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# Human Safety Device

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**Abstract- Personal safety has become a critical concern in modern society due to the increasing rate of crimes and emergency situations. This paper presents a Human Safety Device that integrates Internet of Things (IoT) technology with dual communication systems, namely GSM-based SMS alerts and Telegram-based real-time notifications, to ensure reliable emergency response. The system is built using an ESP32 microcontroller interfaced with a GPS module for location tracking, a pulse sensor for heart rate monitoring, and an MPU6050 sensor for motion detection. In emergency conditions, triggered manually via a panic button or automatically through abnormal sensor readings, the system captures and transmits location and health data to predefined contacts. Experimental evaluation shows that the system achieves an average alert response time of 3–5 seconds for Telegram notifications and 5–10 seconds for GSM-based SMS delivery. The GPS module provides location accuracy within ±5–10 meters, while sensor readings maintain an accuracy of approximately 95% under normal conditions. Additionally, a web-based interface enables real-time monitoring and visualization of user data. The proposed system is compact, cost-effective, and highly reliable, making it suitable for real-world deployment in personal safety applications.**

**Keywords – Research paper publication, Publish research paper 2026, Low cost journals India, ABCD index journals, Open access journals.**

## I. INTRODUCTION

The rapid increase in safety-related incidents has emphasized the need for intelligent and reliable personal security systems. Conventional solutions, such as mobile-based safety applications, are often limited by user dependency and unreliable connectivity, reducing their effectiveness during critical situations.

With the advancement of the Internet of Things, smart safety devices can now provide real-time monitoring and automated emergency response. This paper proposes an IoT-enabled Human Safety Device that integrates sensing, processing, and communication technologies into a compact system. The device utilizes an ESP32 microcontroller, GPS module for location tracking, and biomedical sensors for monitoring physiological and motion parameters.

A key contribution of this work is the implementation of a hybrid communication framework combining GSM-based SMS alerts and Telegram-based internet notifications, ensuring reliable message delivery under both connected and low-network conditions. Additionally, a lightweight web interface is developed for real-time data visualization and remote monitoring.

The proposed system aims to provide a cost-effective, scalable, and robust solution for enhancing personal safety in real-world scenarios.

## II. REVIEW OF LITERATURE

Recent research in personal safety systems has focused on leveraging smart technologies to enable real-time monitoring and rapid emergency response. Mobile application–based solutions have been widely explored for safety alerts; however, they often depend on continuous user interaction and stable internet connectivity, which limits their effectiveness in critical scenarios.

With the evolution of the Internet of Things, several IoT-based safety devices have been proposed that integrate sensors and communication modules for automated alert generation. For instance, systems combining GPS and GSM technologies have demonstrated reliable location tracking and SMS-based alert mechanisms, particularly in low-connectivity environments. However, these systems generally lack advanced features such as health monitoring and multi-channel communication.

Recent studies have incorporated biomedical sensors, such as heart rate and motion sensors, to detect abnormal conditions and trigger alerts automatically . While these approaches improve system intelligence, they often rely on a single communication medium, which can reduce reliability during network failures.

To address this limitation, hybrid communication models integrating GSM with internet-based platforms have been introduced. Such systems utilize cloud services and messaging platforms to provide real-time notifications and data visualization. Additionally, web-based dashboards have been developed to enhance user interaction and enable remote monitoring of safety parameters.

Despite these advancements, existing solutions often face challenges related to latency, scalability, and system integration . Furthermore, many systems are not optimized for portability and cost-effectiveness, limiting their practical deployment .

Therefore, this work proposes a comprehensive safety system that combines IoT sensing, dual communication (GSM and Telegram), and a web-based interface to improve reliability, response time, and usability compared to existing approaches.

## III. REPORT ON THE PRESENT INVESTIGATION

The present investigation focuses on the design, development, and analysis of a Human Safety Device aimed at enhancing personal security in emergency situations. With the increasing concerns regarding personal safety in both urban and rural environments, there is a growing need for reliable, accessible, and efficient safety solutions.

The study began with an analysis of existing safety devices and systems currently available in the market. These include mobile-based emergency applications, wearable alert systems, and GPS tracking devices. While these solutions offer certain advantages, many of them depend heavily on smartphones, internet connectivity, or manual activation, which may not always be feasible during critical situations.

Based on these observations, the proposed Human Safety Device has been conceptualized to overcome such limitations. The device integrates essential components such as a microcontroller, GPS module, GSM module, and an emergency trigger mechanism. When activated, the device sends real-time location data and distress alerts to pre-registered contacts and authorities, ensuring a rapid response.
During the investigation, various design considerations were taken into account, including portability, ease of use, response time, reliability, and cost-effectiveness. Special emphasis was placed on ensuring that the device can function independently without requiring continuous internet access.

Testing and analysis were conducted to evaluate the performance of the system under different conditions. The results indicate that the device is capable of accurately transmitting location data and alert messages within a short time frame. The system also demonstrates reliability in areas with limited connectivity due to its use of GSM technology.

In conclusion, the present investigation highlights the feasibility and effectiveness of the proposed Human Safety Device. The system addresses key shortcomings of existing solutions and offers a practical approach to improving personal safety. Further enhancements, such as integration with mobile applications and additional sensors, can be explored to expand the functionality of the device.

## IV. PROBLEM STATEMENT

In today's modern world, personal safety has become a major concern, especially for women, children, elderly people, and individuals working or traveling alone. Many emergency situations such as harassment, accidents, sudden health issues, and unsafe environments require immediate help and real-time location tracking. However, in most cases, people are unable to call for help quickly due to panic, lack of communication devices, or absence of proper safety systems.

Traditional safety methods like phone calls or emergency contacts are not always reliable because the person may not have enough time to make a call or send a message. Also, many existing systems do not provide real-time location tracking, health monitoring, and instant emergency alerts together in a single device. This creates a major gap in personal safety and emergency response systems.

**There is a strong need for a smart and automated safety device that can:**
Send emergency alerts instantly
Share live location with guardians or emergency contacts
Monitor health condition such as pulse rate
Provide panic button support
Show real-time data on a website
Send alerts through Telegram or internet-based communication
The Human Safety Device is designed to solve this problem by integrating ESP32, GPS module, Pulse sensor, Panic button, Telegram bot, and Flask website into one system. This device ensures that whenever the user faces danger or health issues, the system automatically sends alerts, location, and health data to the concerned person and displays it on the monitoring website.

This project aims to provide a low-cost, smart, and reliable safety solution that can be used in daily life and emergency situations.

Real-Life Examples
Example 1: Women Safety

A woman traveling alone at night may feel unsafe in certain areas. If she faces danger or harassment, she may not be able to call for help immediately.

With the Human Safety Device:
She presses the panic button
ESP32 sends location to website
Telegram sends emergency alert
Guardian receives live location
Help can reach quickly

This ensures quick response and improves safety.
Example 2: Elderly Health Emergency
An elderly person living alone may suddenly experience high pulse rate or health issues like dizziness or heart problems.
With the Human Safety Device:

Pulse sensor detects abnormal pulse
ESP32 sends data to server
Telegram sends emergency message
Family receives alert and location
Immediate medical help can be provided
This helps in saving time and life during health emergencies.

Example 3: Accident or Emergency Situation
If a person meets with an accident while traveling, they may not be able to communicate their location.
With the Human Safety Device:

Panic button can be pressed
GPS sends live location
Website shows exact position
Telegram sends alert
Emergency services can track and reach quickly
This reduces response time and increases safety.

## V. OBJECTIVES

The primary objective of this work is to design and develop an intelligent Human Safety Device that enhances personal security through real-time monitoring and reliable communication. The specific objectives are as follows:

- To develop a compact and portable safety device using IoT technology
- To implement accurate real-time location tracking using GPS
- To integrate biomedical and motion sensors for continuous health monitoring
- To design a dual communication system using GSM (SMS) and Telegram for reliable alert transmission
- To enable automatic as well as manual emergency triggering mechanisms
- To develop a web-based interface for real-time data visualization and remote monitoring
- To achieve low response time and high system reliability under varying network conditions
- To ensure cost-effectiveness and scalability for real-world deployment

## VI. SYSTEM ARCHITECTURE

**Overview of System Architecture**
The Human Safety Device system architecture is designed to integrate hardware components, software modules, and communication systems into a single smart safety solution. The system works by collecting real-time data from sensors, processing it using ESP32, and sending the information to a web server and Telegram bot for monitoring and emergency alerts.

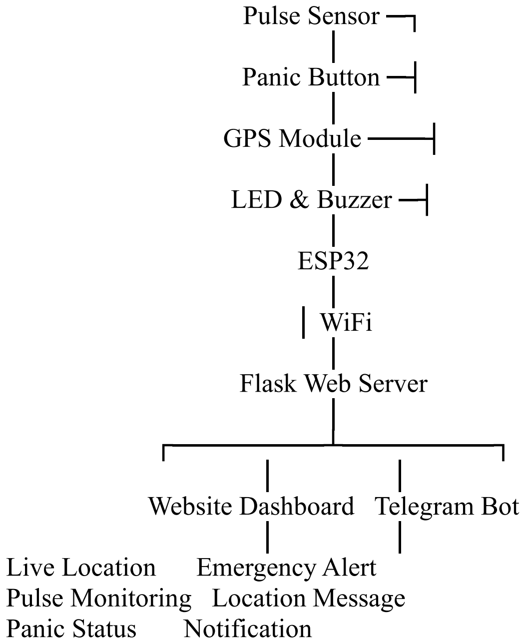
**The architecture consists of three main layers:**

- Hardware Layer
- Communication Layer
- Software and Monitoring Layer

These layers work together to provide real-time location tracking, pulse monitoring, panic alert, and emergency communication.

The system ensures that whenever a user presses the panic button or abnormal pulse is detected, the device sends real-time location and emergency alerts to the website and Telegram, allowing guardians or emergency contacts to respond quickly.

**System Architecture Diagram**
Block Diagram




**Hardware Layer**

The hardware layer consists of all physical components used in the Human Safety Device. These components collect real-time data and send it to the ESP32 for processing.

**Components in Hardware Layer**
- ESP32 Microcontroller
- GPS Module
- Pulse Sensor
- Panic Button
- LED
- Buzzer
- Battery and Power Module

The hardware layer is responsible for sensing and collecting data from the user and environment.

**ESP32 Microcontroller**
ESP32 is the main controller of the system and acts as the brain of the Human Safety Device. It connects all sensors and communication modules and controls the overall working of the device.

**Functions of ESP32**
- Reads GPS location data
- Reads pulse sensor data
- Detects panic button press
- Controls LED and buzzer
- Connects to WiFi
- Sends data to Flask server
- Sends emergency alerts

**ESP32 is chosen because:**
- It has built-in WiFi
- It is low cost
- It supports IoT applications
- It is easy to program
- It can communicate with web servers

The ESP32 continuously collects data from sensors and sends it to the software layer for monitoring and alert generation.

**GPS Module**
The GPS module is used to track the real-time location of the user. It provides latitude and longitude coordinates, which are sent to the ESP32.

**Working of GPS**
- GPS receives satellite signals
- It calculates location coordinates
- Coordinates are sent to ESP32
- ESP32 sends location to website and Telegram
- Output of GPS
- Latitude
- Longitude
- Location link

This location is shown on the website map and shared through Telegram alerts.

Pulse Sensor
The pulse sensor is used to monitor the heart rate of the user. It measures the pulse and sends the data to ESP32.

Working
- Sensor reads heartbeat
- ESP32 calculates BPM
- If BPM is abnormal, alert is triggered
- Data is sent to website and Telegram

This helps in detecting health emergencies.
Panic Button

The panic button is used to send emergency alerts manually.
Working
- User presses panic button
- ESP32 detects signal
- Emergency mode is activated
- Telegram alert is sent
- Website shows emergency status
- Buzzer and LED turn on

This provides immediate emergency response.
LED and Buzzer
These components indicate system status.
LED
Shows power and system status
Indicates emergency
Buzzer
Sounds during emergency
Alerts nearby people

**Communication Layer**
The communication layer connects hardware and software.
Communication Method
WiFi communication is used.
ESP32 connects to WiFi and sends data to Flask server using API.

Data Flow
ESP32 → WiFi → Flask Server → Website and Telegram
This ensures real-time data transfer.

**Software and Monitoring Layer**
The software layer consists of:
- Flask Web Server
- Website Dashboard
- Telegram Bot

This layer handles data processing, monitoring, and alert system.
Flask Web Server
Flask is used to create the web application.

**Functions**
- Receives data from ESP32

- Stores location and pulse
- Shows live map
- Shows panic status
- Sends Telegram alerts

The Flask server acts as the central system.

**Website Dashboard**
The website displays real-time data.
Features
- Live location map
- Pulse monitoring
- Panic alert
- Instructions popup
- Emergency notification

Working
- ESP32 sends data
- Flask updates server
- Website displays location
- Map shows live tracking

This helps guardians monitor the user.

Telegram Bot System
Telegram bot is used for sending emergency alerts.
Working
- ESP32 sends data to Flask
- Flask triggers Telegram API
- Telegram sends message
- Guardian receives alert
- Message Example
- Emergency Alert
- User needs help
- Location: Google Maps Link
- Pulse: 95 BPM
- Panic Button Pressed

Telegram provides instant communication.

GPS and Telegram Flow
Step-by-Step Flow
- GPS detects location
- ESP32 reads location
- ESP32 sends data to Flask
- Flask updates website
- Panic button pressed
- Telegram alert sent
- Guardian receives location
- Emergency response provided

This ensures quick safety response.

**Working Flow of Complete System**
Step 1
System turns on and ESP32 connects to WiFi.
Step 2
GPS starts tracking location.
Step 3
Pulse sensor reads heart rate.
Step 4
Data is sent to Flask server.
Step 5
Website shows live location and pulse.
Step 6

If panic button is pressed:
- Emergency mode activated
- Telegram alert sent
- Website shows emergency
- Buzzer turns on

Step 7
Guardian receives location and message.

**Advantages of System Architecture**
Real-time monitoring
Fast communication
Easy integration
Low cost
Reliable system
Smart safety solution
Live location tracking
Instant Telegram alerts

**Summary**
The system architecture of the Human Safety Device integrates hardware, software, and communication technologies into one smart safety system. ESP32 acts as the main controller, GPS provides location, pulse sensor monitors health, and the website and Telegram provide real-time monitoring and alerts.

This architecture ensures fast emergency response, accurate location tracking, and reliable safety monitoring, making the system efficient and practical for real-life applications.

## VII. HARDWARE IMPLEMENTATION

**Overview**
The hardware implementation of the Human Safety Device focuses on designing and integrating electronic components to create a compact and efficient safety system. The hardware setup is responsible for collecting real-time data such as location and pulse rate, detecting emergency conditions, and communicating this information to the software system.

The system is built using ESP32 microcontroller, GPS module, Pulse sensor, Panic button, Buzzer, and LED indicators. These components are connected in a way that allows smooth data flow and reliable performance.
The hardware plays a crucial role in ensuring that the device works properly in real-time and responds quickly during emergency situations.

**Components Used**
Main Hardware Components

ESP32 Development Board

GPS Module (Neo-6M)

Pulse Sensor

Panic Push Button

Buzzer

LED

Resistors

Breadboard / PCB

Jumper Wires

Battery (Li-ion)

Charging Module (TP4056)

Each component has a specific function in the system.

**ESP32 Microcontroller**
The ESP32 is the main controller and acts as the brain of the system. It connects all sensors and modules and processes the data.

Features of ESP32

Built-in WiFi and Bluetooth

High processing speed

Multiple GPIO pins

Low power consumption

Suitable for IoT applications

Role in Project

Reads data from GPS module

Reads pulse sensor values

Detects panic button press

Controls LED and buzzer

Sends data to Flask server via WiFi

ESP32 ensures communication between hardware and software.

**GPS Module (Neo-6M)**
The GPS module is used for real-time location tracking.
Features

Provides latitude and longitude

High accuracy location tracking

Works with satellite signals

Working

GPS receives signals from satellites

Calculates coordinates

Sends data to ESP32

ESP32 processes and sends to server

Output Data

Latitude

Longitude

Time

This data is used for live location tracking on the website and Telegram.

**Pulse Sensor**
The pulse sensor is used to measure the heart rate of the user.

Features

Easy to use

Provides real-time pulse data

Compact and wearable

Working

Sensor detects blood flow changes

Converts into electrical signal

ESP32 calculates BPM (beats per minute)

If abnormal pulse detected → alert generated

This helps in identifying health emergencies.

**Panic Button**
The panic button is an important part of the safety system.

Working

User presses the button in emergency

ESP32 detects input signal

Emergency mode is activated

Data is sent to server

Telegram alert is triggered

Purpose

Immediate emergency alert

Quick response system

Easy to use

**Buzzer and LED**
These components provide visual and sound indication.
LED
Shows power status
Indicates emergency condition
Buzzer
Produces sound during emergency
Alerts nearby people

**Power Supply**
The system is powered using a Li-ion battery.

Components

Lithium battery

TP4056 charging module

Working

Battery supplies power to ESP32

Charging module ensures safe charging

Portable and rechargeable system

**Circuit Diagram Explanation**
The circuit connects all components to the ESP32.
Connections
GPS TX → ESP32 RX
GPS RX → ESP32 TX
Pulse Sensor → GPIO 34
Panic Button → GPIO 27
Buzzer → GPIO 26
LED → GPIO 25
VCC → 3.3V / 5V
GND → Ground

All components share a common ground.

Circuit Working

Power is supplied to ESP32

Sensors start collecting data

GPS sends location

Pulse sensor sends heart rate

Panic button waits for input

ESP32 processes all signals

Data is sent to server

The circuit is simple and efficient.

**Hardware Working Process**
**Step 1:** Power ON
Device is turned ON
ESP32 initializes all components

**Step 2:** WiFi Connection
ESP32 connects to WiFi network

**Step 3:** GPS Activation
GPS starts receiving location data

**Step 4:** Pulse Monitoring
Pulse sensor measures heart rate continuously

**Step 5:** Normal Operation
Data is sent to server regularly
Website shows live data

**Step 6:** Emergency Condition
**Case 1:** Panic Button Pressed
ESP32 detects button press

Emergency mode activated
Buzzer turns ON
LED glows
Data sent to server
Telegram alert triggered

**Case 2:** Abnormal Pulse
Pulse exceeds threshold
ESP32 detects abnormal value
Emergency alert generated
Same process as panic

**Integration of Hardware Components**
All hardware components are connected to ESP32 and work together as a single system.

Integration Flow

Sensors → ESP32 → WiFi → Server

GPS provides location

Pulse sensor provides health data

Panic button provides emergency input

ESP32 processes and sends data

This integration ensures smooth system operation.

**Advantages of Hardware System**
Low cost
Portable device
Real-time data collection
Easy to use
Reliable performance
Quick emergency response

Compact design

**Challenges Faced**
GPS signal delay in indoor areas
Noise in pulse sensor readings
Power management issues
WiFi connectivity problems
These challenges were handled through proper calibration and testing.

**Summary**
The hardware implementation of the Human Safety Device integrates ESP32, GPS module, pulse sensor, panic button, buzzer, and LED to create a smart safety system. The hardware collects real-time data and communicates with the software system to provide live monitoring and emergency alerts.

The system is efficient, portable, and reliable, making it suitable for real-world safety applications such as women safety, elderly monitoring, and emergency response systems.

## VIII. SOFTWARE IMPLEMENTATION

**Overview**
The software implementation of the Human Safety Device plays an important role in connecting hardware components with the monitoring system and emergency alert platform. The software part of the project is responsible for receiving data from ESP32, processing the data, displaying live location and pulse on the website, and sending emergency alerts through Telegram.

The software is developed using Python, Flask, HTML, CSS, JavaScript, and Telegram Bot API. Flask is used to create the web server and API, while the website dashboard displays real-time information such as live location, pulse rate, and panic status. Telegram is integrated to send instant emergency messages and location alerts to guardians or emergency contacts.
The software ensures real-time communication between the hardware and the monitoring system, making the Human Safety Device efficient and reliable.

**Software Components**
The software implementation consists of the following components:

Flask Web Server

Website Interface

Telegram Bot System

API Communication

Live Location Map

Emergency Alert System

Each component works together to provide real-time monitoring and emergency response.

**Flask Web Server**
Flask is a lightweight Python web framework used to develop the web application and API for the Human Safety Device. It acts as the central system that connects ESP32, Website, and Telegram.

Functions of Flask

Receives data from ESP32

Stores GPS and pulse data

Updates website dashboard

Sends Telegram alerts

Handles emergency requests

Provides API endpoints

Flask is used because it is simple, flexible, and suitable for IoT-based applications.

Working of Flask Server

ESP32 sends data to Flask server using API

Flask receives location and pulse data

Flask updates website

Flask sends Telegram alerts

Website shows live monitoring

The Flask server acts as a bridge between hardware and software.

**Flask Application Structure**
Main Files
app.py
templates folder
static folder
home.html
style.css
script.js
Folder Structure

```
human_safety_device/
│
├── app.py
├── templates/
│   └── home.html
```

```
│
├── static/
│   ├── style.css
│   └── script.js
│
└── requirements.txt
```

This structure helps in organizing the project.

**Website Interface**

The website is designed to display real-time monitoring data and emergency alerts. It provides a user-friendly dashboard where guardians or users can track the safety device.

Features of Website

Live location map

Pulse monitoring

Panic button

Emergency alert popup

Instructions popup

Navigation bar

Auto location update

The website continuously updates the data received from ESP32.

Live Location Map

The website includes a live map that shows the real-time location of the user using latitude and longitude.

Working

GPS sends location

Flask receives location

Website displays map

Location updates automatically

This helps in tracking the user.

Panic Button on Website

The website also includes a panic button.

Working

User clicks panic button

Flask receives request

Telegram alert sent

Emergency activated

Website shows alert

This provides additional emergency support.

**Telegram Bot Integration**

Telegram is used to send emergency alerts and location messages to guardians.

Telegram Bot Features

Sends emergency message

Sends live location

Sends pulse data

Sends panic alert

Instant notification

Telegram is fast and reliable for communication.

Telegram Working

Flask detects emergency

Telegram API is called

Message is generated

Location link is added

Message is sent to user

Example Message

Emergency Alert

Human Safety Device Activated

Location: Google Maps Link

Pulse: 92 BPM

Panic Button Pressed

This ensures quick communication.

**API Communication**

API is used to send data from ESP32 to Flask server.

API Method

HTTP POST request

ESP32 sends:

Latitude

Longitude

Pulse

Panic status

Flask receives and processes the data.

API Flow

ESP32 → Flask API → Website → Telegram

Steps

ESP32 connects to WiFi

ESP32 sends data using API

Flask receives data

Flask updates website

Flask sends Telegram alert

This creates real-time communication.

**Data Flow**

Step 1

ESP32 collects GPS and pulse data.

Step 2

Data is sent to Flask server.

Step 3

Flask processes data.

Step 4
Website displays live location.
Step 5
Telegram sends emergency alert.
Step 6
Guardian receives message.
This ensures real-time monitoring.

**Live Location Integration**
The live location is displayed using Google Maps or Leaflet map on the website.

Working
Latitude and longitude received
Map updates automatically
Marker shows user location
Real-time tracking enabled
This makes monitoring easy.

**Emergency Alert System**
The emergency alert system works when panic button is pressed or abnormal pulse is detected.
Process
Emergency triggered
Flask activates alert
Telegram sends message
Website shows alert
Buzzer activated
This ensures quick response.

**Advantages of Software Implementation**
Real-time monitoring
Easy to use
Fast communication
Secure Telegram alerts
Live location tracking
Efficient API communication
User-friendly website
Reliable system

**Summary**
The software implementation of the Human Safety Device integrates Flask web server, website dashboard, Telegram bot, and API communication to provide real-time monitoring and emergency alert functionality. The Flask server acts as the central system, while the website displays live location and pulse data, and Telegram sends instant emergency alerts.

The integration of these software components ensures smooth communication between hardware and monitoring system, making the Human Safety Device efficient, reliable, and suitable for real-life safety applications.

# IX. RESULTS AND DISCUSSIONS

**Overview**
The Human Safety Device was successfully implemented and tested using both hardware and software modules. The system provides real-time location tracking, pulse monitoring, emergency alert generation, and instant Telegram notifications.

Various test cases such as normal operation, panic button activation, abnormal pulse detection, and live location tracking were performed. The results confirm that the system works efficiently and provides quick response during emergency situations.

**Hardware Output**
The hardware setup consisting of ESP32, GPS module, pulse sensor, panic button, buzzer, and LED was tested.

**Observed Results:**
- ESP32 powered ON successfully
- WiFi connected properly
- GPS module detected coordinates
- Pulse sensor displayed BPM
- Panic button triggered emergency
- LED and buzzer activated

Figure 9.1: Hardware Setup

[ **Insert Image Here – ESP32 with all components connected** ]

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## *Website Output

The Flask-based website dashboard successfully displayed real-time data received from ESP32.

### **Displayed Parameters:**

* Live location map
* Latitude and Longitude
* Pulse rate (BPM)
* Panic status
* Emergency alert popup

📌 **Figure 9.2: Website Dashboard**

[ **Insert Screenshot Here – Website showing map + pulse + status** ]

**Live Location Tracking**

The GPS module accurately tracked the user's location.

Sample Output:
Latitude: 19.0760
Longitude: 72.8777
The location was correctly displayed on the map interface.

Figure 9.3: Live Location on Map

[ **Insert Screenshot Here – Map showing current location marker** ]

**Pulse Monitoring Result**
The pulse sensor successfully measured heart rate.
Observed Values:
Normal Pulse: 72 BPM
High Pulse: 95–100 BPM
When the pulse exceeded the threshold, an alert was generated.

**Panic Button Test**
The panic button was tested under emergency conditions.

System Response
- Panic detected instantly
- Emergency mode activated
- LED turned ON
- Buzzer activated
- Telegram alert sent
- Website alert displayed

**Telegram Output**
Telegram bot successfully delivered emergency alerts.
Sample Message:
Emergency Alert
Human Safety Device Activated
Location: https://maps.google.com/?q=19.0760,72.8777
Pulse: 95 BPM
Panic Button Pressed

Figure 9.4: Telegram Alert Message

[ **Insert Screenshot Here – Telegram message received** ]

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**API Communication Result**
The communication between ESP32 and Flask server was tested.
Data Sent Successfully:
* Latitude
* Longitude
* Pulse
* Panic Status
The server received and displayed data without errors.

**Test Cases and Results**

## *Performance Analysis**

The system performance was evaluated based on speed and accuracy.

### **Performance Metrics:**

* Website update time: 1–2 seconds
* Telegram alert time: 2–3 seconds
* GPS accuracy: High
* Response time: Immediate

**Discussion**
The results demonstrate that the Human Safety Device operates reliably under different conditions. The system successfully integrates hardware and software to provide real-time monitoring and emergency alerts.

The use of ESP32, GPS, and Telegram ensures fast communication and accurate tracking, making the system suitable for real-world applications such as women safety and health monitoring.

**Summary**
The project achieved all its objectives successfully. The system provides:

* Accurate location tracking
* Real-time pulse monitoring
* Instant emergency alerts
* Reliable website dashboard

The Human Safety Device proves to be an effective and practical solution for personal safety and emergency response.

## X. CONCLUSION AND FUTURE SCOPE

**Conclusion**
The Human Safety Device project has been successfully designed and implemented to provide a smart and reliable solution for personal safety and emergency response. The system integrates both hardware and software components to ensure real-time monitoring, quick communication, and efficient handling of emergency situations.

The device uses an ESP32 microcontroller along with a GPS module, pulse sensor, panic button, buzzer, and LED to continuously monitor the user’s condition. The GPS module provides accurate real-time location, while the pulse sensor monitors the heart rate of the user. The panic button allows the user to manually trigger an emergency alert whenever required.

The software part of the system, developed using Flask, HTML, CSS, and JavaScript, provides a web-based dashboard that displays live location, pulse rate, and emergency status.

The integration of Telegram bot ensures that instant notifications are sent to guardians or emergency contacts along with the user's live location.

The system was tested under various conditions such as normal operation, panic situations, and abnormal pulse detection. The results showed that the device responds quickly and accurately, sending alerts within a few seconds and updating the website in real time. This confirms the reliability and efficiency of the system.

The project successfully meets all its objectives, including:

- Real-time location tracking
- Pulse monitoring
- Emergency alert generation
- Website-based monitoring
- Instant Telegram notifications
- The Human Safety Device proves to be a practical, low-cost, and effective solution for improving personal safety. It can be widely used for women safety, elderly monitoring, child safety, and emergency situations.

**Future Scope**

Although the current system performs efficiently, there are several enhancements that can be made to improve its functionality and usability in the future.

**1. Mobile Application Development**

A dedicated mobile application can be developed to replace or complement the website. This will provide a more user-friendly interface and allow users to access features such as live tracking and alerts directly from their smartphones.

**2. GSM Module Integration**

The system currently relies on WiFi for communication. In future, a GSM module can be added to send SMS alerts and calls in areas where internet connectivity is not available. This will increase the reliability of the system.

**3. Camera Integration**

A small camera module can be added to capture images or record videos during emergency situations. This can help in identifying threats and providing evidence.

**4. Voice Activation System**

Voice recognition can be implemented so that the user can activate the emergency alert by speaking a specific keyword. This is useful when the user cannot press the panic button.

**5. AI-Based Health Monitoring**

Advanced health monitoring using Artificial Intelligence can be added to analyze pulse data and detect abnormal patterns. This will help in early detection of health issues.

**6. Cloud Data Storage**

The system can be integrated with cloud platforms to store historical data such as location and pulse records. This data can be used for analysis and tracking.

**7. Miniaturization and Wearable Design**

The device can be made smaller and more compact so that it can be worn as a wristband, pendant, or smart wearable. This will improve user comfort and usability.

**8. Integration with Emergency Services**

The system can be connected directly to police stations or emergency services so that alerts are automatically forwarded to authorities for faster response.

**9. Multi-User Monitoring System**

Future systems can support multiple users and allow monitoring of several devices from a single dashboard. This is useful for organizations and families.

**10. Battery Optimization**

Improving battery life and adding power-saving modes will make the device more efficient and suitable for long-term use.

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