Iot Based Fall Detection System for Elderly/Physically Challenged People

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ABSTRACT: Fall is the one of the leading problems among elderly and physically challenged people. Fall detection is the major challenge in public health care domain. This paper develops fall detection system using IoT. Internet of things (IoT) is a networking concept that allows connection of various smart devices. This concept plays a huge role everywhere. An Arduino based IoT device for fall detection has developed especially for elder peoples who are staying alone in home. If the old age peoples felt down in most of the cases, it will lead to serious injuries and they can't raise voice due to shock .They must be helped on time in order to avoid the further danger. The main aim of our project is to make the detection of fall on Arduino based device. This device is used to detect the fall of a person with the help of accelerometer and this is specially designed to contact an respective caretaker as soon as possible. The accelerometer senses the position of the person by three axes. If the fall is detected the care taker will receive a call and SMS alert through the mobile phone.
KEYWORDS: Accelerometer, fall detection, Internet of things (IoT)

I. INTRODUCTION

This paper introduces an easily operated IoT based fall detection device for elderly/physically challenged people. When it comes to elder/physically challenged people, it becomes necessary to monitor them for their health and safety. Due to weakness and weak joints they have a great risk of falling down. Now it is important to know if a person has fallen so that he/she can be helped on time. Also people on wheelchair need to be checked for fall detection. For this purpose we propose a fall detection system using IoT (Internet of Things) and Arduino. The system uses accelerometer sensor to detect person movement.

II. EXISTING SYSTEM

In the existing system the wheel chair is controlled manually from the joystick and there is no fall detection system to detect the fall of the patient from the wheelchair.

III. PROPOSED SYSTEM

Arduino based IOT device for wheel chair fall detection has developed for elderly/physically challenged people who are staying alone in home. This work is based on the threshold based system for detection and tracks if the parameter of the angle is increased above the threshold or not in the certain interval of time. If the person falls then there must be a certain change in the acceleration in the certain time interval and if there is no orientation change which notifies that the person has fall. The circuit of fall detection is built with the Arduino UNO and the ADXL335 accelerometer. This is used to track the changes in the position of the angle along the axis. Here, it can clearly notice that if the old age people felt down the damage and the effects are more when compared with the normal person as they aged. And if they felt down in most of the cases, it will lead to serious injuries and they can't raise voice due to shock. To resolve this problem and to monitor the actions of the old age peoples in home this work is more useful and will help to keep track. The implementation is based on the combination of both hardware and software that detects and triggers the entitled person through SMS alert. The special feature of this device is portable and it can fix in any space like wheel chair, and bed.

IV. MOTIVATION OF THE PROJECT

In around 35 years and by 2050, it's estimated that more than one in each group of five people will be aged 65 or over. In this age group, falling is one of the most serious life-threatening events that can occur, as approximately one-third to one-half of the population aged 65 and over (mostly aging care centres residents) experience falls on a yearly basis and half of these elderly do fall

repeatedly. So, the automatic detection of falls would help reducing the time of arrival of medical assistance, and accordingly reducing the mortality rate.

V. PROBLEM STATEMENT

Most of handicapped people who use wheelchair are helpless. Many times they are alone and may require help in many cases. There will be scenario in which they will be alone and may fall down and they will require help. Our System will provide Fall Detection System to help them.

VI. BLOCK DIAGRAM

Transformer is used here to step down the 230v ac to 12/5v ac. The bridge rectifier circuit is used to convert 12v ac to 5v dc. The obtained 12v dc is pulsating so capacitor is used as the filter to obtain pure DC. The voltage regulator Ic7805 is used to obtain constant supply of 5v DC. The led used in the rectifier circuit is used for the indication of the supply. Relay is connected to both Arduino and node mcu. Tx of the controller is given to the common pin. In NC condition, the values of accelerometer are getting updated in node mcu. When the fall is detected relay is switched on and gives the intimation through GSM module. LCD (16×2) is used to monitor the working of the entire setup since the values of accelerometer and GSM module are displays in it. NodeMCU works on MQTT (message queue telemetry transport) protocol. This protocol acts as a broker which collects the data from the controller and uploads it in the cloud. It both receives and transmits the data. Buzzer is used to give an acknowledgement when the fall is detected. GSM module is used to obtain the call and message alert when the fall is detected. The NO pin of the relay is connected to the receiver of GSM module so when the fall is detected the transmitted data from the node mcu is received through the relay to GSM module. Hence we receive the call and message alert through the mobile phone.
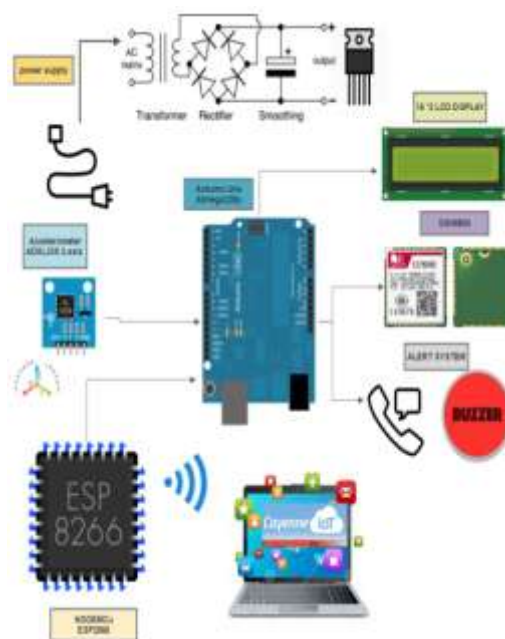

Fig 1 : block diagram

VII. LITERATURE SURVEY

The authors proposed the fall detection techniqueusing smart phones. This approach utilizes the usage of mobile phone accelerometer that captures data to decide. The major application is all about the usage of android platform [1]. The advantage of using this approach with smartphones which has embedded with multiple sensors such asmicrophone, camera, GPS, accelerometer. Usage of android platform makes this work more realistic and gives the required data and the output very accurate. Therefore, this work is considered as more realistic because of the usage ofandroid platform. This system has developed upondifferentiating the differences in the position of a person then and back of the fall.

The author propose a novel, smart and cost-effective fall-detection system by merging latest technology as Internet of Things and existing algorithms like Motion History Image and C-Motion[2].This system uses low-cost Pi Camera mounted on Raspberry Pi to monitor and detect person's fall-like movements. Pi Camera is a smart camera can be easily fixed on windows and walls of living room. System will be watching keenly for fall detection and unexpected motion changes in targeted person. An unexpected abrupt change with peak in the system is treated as a fall.

The authors proposed elderly fall detection using wearable sensors. Falls are very common among the elderly.They are the second leading cause of accidental injury death for people of all ages [3]. The wearable fall detectors are available in

the form of pendants and wrist bands. These are waterproof. If they press the incorporated alarm button when they fall, or if they are unconscious after a fall, alarmwill be triggered to alert the desired person or the callcenters through the wireless link into a local telephone.

The author proposes an IoT-based fall prevention and detection system for such individuals to promote independent living without depending on others or the need to be monitored constantly, thereby increasing their quality of lives. Our system prototype detects a fall using a threshold based accelerometer algorithm and uses BLE modules deployed at strategic locations to prevent a fall [4]. This alerts users to be more careful in those areas by generating audio message and even if a fall does occur, it notifies parents, caretakers and medical in-charge people via SMS.

The authors proposed an Arduino based IOT device for septuagenarian falldetection has developed especially for the elder peoples who are staying alone in home. If the old age peoples felt down in most of the cases, it will lead to serious injuries and they can't raise voice due to shock [5]. This work possesses to make the detector on arduino based device for the old age people who fall down. The device is used to detect the falling of a person with the help of accelerometer. The implementation is based on the combination of both hardware and software that detects and triggers the entitled person through SMS alert.

SYSTEM ARCHITECTURE

VIII.   HARDWARE DESCRIPTION

Arduino: The Arduino micro controller is an open source platform type convenient to function. It has six analog pins and fourteen digital input and output pins, energy jack for vigor connection. It's an In-procedure-Programmable gadget this implies the purchaser don't have any ought to make use of the dispose of the IC, we are able to with no second's lengthen join the Arduino to the pc and determining the first-rate possible COMM port. One of kind varieties of Arduino micro controllers is available in market like UNO, Nano.

Fig 2: Arduino

Accelerometer ADXL335: ADXL335 is 3 axis based sensor that measures the movement of the person

Fig 3:3-axis accelerometer

Power supply: This section provides power to the project so that it can run properly. Here we are using power supply board to do some functions. In this board we are using some components like transformer, rectifier, regulators, filters and etc. Some Basic components used in Power Supply:

Rectifier: Rectifiers are used to convert alternating current into direct current. We have two type of rectifiers one is half wave rectifier and the one is full wave rectifier. Here in our project we are using full wave bridge rectifier. The advantage of full wave bridge rectifier is it will convert the whole alternating current into direct current without any loss. This is the summary about full wave bridge rectifier.
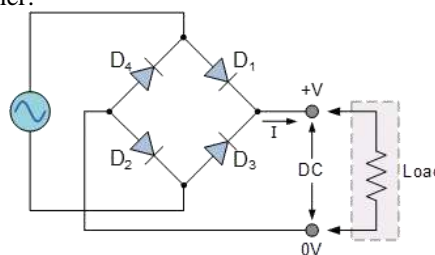

Fig 4: rectifier circuit

Capacitors: Capacitors are the basic components which are used probably in every electronic project with the great value. They are basically used to store the charge but the main aim to use rectifiers is to make the smoother output. We can say that the capacitors are the filters because they can filter out the up or high edges from the upcoming input. By doing this they are giving a proper and smooth

output which is the basic requirement of every project.

Fig 5: capacitors

Voltage regulators: The voltage regulators are the components which are high in demand in the electronics projects because we are getting some common supply for our projects but the components we are using in our projects need different voltage. So here we need a device which can provide a desirable input for each component. So from here we can understand the importance of the voltage regulators. We have some 78XX series for regulators where 78 indicate the series number and the XX indicate the output of the regulator.

Fig 6: voltage regulator

Node MCU: The ESP8266 is the name of a micro controller designed by Espressif Systems. The ESP8266 itself is a self-contained Wi-Fi networking solution offering as a bridge from existing micro controller to Wi-Fi and is also capable of running self-contained applications. This module comes with a built in USB connector and a rich assortment of pin-outs. With a micro USB cable, you can connect NodeMCUdevkit to your laptop and flash it without any trouble, just like Arduino.

Fig 7: Node MCU

A 16X2 LCD is connected with Arduino at 7,8,9,10,11 and 12 pins to display the reading of various sensors.

Buzzer: A **buzzer** or beeper is an audio 335signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of **buzzers** and beepers include alarm devices, timers.

Fig 8: buzzer

LCD Display (16 X 2):Alphanumeric displays are used in wide range of applications, including palmtop computers, word processors, photocopiers, point of sale terminals, medical instruments, cellular phones, etc. 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters, symbols.

Fig 9: LCD display

IX. Software

ARDUINO IDE:

To program Arduino we need some integrated development environment. So every controller has their different integrated development environment. In Arduino we have given flexibility that it has its own Arduino IDE software. With the help of that software we can program our Arduino very easily. We don't need any external dumper for dump the program.

NODE MCU:

It is used as a "Central Node". This has an inbuilt WI-FI module. Thus microcontroller unit has "ESP8266 WIFI-SOC". All the sensors all connected to this MCU where this does all the processing and sending the data to remote Iot server. This NodeMCU is sends the data to a remote Iot server through WI-FI. This uses "MQTT protocol" for sending the data to the server.

MQTT (MESSAGE QUEUING TELEMETRY TRANSPORT) PROTOCOL:

This is an ISO standard protocol which uses TCP/IP for transferring the data. This uses publish-subscribe model of transfer. This protocol was designed for sending data from the remote location where the bandwidth and the data transfer rates are very slow.

X.   REMOTE SERVER (CAYENNE):

The data from all the sensors is stored in a remote Iot server where we can use this data for further analysis. There are many Iot servers which provide different tools. In this project, we are making use of "Cayenne Iot Cloud Platform". This is a free Iot cloud platform. This cloud platform provides many cloud services like data visualization, alerts and etc. This server provides the facility to any number of sensors and devices. We can see the data on the dashboard in any format. This server also has a mobile application which can also be used for seeing the data using mobile.

XI.   HARDWARE RESULTS

The respective caretaker will receive a message and a phone call, and buzzer will snooze continuously so it will help the elderly/ physically challenged to help them and the caretaker will help them faster
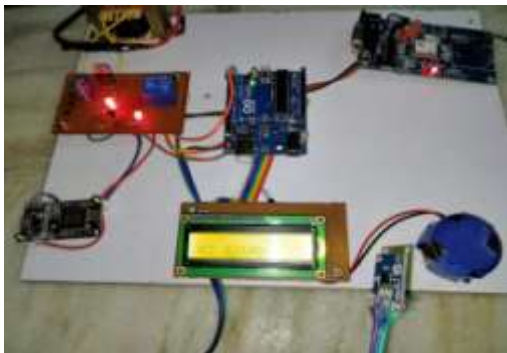

Fig 10: hardware connection

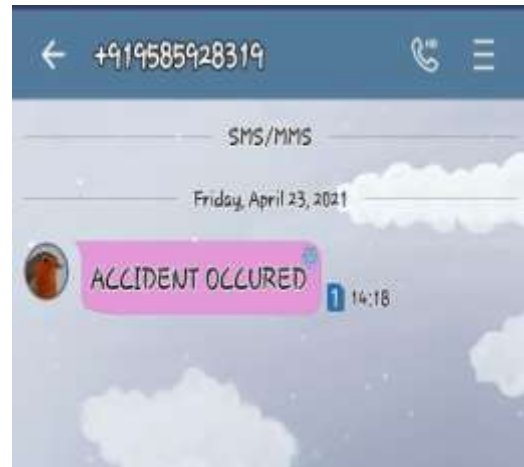**Fig 11: call received during fall**

Fig 12: message received during fall

XII.   ADVANTAGES

Our work the detector is based on IOT based sensor device which keeps on track the changes in motion of the person and also saves the information. The device is very much portable than compared to existing systems which helps to fix in any space like wheel chair and bed. This has been considering as special feature of this work when compared to the existing works. The major advantage of this work is that this sensor device sends the SMS alert to the respective person which is very much useful for the person to know that the elder/physically challenged has felt down so that they can take the immediate actions to save them. And if the person has not receives the SMS alert, the device automatically makes call to the entitled person.

XIII.   DISADVANTAGES

Complexity: IoT is a complex system. Any failure or errors in the software or hardware will cost serious troubles. Not only has that power cut also made us uncomfortable

Privacy/Security: With the majority of this IoT information being transmitted, the danger of losing security increments. In-accurate data: Even though the device can give you huge amounts of information in regard to the activity and wellness, numerous tests demonstrates that the information isn't 100% precise and not by any means 80% once in a while.

XIV.   SCOPE AND APPLICATION

Our project has a wide range of application and scope in following areas:
• Physically Challenged People
 Physically Disabled People can use it as per their purposes. People who are able to use their hand can use Joystick; People suffering from certain paralysis

can use either voice or head movement as per requirement.

• Patients in the Hospitals

People suffering from certain paralysis can use either voice or head movement as per requirement.

• Old Age Homes People at old age homes can use this chair as per their requirement.

XV. FUTURE SCOPE

Alternate power source:

Solar panel roof can be used as alternative power source and also it can be a protective layer from rain and sun

XVI. CONCLUSION

The device can detect falls and direct much needed attention to the person. However, the device has to be further modulated and changed according to personal requirements. Using, threshold algorithm we can make the device more accurate and robust. Furthermore, the device also needs to take into account other factors like different medical conditions of the person. The situation has attracted a lot of researchers and various researches are going on to determine a perfect way to detect and prevent falls. Using sensors mentioned in the paper is an approach that can be further enhanced to enhance the overall working of the system.

REFERENCES

[1] Tran Tri Dang, Hai Truong and Tran Khanh Dang, "Automatic Fall Detection using Smartphone Acceleration Sensor" International Journal of Advanced Computer Science and Applications(IJACSA), 7(12), 2016.

[2] S. A. Waheed and P. Sheik Abdul Khader, "A Novel Approach for Smart and Cost Effective IoT Based Elderly Fall Detection System Using Pi Camera," 2017 IEEE

[3] M. Saleh and R. L. B. Jeannès, "Elderly Fall Detection Using Wearable Sensors: A Low Cost Highly Accurate Algorithm," in IEEE Sensors Journal, vol. 19, no. 8, pp. 3156-3164, 15 April15, 2019

[4] L. Sumi, I. Longchar and S. Dey, "IoT-based Fall Prevention and Detection for Senior Citizens, Physically and Intellectually Disabled," 2019 International Conference on Information Technology (ICIT), Bhubaneswar, India, 2019, pp. 190-195

[5] N. Jayashree, B. Pavithra, S. Monika, R. Charanya and M. Priya, "Arduino Based Iot Device for Septuagenarian Fall Detection," 2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE), Vellore, India, 2020, pp.