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IoT BASED WHEELCHAIR FALL DETECTION SYSTEM

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Abstract—

It is important to take care of our elderly people and keep an eye on their well-being and security. It is likely that they have a high risk of falling because of their fragile bones and joints, which brings in the usage of wheelchair for most of the old people. A wheelchair-bound individual who is physically impaired needs to be watched out for falls as well. There are currently monitoring systems using CCTV cameras, but they are very expensive. The average person cannot afford such a system. As a result, we suggest an affordable fall detection system using the newest technology such as Internet of Things (IoT). The system uses gyroscope and accelerometer sensors to detect individual movements. Both collaborate to detect the fall events improving the detection's accuracy. It might be mounted on a person's hand or wheelchair for finding. The sensor is connected to a microcontroller so that it can continuously monitor the data about the increasing speed. What if the individual did not fall and the warning given was false? The framework allows the alarm to be turned off if the individual presses the snooze button within 5 seconds. Therefore, IoT will reduce user effort while also generating fertile work that makes accessing the system simple.

Keywords- *Arduino UNO R3, wheelchair falld etection, accuracy, Sensors*

I. *Introduction:*

The majority of wheelchair users are elderly persons and those with disabilities. These individuals are at a greater risk of falling and getting hurt. Because no one is aware that they are unconscious when they fall, this incident can be lethal. These persons may sustain more serious wounds if they live alone or if their relatives and friends are not present. If a falling incident occurs, it is crucial to have a timely response and rescue time.

Medical care must be given right away to lower the possibility of getting injured from fall that these individuals would suffer injury from a fall. As a result, a trustworthy fall detection system can aid in the detection of falls in elderly persons and the search for support and assistance. There are now two types of wheelchairs: commercial and intelligent or motorized wheelchair. Commercial wheelchairs are often those which are not powered with any technology. On the other hand, a smart or powered wheelchair has a controller unit that enables the user to enter data via a joystick, voice command, and other methods so that the wheelchair can move to the desired location automatically. Therefore, in this project we can solve this issue.

By employing IR sensors, where we can technologically keep an eye on them. With the help of this device, we can monitor them and even detect the falls.

A. Objective:

To develop a wheelchair fall detection system using Internet of Things (IoT) technology and a sensor that can assess the situation and update the system in real time. The system's purpose is to trigger a response that will decrease the severe impacts of a fall while also giving users a helpful alternative to an alarm once a fall has taken place.

2. Literature review:

With the advent of technology, the wheelchair had evolved into a smart wheelchair. A smart wheelchair is one that has been created to be able to move on its own at the user's command. As aforementioned that there are two types of wheelchairs: Intelligent or Smart wheelchair and Commercial wheelchair. The smart wheelchair has many features, including automatic navigation, object detection, and others. There is no given fall detection system for the commercial wheelchair or the smart wheelchair.

In order to detect a fall occurrence, currently available commercialized fall detection systems require the user to wear a wearable object, such as a bracelet or a pendant. These systems don't offer any technology that would enable the system to look for assistance automatically. There is a need for a tool or fall detection system that can call for assistance or help without pressing a button or using vocal commands. This system must be compatible with the present wheelchair, particularly those which are commercial or existing wheelchairs and the one's which are economical. The implementation of IoT has improved the smart wheelchair because the data collected from the sensor will be sent to the cloud and analyzed. The most recent IoT technology improvements such as machine learning, following, navigation assistance, and fall detection have come into the picture and are compatible with the wheelchairs.

3. Methodology

A. Block Diagram

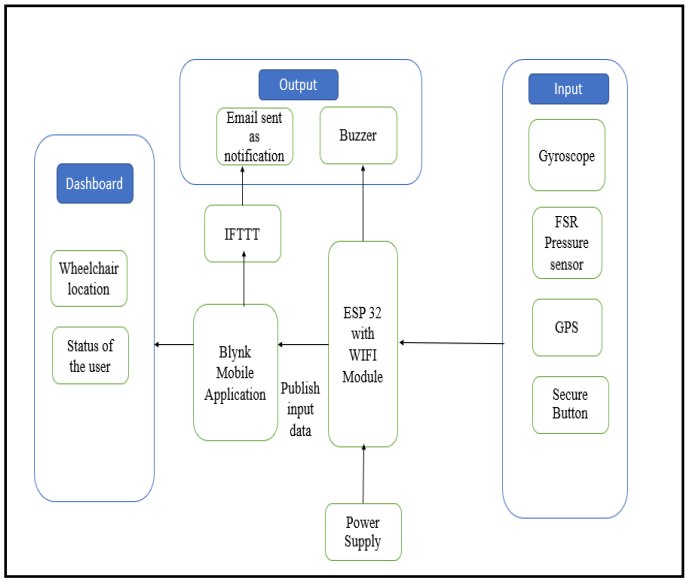


Fig 1. Block Diagram

B. Hardware Specifications

A. Arduino UNO R3

Fig.3.1. Arduino UNO

B. PIR Sensor

Fig.3.2.PIR Sensor

C. Light Emitting Diodes (LED)

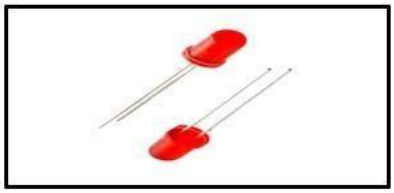


Fig.3.3.LED's

D . Resistors : 2K ohm -2No.; 500 ohm -1No.; 50 ohm - 1No

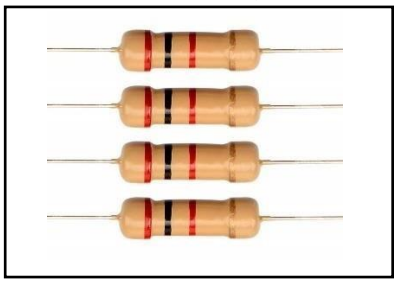


Fig 3.4 Resistors

E. Buzzer

Fig 3.5. Buzzer

F. Breadboard

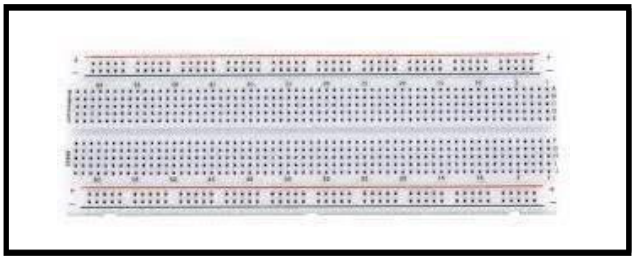


Fig.3.6 Breadboard

G. Connecting Wires

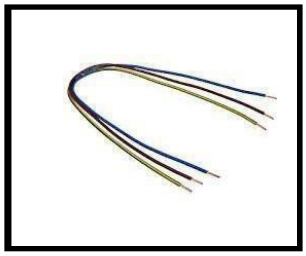


Fig.3.7 Connecting Wires

H. Switch Button

The overall detailed wiring diagram for the fall detection system is depicted below as follows:

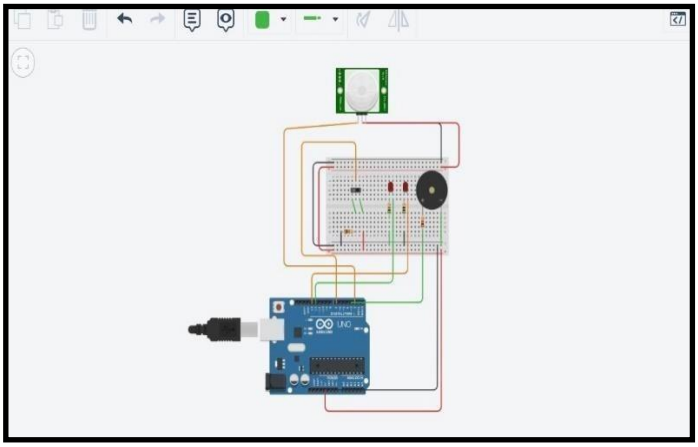


Fig.2. Wiring Diagram

3. Working and its principle

As we can see from the principle of operation the PIR sensor can detect a person's fall. People who move far away from the PIR sensor or if the elderly people who fall off their wheelchairs, the sensor detects and cause the buzzer to sound, and we must turn it off manually. The PIR sensor will read the value from pin 2 of the Arduino UNO R3, whereas the button will read the value from pin 7. If the value read by button is high, then pin 12 is set high, i.e., LED 1 glows. If the value read by button is low, then pin 12 is set low and LED1 doesn't glow. If both the sensor value and button is high, then LED2 will glow, which results in detection of fall. If both the sensor and button is set low, then both the LEDs are turned OFF. If value of x=1, and sensor is low; switch button is high, and we get the sound from the buzzer
i.e. we use tone function tone (3,500, l00) which means as buzzer is connected to pin 3, 500Hz frequency sound buzzes by the buzzer with a duty cycle of 100%.

A. Connections

1. Place the slide switch on the breadboard.
2. Connect the switch to Vcc and Ground using a resistor.
3. Now, we have to connect components such as Buzzer, Sensor, switch to Arduino UNO R3.
4. Connect the D2 pin of Arduino to the switch.
5. Connect the D3 pin of Arduino to Buzzer.
6. Connect the D13 pin of Arduino to the anode of LED2
7. Connect the D12 pin of Arduino to the anode of LED1 Using resistor.
8. Connect the sensor output to the power supplies.
9. Test the developed system.

4. RESULTS

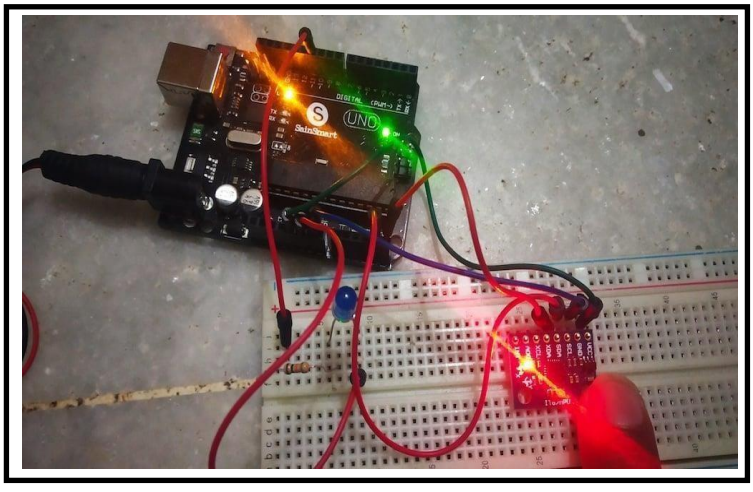
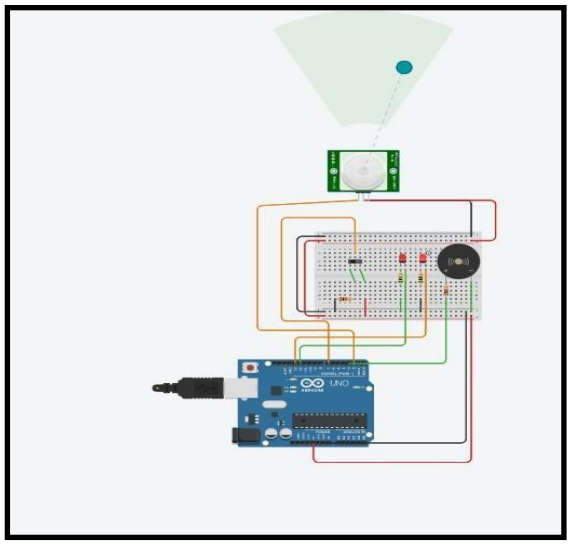


Fig 5.1 Hardware result attached for reference



5. *Advantages and applications*

A. ADVANTAGES

- Allows the user to call for assistance without pressing the call button.
- Simple and easy to design
- It is economical and can be afforded by everyone.

B. APPLICATIONS

- Patients and elderly people can be monitored at home.
- It is also employed for any other security emergencies.
- Finds its applications in Hospitals and also in the Military.

6. *Conclusion*

The initial goals were successfully designed and achieved. Following the design of the overall system's circuit and programming is done for each sub-system. When either system detects a fall, the alert system is triggered. The implementation, execution as well as simulation is achieved.

7. *References*

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