IOT Based Household Health Safety System

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Abstract
IoT opens the pathway of modernized health care and safety systems to monitor the physical parameters of the persons. But the emerging count of accidents and deaths occur inside the houses are created the necessity of making real-time monitoring and identification systems to rescue the affected person whoever got injured inside the house. Thus to provide this systematic approach the combination of sensors and the micro-controller unit with IoT will help to provide the accurate and optimistic response for the recovery of the persons injured. The Arduino Mega controller used in this system will get the foot vibrations and accidental vibrations using the piezo electric sensors or rubberized micro switches. These vibration values will be converted into electrical signals in the sensor itself and given to Arduino Mega controller for the processing. It will compare these signals with pre-programmed values and produce the rescue signal and is fed to the GSM module. The rescuer mobile will get this signal through call or message and the person who got injured can be rescued immediately by actuating the solenoid lock module with the reply mobile command. Thus using this method many lives can be saved from endangered situation.

Keywords: *Piezoelectric sensors, Arduino-microcontroller, GSM module, Relays, Solenoid lock.*

I. INTRODUCTION

Accidental management and health safety is important for the lifesaving of injured persons. According to WHO, World Health Organization, 32% of deaths occurred in homes are due to the accidents like slipping, fainting happened inside the bathrooms and in stairs. Due to these type of household accidents, the endangering of life of the injured persons will get increased and it has to be solved to avoid the deaths of people. Accidental nervous attacks will cause paralysis, memory loss and coma to the injured persons. . There have been distinctive health challenges focused in the society through technical innovations. Elderly people and the disabled have to be taken care for their health safety and emergency household accident management. For the timely response and recovery, it has to be monitored in real time and the faster reaction has to be made to save the injured person. Even though the accident is small, if it creates blood loss, severe injuries, it will lead to the loss of life. To resolve this issue, the pressure obtained from the tiles can be processed using the microcontroller to detect and rescue the injured person.

Objective:

1. To detect the fall of a person inside the house.
2. To produce the rescue signal to rescue the person through GSM communication.

II. LITERATURE SURVEY

This survey is conducted to understand the different fall detection systems and piezoelectric power generation systems.

Yi-Zeng Hsieh [1], NOV 2017 studies the modern development of home intelligent fall detection IoT system based on feedback optical flow convolutional neural network. But this system is a costlier one due the neural network analysis and optical flow system.

Raul Igual [2], JULY 2013 studies the Challenges, Issues and Trends in Fall Detection Systems. This article also aims to serve as a reference for both clinicians and biomedical engineers planning or conducting field investigations.

Kiran Boby [3], APR 2014 studies thefootstep power generation using piezo electric transducer. But this method can be used for the power generation only. It is an optimistic method but instead of power generation, the pressure on the piezoelectric sensors can be used for fall detection.

III. SYSTEM BLOCK DIAGRAM

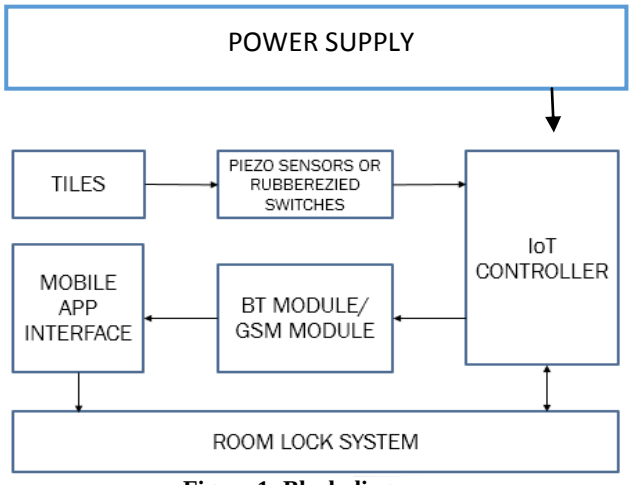


Figure 1: Block diagram

IV. HARDWARE DESIGN

A. Power supply module

A 230V to 12V converter circuit is used to supply the overall system to detect the fall of a person and to produce the rescue signal. A rectifier circuit is also used to supply the 5V DC voltage to the Arduino microcontroller for the processing. There are separate supply paths for controller, relay, sensors, etc.

B. Piezoelectric sensors

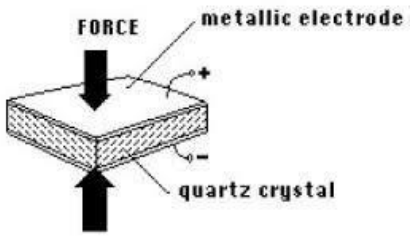


Figure 2: Piezoelectric sensor

The piezoelectric effect can be understood as the linear electro-mechanical interaction between the mechanical and the electrical state in crystalline materials with no inversion symmetry.

The piezoelectric sensor is a transducer which converts the mechanical stress, which it experiences, into the equivalent electrical quantity. Thus the vibration or pressure is converted into electrical quantity and this value is fed to the microcontroller unit.

C. Arduino microcontroller

A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system and the typical microcontroller includes a processor, memory and input/output (I/O) peripherals on a single chip. A microcontroller's processor will vary by application. Options range from the simple 4-bit, 8-bit or 16-bit processors to more complex 32-bit or 64-bit processors. In terms of memory structure, microcontrollers can use random access memory (RAM), flash memory, EPROM or EEPROM.

Figure 3: Arduino Uno board

Arduino is an open source electronics prototyping microcontroller platform based on flexible hardware and software. The Arduino is a simple yet sophisticated device which is based on Atmel's ATmega microcontrollers. The software language is based on AVR C programming language and can be expanded through C++ libraries. Arduino Uno microcontroller board is based on the Atmel's ATmega328 microcontroller.

It can be programmed through the Arduino IDE platform. According to the program, various inputs from the sensors, switches and process them to produce the required output. In this project output is the GSM module triggering signal.

D. GSM module

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. GSM modems support an extended set of AT commands for their operation. These extended AT commands are defined in the GSM. AT commands are the instructions used for controlling a modem. AT stands for Attention. Each and every command line starts with "AT" or "at".

Figure 4: GSM module

In this safety system the GSM module gets the signal from the micro controller and it sends the message or calls the rescuer according to the pre-setup in the program. The reply call or message is obtained through this module and the solenoid lock is controlled by this reply signal to rescue the injured person.

E. Relay module

A relay is commonly used to interface a low-current circuit to a higher-current circuit. Basically, a relay is an electromagnetic switch control. The input side is a coil where the output side is a switch that magnetically connected to a coil. When current flows through the coil, the switch toggles between the ON and OFF states. Thus a relay is useful to control and operate the appliances and other mains-powered devices using the microcontroller.

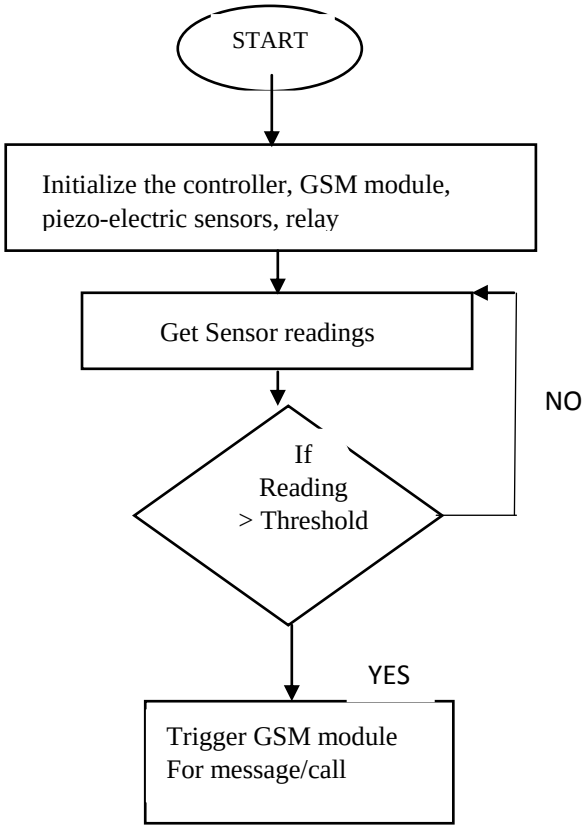
F. Solenoid lock system

A solenoid lock system is an electromagnetic locking system that can be operated using a relay. Whenever a person who is inside the bathroom got injured, the door has to be opened to rescue or recover the person.

V. WORKING

In this project, the person who got injured will be rescued and recovered using the IoT based system. The elderly and disabled person or even an ordinary person also fall on the ground by slipping, fainting, etc. This fall may cause physical injury to the person. If this injury is severe like blood loss, that injured person have to be rescued immediately for his life saving. Thus using our system the fall down of a person inside the house or bathroom can be easily detected. In the proposed system, there are piezoelectric sensors incorporated under the tiles of the ground of house or bathroom. Whenever a person walks eventually he press two or three tiles using his feet which causes the piezoelectric sensors to generate low voltage. If the person fall on the ground, which means on tiles, there will be pressure on more than four tiles at a time by the body of the person. Thus the piezoelectric sensors get more pressure and they generate more voltage. This voltage levels are already verified and the threshold value of the voltage is set in the microcontroller. That Arduino microcontroller compares the values of the piezoelectric sensor output voltage and the pre-set threshold voltage. If the output from the piezoelectric sensors exceeds the threshold then there will be a signal produced by the controller to trigger the GSM module to send a message or call a registered number of a person who can rescue the injured person. The rescuer number and the rescue message should be already coded to microcontroller and the GSM module using the AT commands. The network registration of the SIM card inserted in the GSM module can be easily verified by calling the number of that SIM card. The ring sound is heard then the SIM card is registered in the network using the GSM module successfully. Thus the rescuer will get the message or call indicating that his relative or friend got injured and he can immediately go to the house to save them. If the person got inside any rooms or bathroom, he can reply to the message or call he received in the same way to actuate the solenoid lock system to open the door which is already incorporated with the doors. Thus any person who is in a hurry of to be saved can be saved immediately as life is a precious concern. The relay is used to supply the solenoid lock system with the help of GSM module command.

VI. FLOW CHART



VII. CONCLUSION

This paper was aimed not only to detect the physical fall down of a person but also to bring the technology close to the people to save their life. As ignorance makes more damage and death than the physical injuries, this project will help many lives to be saved. This project is very essential for those who have no one to take care of them directly. It also helps the elderly people and disabled persons to get saved from endangered situation.The paper proposes smart system for health safety with Internet of Things application which promises to overcome certain challenges which lie in the present day health monitoring systems. Projects like this encourage people to take up health cautious as an important thing. This is very essential in highly populated countries, especially India, where personal healthcare solution is the requirement of the people.

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