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ESP 8266 Based Fall Detection System

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Abstract— **Health is the major concern in today's lifestyle which increases with the age. Falls are the Second most common cause of accidental or unintentional injury deaths globally, according to the World Health Organization. Adults over 65 account for the majority of fatal falls. Consequently, the use of fall detection systems can enhance the quality of life for senior citizens.In this system we are using accelerometer to detect the fall and it will alert the respective care taker using the mobile notification when the fall occurs. The device is tied around the waist of patient so our system is able to detect the standing and lying position of body.This system will be a lot helpful to decrease the fall rate and also it is affordable to everyone. The system was able to accurately record fall detection accuracy up to 93.3% in everyday activities with a fall detection error rate of 2%.**

Keywords— **Fall Detection, Node MCU ESP 8266, Temperature sensor, Vibration coin, Health Care.**

I. INTRODUCTION

Due to many disabilities and muscle weakness in elderly people, fall becomes the more significant aspect in elder people and these falls may lead to severe injuries and sometimes also becomes the reason of death.This is serious public health issue and have serious impact on health and healthcare costs. Along the people, the possibility of fall increases three times as they become 65 or more. Elders care can be improved by using various sensors and technologies and can track the activities of the patients.Due to these consequences fall detection becomes the major area of research. Considering all the situations our system will be working on the fall detection using the accelerometer in which we are using the accelerometer as input device and it will detect the fall and alert will be sent to the respective caretaker.

II. LITERATURE REVIEW

This Research paper offers a thorough analysis of modern fall detection methods, taking the most potent deep learning approaches.Zhongtang Zhaoexamined the most modern and efficient deep learning fall detection techniques and divided into three groups: Systems based on Convolutional Neural Networks (CNN), Long systems based on auto-encoders and short-term memory (LSTM). Among those examined three-dimensional systems (3D) LSTM, 10-fold cross-validated CNN, and CNN. [1]

The Fall Alarm system, which employs a smartphone for fall detection and location, is described in this paper. A tri-axial accelerometer sensor and an inbuilt Wi-Fi module in the phone are employed to provide the necessary data. The presence of a fall is determined by analysing accelerometer data using a decision tree model. If a fall is believed to have occurred, a message is raised asking for the user's input. The system begins locating where the fall event will occur when a person is only slightly harmed and is unable to react in time, and then automatically sends an SMS message to his selected guardian along with an alarm message (Short Message System). As a result, fall victims can be treated and monitored in real time. Among the elderly, accidental falls are a major cause of autonomy loss, fatalities, and injuries. Accidental falls have a significant influence on national health system expenses as well. [2]

In this study, a fall detection system is created that uses gyroscopes and accelerometers. Static posturesand dynamic transitions are the two categories into which they divide human activity.There device can distinguish between fourdifferent body positions by employing two tri-axial accelerometers. Static positions include sitting, bending, standing, and laying.Motions between these still poses are taken into consideration. as transitions in motion. Angle and linear acceleration. To assess ifmotion changes are deliberate, velocity are measured. If there is a change before a laying position is discovered, even though itwas not done on purpose. Their program, decreases both when used with accelerometers and gyroscopes. Increasing fall detection accuracy while reducing false positives and false negatives. [3]

The FallDroid smart phone fall detection system is described by authors in this work. They used a two-step algorithm to monitor and identify fall occurrences using the inbuilt accelerometer signals. The proposed algorithm, which combines the threshold-based method (TBM) and the multiple kernel learning support vector machine (MKL-SVM), makes use of cutting-edge methods to accurately identify fall-like events (like lying on a bed or coming to a sudden stop after running) and minimise false alarms.[4]

In this study, the Fall Alarm system, which uses a smartphone for fall detection and localization, is introduced. To give thenecessary information, a tri-axial accelerometer sensor and an embedded Wi-Fi module in the phone are used. A decision treemodel evaluates accelerometer data to determine if a fall has occurred. A notice is raised to request the user's input if a fall issuspected. When a person is barely hurt and unable to react in time, the system by detecting nearby Wi-Fi signals, start positioningwhere the fall event will happen then automatically send an SMS message to his designated guardian along with an alarm message (Short Message System). As a result, the Real-time monitoring and treatment are possible for fall victims. [5]

III. METHODOLOGIES

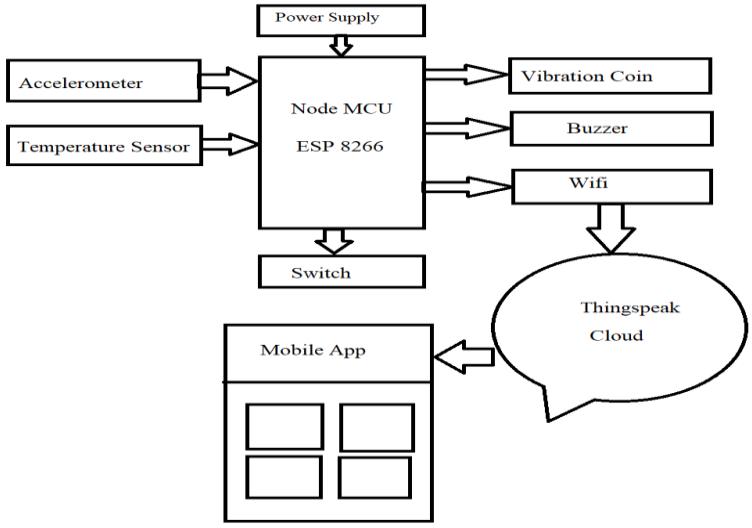

Fig1.Block Diagram

1. Node MCU ESP8266 –

ESP 8266 is an open-source firmware and development board specially made for IOT based applications**.** Itis 30 pins module which supports Wifi connectivity. The Node MCU takes 5V to 12V as a input voltage but operates on 3.3V because it has inbuilt voltage regulator which converts input voltage into 3.3V. As node MCU is main component of the system all other components are connected to it. It will receive information/data from the accelerometer and temperature sensor and interacts with ThingSpeak cloud using Wifi.

2. Accelerometer ADXL 345 -

The ADXL345 is a small, thin, ultralow power, 8 terminal and 3-axis accelerometer with high resolution (13-bit) measurement atup to ±16 g. It measures both dynamic acceleration resulting from motion or shock and static acceleration such as gravity. It hason-board 3.3V regulator and logic-level shifting circuitry.Since this accelerometer is connected to Node MCU ESP 8266 the datagenerated with the help of ADXL 345 is sent to the Node MCU. The co-ordinates of accelerometer changes when person falls.

3. Temperature Sensor LM 35 –

The LM35 is a 3 terminal precision integrated-circuit temperature devices with an output voltage linearly proportional to theCentigrade temperature. The LM35 device is rated to operate over a −55°C to 150°C temperature range.Temperature sensor isconnected to Node MCU ESP 8266. It will measure the body temperature of the person when the fall is detected.

4. Switch –

Switch is used turn ON or turn OFF the system. It is necessary to turn OFF the system when person is going to take rest or sleep. Otherwise unnecessary fall is detected and notification will be sent to the caretaker.

5. Vibration Coin –

Vibration coin is two terminal device which is connected to the Node MCU. It will receive signal from Node MCU when the fall is detected and it will starts vibrating. This will help to make person conscious.

6. Buzzer -

Buzzer is a two terminal device which is connected to Node MCU. Buzzer will get the signal from Node MCU when the fall is detected and it will start making noise when the person falls so that nearby caretakers can reach to that person.

7. ThingSpeak Cloud –

ThingSpeak is an IOT analytics platform service that allows us to aggregate, visualize, and analyze live data streams in the cloud.ThingSpeak provides instant visualizations of data posted by devices to ThingSpeak cloud. Node MCU is connected to ThingSpeakcloud through WIFI. All the real time data of the system will get stored in the Thing Speak cloud.

8. Mobile App –

To receive the notification on mobile phone Blynk app is used. It is an IOT platform for iOS or Android smartphones that is usedto control Arduino, Raspberry Pi and Node MCU via the Internet. It is connected to the ThingSpeak cloud.The notification willbe shown on Blynk App when the person falls.

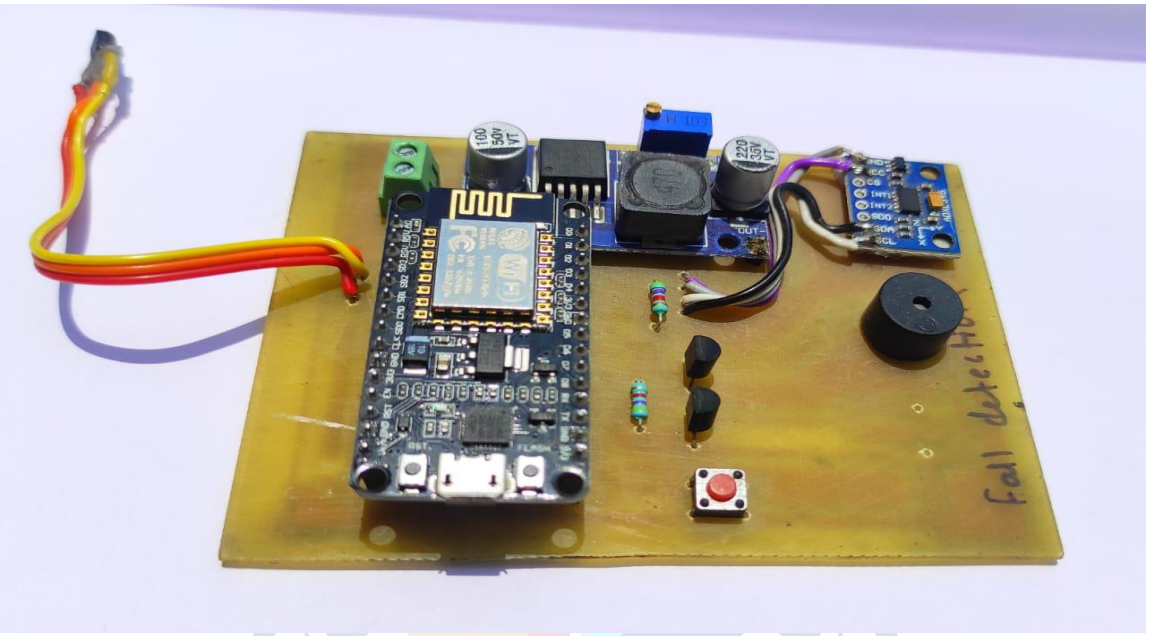

Fig2. Hardware Connections

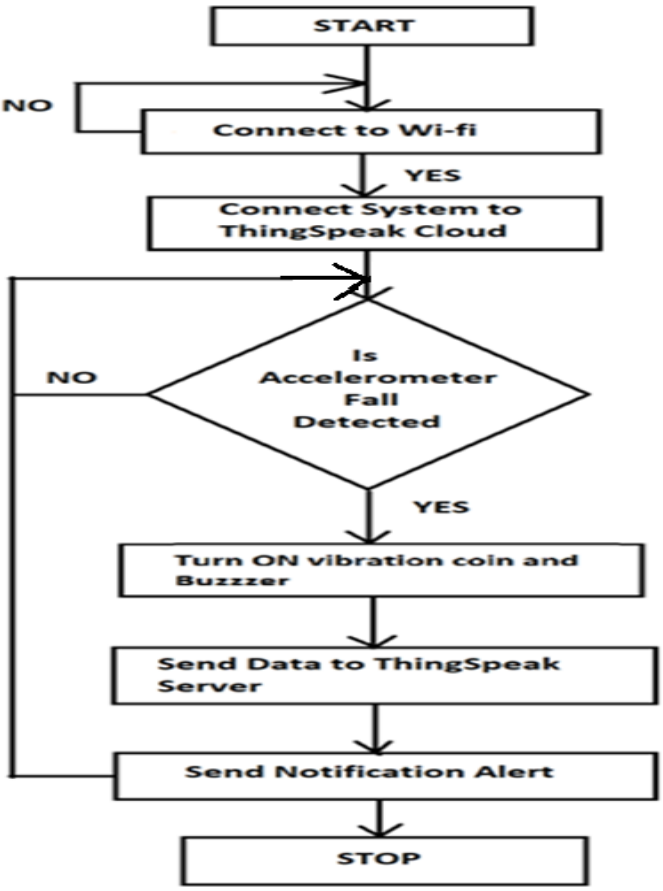

Fig 3. Flow Chart of ESP 8266 Based Fall Detection System

The system triggers when there is sudden change in co-ordinates of accelerometer, by this standing and lying position of the person is determined and fall is detected.Once the fall is detected by the accelerometer it gives input to the Node MCU. ESP 8266 is connected to the ThingSpeak cloud using Wifi. All the real time data is sent to the ThingSpeak cloud using Wifi.Node MCU will turn on the vibration coin and buzzer. Vibration coin is used to make the person conscious when the person falls also Buzzer will start making noise so that nearby caretaker or doctor can reach to that person. Temperature sensor will measure the body temperature of the person when fall is detected. All these real time data is sent to ThingSpeak cloud and this data can be used by doctors for further analysation. Notification will be sent by IOT based Blynk app on respected caretaker or on doctor's phone in the form of notification.

ALGORITHM

Step 1 – Start.
Step 2 – Connect the system to ThingSpeak cloud using Wifi.
Step 3 – If the co-ordinates of the accelerometer changes, then the fall is detected
Step 4 – If no fall is detected by accelerometer, then go to step 2.
Step 5 – When the fall is detected by the system, Buzzer and Vibration coin starts.
Step 6 – The real time data of the system is sent to the ThingSpeak server.
Step 7 – Mobile app. is connected to the ThingSpeak server.
Step 8 – Notification is sent on Mobile phone.
Step 9 – End.

IV.RESULT

When the fall is detected by the system, the buzzer, vibration coin and temperature sensor will start working. Buzzer will start making the noise, vibration coin will start vibrating to make person conscious. And temperature sensor will measure the temperature of the person when fall happens. The output message is shown on Arduino IDE and notification is sent on caretaker's or doctor's phone in the form of notification.

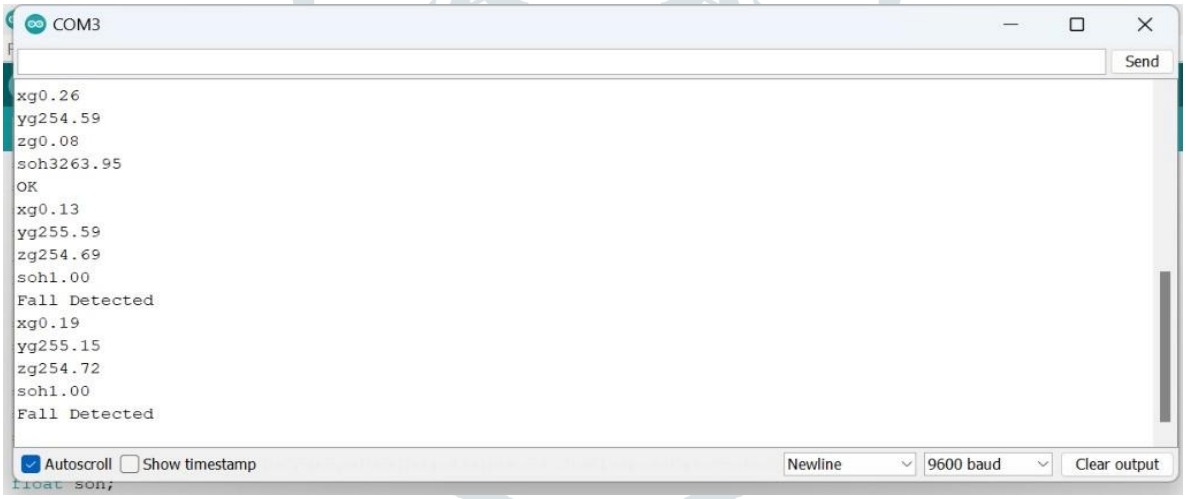

Fig.4Result obtained on Arduino IDE.

V.CONCLUSION

Health is the major concern in today's lifestyle which increases with the age. Falls are the second most common cause ofaccidental or unintentional injury deaths globally. It requires urgent attention and effective solution.We will work on developingand designing a Fall Detection System which will help the families to take care of their elder family members. The proposedsystem will detect the fall and alert will be sent to the caretaker in the form of notification. And this will avoid the hard incidents.

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