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SMART SAFETY BAND

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Abstract

In today's busy world, the number of victims of unethical physical harassment and crime is increasing day by day. Human security is the main objective of our project. To build a quick-responding alert system, we introduce an innovative Internet of Things (IoT)-based solution in the form of a "Smart Safety Band," which keeps monitoring the individual and indicates a threat. The microcontroller used is interfaced with multiple sensors. When a threat is detected by the alert system, it transmits data through the GSM module directly. The transmitted data during the threat includes the GPS location along with the abnormal readings recorded. Our model can detect sudden falls and unexpected attacks manifesting as a change in pulse rate or temperature. To detect the threat, we are also using the voice module and the emergency key, for which verification from the user is not required if the victim notices any suspected threat. The alert will then be sent. A non-lethal electric shock is produced in all cases for safety. The system can function even if the band has been destroyed after sending the first alerts. Automation ensures that even if the user is incapacitated, the band automatically sends signals through the server without requiring any user input, and it also contains the shock mechanism to produce a non-lethal electric shock in emergency situations. In order to make it more cost-efficient, we are using a voice sensor instead of a voice module, which measures the pitch of frequencies. To make the system more compact, we are using Arduino Nano instead of Arduino Uno.

Keywords: Threat, IoT, detection, GSM, GPS

1. INTRODUCTION

Safety plays an important role in everyone's day-to-day lives, especially while walking or jogging during the early hours of the morning to have less hindrance, early arrival to workstations to be more productive, travelling alone to unknown places either due to work or entrainment, or simply running daily errands. And due to the rise of crimes and the unsecure environment, it became tedious to travel alone. Every one in three people loses the opportunity to have a bright and safe future due to an unsafe environment. So, to overcome this problem, we introduced a wrist band that helps monitor the user's activity.

Smart wristbands have been in use for a brief period of time. Every other person in a gathering possesses one. It is easy to carry everywhere, can be used by anyone, and is easy to explain and understand the working with simple commands. Most bands are user-controlled, or one should manually press the buttons to work, which is not very efficient in an emergency situation.

There are many reasons for movements in the human body, whether walking, sitting, or running. We need to consider all possibilities for human body movements. So, we need an efficient safety band such as the "Smart Safety Band". Here in our proposed model, the band is working using various sensors that detect the user's bodily movements and send updated information. This device can be operated manually by pressing a button.

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2. HARDWARE DESCRIPTION

A. Arduino NANO:

Arduino nano is a type of microcontroller board that is built using an ATMEGA328P microcontroller. We used this microcontroller because it is small, flexible, and capable of providing the same specifications as other microcontrollers. It is capable to interface software and hardware efficiently. This microcontroller uses a USB cable for the power supply and can provide an operating voltage of 5 volts. The flexibility and eco-friendly nature of Nano make it a unique choice to create electronic devices and projects with compact size

Here, this microcontroller is programmed using Arduino software (IDE) and operates both offline and online. It is small in size compared to the UNO board. The Arduino Nano is organized using the Arduino (IDE), which can run on various platforms. Here, IDE stands for Integrated Development Environment. Using the constant voltage, the Arduino Nano is used to produce a clock of a precise frequency. The Arduino Nano is used in various applications such as Robotics, Control System, Instrumentation, Automations, and Embedded Systems.

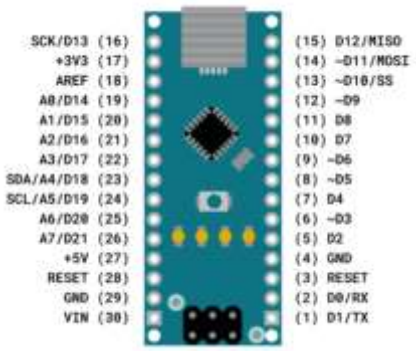

Fig 2.1 Arduino Nano

A. GSM Module

The GSM module has a SIM circuit that is enabled with a unique SIM card. When the module receives the data or the emergency key is pressed manually, the user's location details are sent in the form of a short message service (SMS). It is responsible for communication between the device and the data receiver.

Fig 2.2 GSM Module

B. GPS Module

The GPS module is widely used in a vast range of applications like mapping, monitoring objects or personal movement, navigating, or most commonly, locating or determining position (location). They receive data from satellites through tiny antennas and processors equipped with modules with dedicated RF frequencies. It receives information in the form of longitude, latitude, altitude, etc.

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Fig 2.3 GPS Module

C. Sound Sensor

The sound sensor can detect sound waves that are travelling through the air. It is cost-efficient and easy to use. Depending upon the sound audibility the measurement is taken.

Fig 2.4 Sound Sensor

D. Heart Beat Sensor

The heart beat sensor is used to detect the heartbeat of the user, and it plays a vital role when the user's pulse goes above or below the fixed threshold value. It is a finger-detection heartbeat measuring sensor module that uses the user's finger to detect heartbeat rate.

Fig 2.5 Heart beat Sensor

E. Temperature Sensor

The user's body temperature is monitored in real time using a temperature sensor. Even with slight changes in temperature with respect to the threshold value, a message is sent indicating the current readings.

Fig 2.6 Temperature Sensor

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F. Relay

The relay is activated by a low-power microcontroller signal. It is an electric switch controlled by an electromagnet that, upon activation, pulls either an open or closed circuit.

Fig 2.7 Relay

G. **Shock generator**

A nonlethal electric shock is generated when the user comes into contact with a predator.

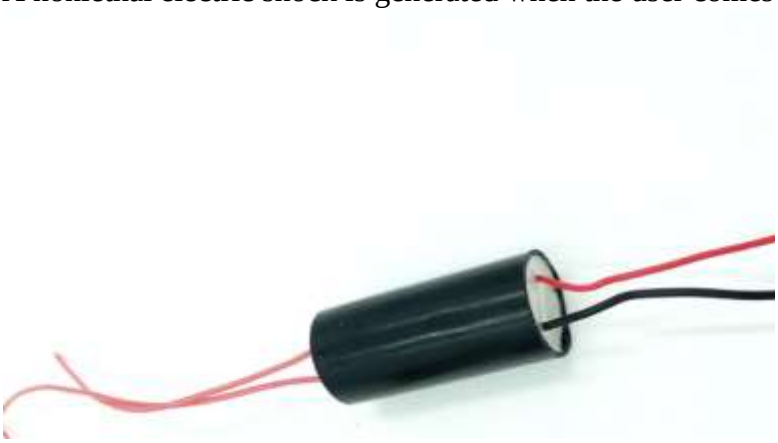

Fig 2.8 Shock Generator

H. Emergency key

Along with all other sensors, there is an emergency key equipped in the device to control or send details by pressing the button manually.

3. SOFTWARE DESCRIPTION

Arduino IDE

The Arduino software (IDE) is an integrated development environment that is open source, which we used to code the Arduino boards. It provides a huge Arduino library to write and upload the programme to the Arduino board using a USB cable. The IDE application is suitable for different operating systems such as Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment**.** The Arduino Software (IDE) makes it easy to write code and upload it to the board offline. We recommend it for users with poor or no internet connection. This software can be used with any Arduino board. It connects to the Arduino boards to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension. ino.

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4. METHODOLOGY

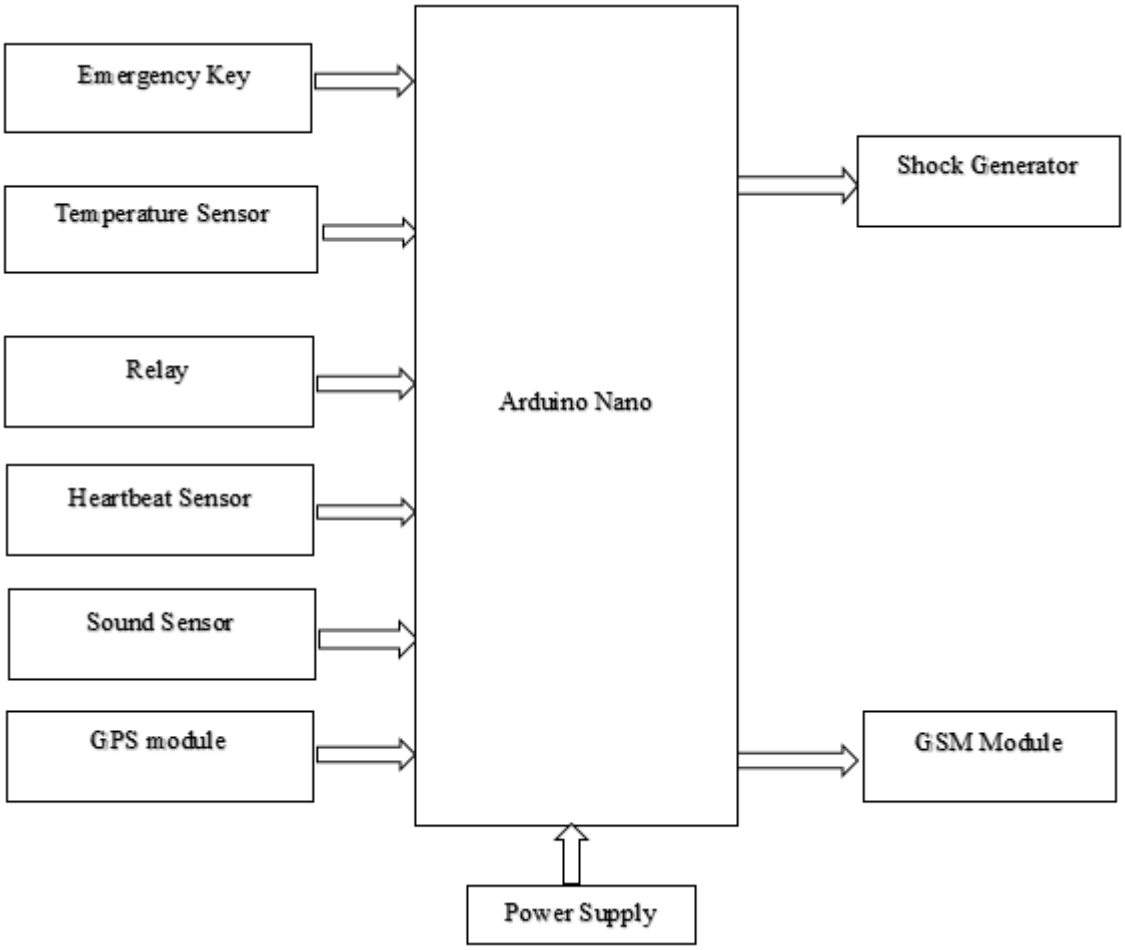

Fig 3.1 Block Diagram of the System

In any emergency situation, people get panicked and may not be able to operate their smart phone applications, so they cannot immediately defend the attacker and protect themselves. So, in these situations, we proposed a system that can be useful to everyone for security purposes. It consists of a wearable safety device having sensors and an emergency button that, when activated, sends an alert message with location information. Here, people can get swift and supreme safety support by pressing the device's emergency switch. If any incident occurs, this device can track the user's location in real-time. In another case, it even worked with body temperature and the pulse rate of the user. Here, the system keeps monitoring the user's temperature and pulse rate. The values from the sensor per 10 seconds will be sent to the server. If the temperature or pulse rate is below the threshold minimum or exceeds the threshold maximum of their respective values, then the system automatically activates. If the user doesn't respond in the given time, then, with the help of the GSM module, 3 alert messages will be sent to the user, If the user doesn't respond in a given time, then this system responds to such a request by sending an SMS containing location information to trusted contacts. But if the user replies, then the flow of the system will stop working in a normal way. In addition, this device functions in both online and offline mode.

5. RESULTS

The overall setup of the project is as shown in fig 4.1

Fig 4.1 Project Setup

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With the help of changes in temperature and pulse rate, this smart safety band can identify abrupt falls and unplanned attacks. A notification with user details is delivered to trusted contacts if the user does not respond to the alert in 30 seconds. The victim will receive an alert if there is any potential threat, as we are employing an emergency key for which user verification is not necessary. It also has a shock mechanism that may provide a non-lethal electric shock in an emergency.

Heart Beat: The pulse sensor in this instance continuously tracks the wearer's heart rate. Here, a minimum and maximum threshold value have been set. The technology detects threats and alerts the trusted contacts if the pulse drops below the lowest threshold or rises above the maximum.

Fig 4.2 Heart Beat Message

Temperature: In this case, a temperature sensor continuously checks the wearer's pulse. Here, a minimum and maximum threshold value have been set. The technology detects threats and alerts the trusted contacts if the pulse drops below the lowest threshold or rises above the maximum.

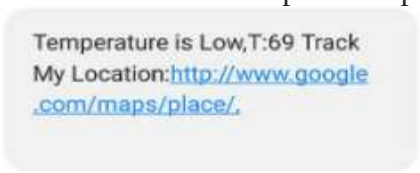

Fig 4.3 Temperature Message

Voice Alert: Here the Sound sensor monitors continuously pitch voice of the person wearing band. Here we have fixed a threshold value of minimum and maximum. If the pitch goes below the minimum threshold or beyond the maximum the system detects threat and sends alert messages to the trusted contacts.

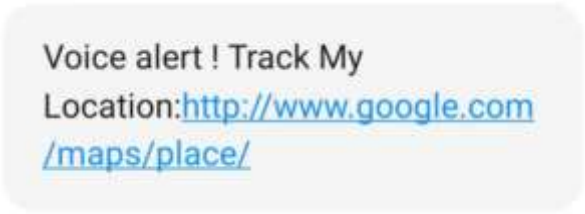

Fig 4.4 Voice Alert Message

Emergency key: If the individual wearing the band feels threatened, they can use this key to immediately activate the system and send alert messages to their trusted contacts.

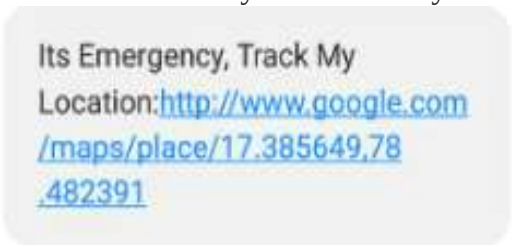

Fig 4.4 Emergency Key Message

Our system has been successful in implementing the intended outputs to guarantee an individual's safety and security. Multiple sensors are interfaced with the microcontroller Arduino Nano ATMEGA328P used in this project. These sensors continue to watch over the individual wearing the band. The alarm system directly transmits data through the GSM module when a threat is identified. GPS coordinates and any recorded aberrant readings are among the data delivered during a threat.

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6. CONCLUSIONS AND FUTURE SCOPE

Our project's major objective is to make sure that everyone feels safe and secure while commuting at night, on isolated roads, or while going to work or school. With more study and innovation, we can partially overcome the issues by implementing real-time applications and an improved gadget that can be utilised to protect individuals in dangerous situations. The project has undergone successful testing with accurate user location data, flawless operation of all sensors in a variety of environments, and efficient threat detection. Being the first of its kind, this type of concept will naturally play a significant part in ensuring safety. The proposed design would address problems that people have recently encountered and work to fix them with the aid of cutting-edge technology. This system is capable of carrying out real-time monitoring and accurately identifying threats. This work aims to keep everyone secure, and since it's portable, it can be readily transported anywhere. The user's temperature and heartbeat are continuously monitored by the system. Both the temperature and the heartbeat have their threshold minimum and maximum values specified. Along with voice alert capability a non-lethal electric shock is generated using shock generator If the temperature, heartbeat or pitch voice is dropped below the threshold minimum or beyond the threshold maximum of their respective values, then the signal will be sent to mobile application as an alert message. The signal will be delivered to the mobile application as an alert message if the temperature or pulse fall below the threshold minimum or rise above the threshold maximum of their respective values. The procedure of sending an alert message happens automatically; the user does not need to touch any buttons. Because it is so affordable, the average person may use this device when travelling outside.

Future Scope:

Additional features can be added to the hardware, like a camera and sound recorder. So that live updates of the user can be observed and provide safety measures in case of danger, and the latest versions of hardware can be used to improve performance. We will Add two-step verification for some kinds of alerts that might be due to panic situations. This can be achieved by adding an alarm to the system.

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