are seperated into test sets
training_set = subset(datasets,split==TRUE)
test_set = subset(datasets,split==FALSE)

#SCALING TO BRING DATA TO COMMON RANGE
training_set[-9]=scale(training_set[-9])
test_set[-9]=scale(test_set[-9])
```

```
#PCA MODEL GENERATION
pca = preProcess(x=training_set[-9],method = c("pca"),pcaComp = 2)
#PREDICTING THE TEST AND TRAINING SETS WITH THE GENERATED PCA MODEL
training_pca_set = predict(pca,training_set)
training_pca_set = training_pca_set[c(2,3,1)]
test_pca_set = predict(pca,test_set)
test_pca_set = test_pca_set[c(2,3,1)]

#BINOMIAL-REGRESSION
binomial_resgressor = glm(Class~.,family = "binomial",data = training_pca_set)
predict_set = predict.glm(binomial_resgressor,type = "response",test_pca_set)

#plot for binomial-regression
par(mfrow=c(1,3))
for(i in 1:3) {
  boxplot(predict_set[,i], main=names(predict_set)[i])
}


#SVM-CLASSIFICATION
#e1070 is a library required to implement Support Vector Machine
library(e1071)
svm_model=svm(Class~.,data = datasets)

#MULTIVARIENT-REGRESSION
multivarient_regressor = lm(formula = Class~.,data = training_set)
#plot(svm_model,data = datasets,dependentvariable~independent,slice=list(missvar=position,missvar=position))

type.convert(datasets)
  while (SerialGPS.available() > 0)
    if (gps.encode(SerialGPS.read())) {
      if (gps.location.isValid()) {
        Latitude = gps.location.lat();
        LatitudeString = String(Latitude, 6);
        //        lati = String(Latitude , 2);
        Longitude = gps.location.lng();
        LongitudeString = String(Longitude, 6);
        //        longi = String(Longitude , 2);
        //  lcd.clear();
         //  lcd.setCursor(0, 0);
         //  lcd.print(LatitudeString);
         //  lcd.setCursor(0, 0);
         //  lcd.print(LongitudeString);
      }
      Serial.println(LatitudeString);
    }
   delay(200);
 }

 void latLongStart(String li, String lon) {
   while (1) {
     String SMS;
     sim.println("AT+CMGF=1");  //Sets the GSM Module in Text Mode
     delay(1000);
     sim.println("AT+CMGS=\"+918500793888\"\r"); //Mobile phone number to send message

     SMS = String("Please help me, I am in trouble at this location \n https://www.google.com/maps/place/" + li + "," + lon);
     sim.println(SMS);
     delay(1000);
     sim.println((char)26);  // ASCII code of CTRL+Z
     delay(500);
     break;
     _buffer = _readSerial();
     //
     //  digitalWrite(buzzer, LOW);
   }
 }
 //

 String _readSerial() {
   _timeout = 0;
   if (!sim.available() && _timeout < 12000) {
     delay(13);
     _timeout++;
   }
   if (sim.available()) {
     return sim.readString();
   }
 }
```

15.Conclusion:

The HELPMATE – A Women Safety Device Using IoT and Machine Learning is a smart, , and real-time safety system designed to address the limitations of existing women safety solutions. Unlike traditional devices that require manual activation, this system uses physiological sensors, machine learning, and IoT communication to autonomously detect danger and trigger emergency alerts.By implementing logistic regression, decision tree algorithms, and multi-hop ZigBee communication, the system ensures high accuracy in threat detection, fast response times, and reliable operation even in low-network areas.

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