RV College of Engineering®

(Autonomous Institution Affiliated to VTU, Belagavi)

Fall Detection System With IoT

Experiential Learning Project

Submitted by

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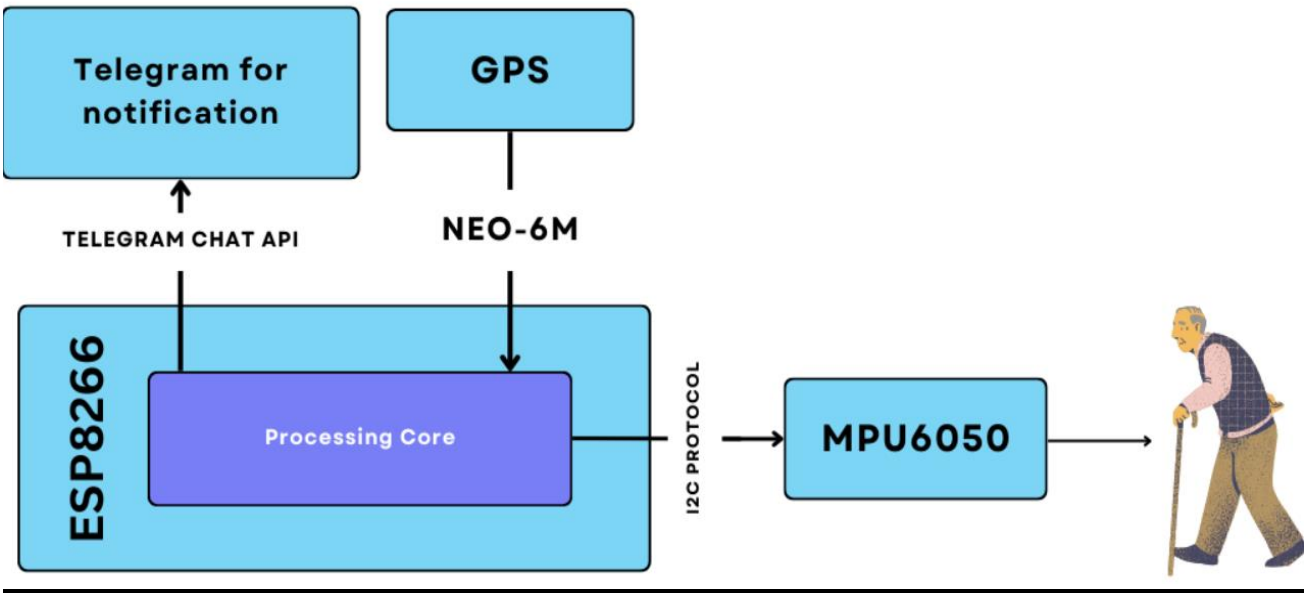
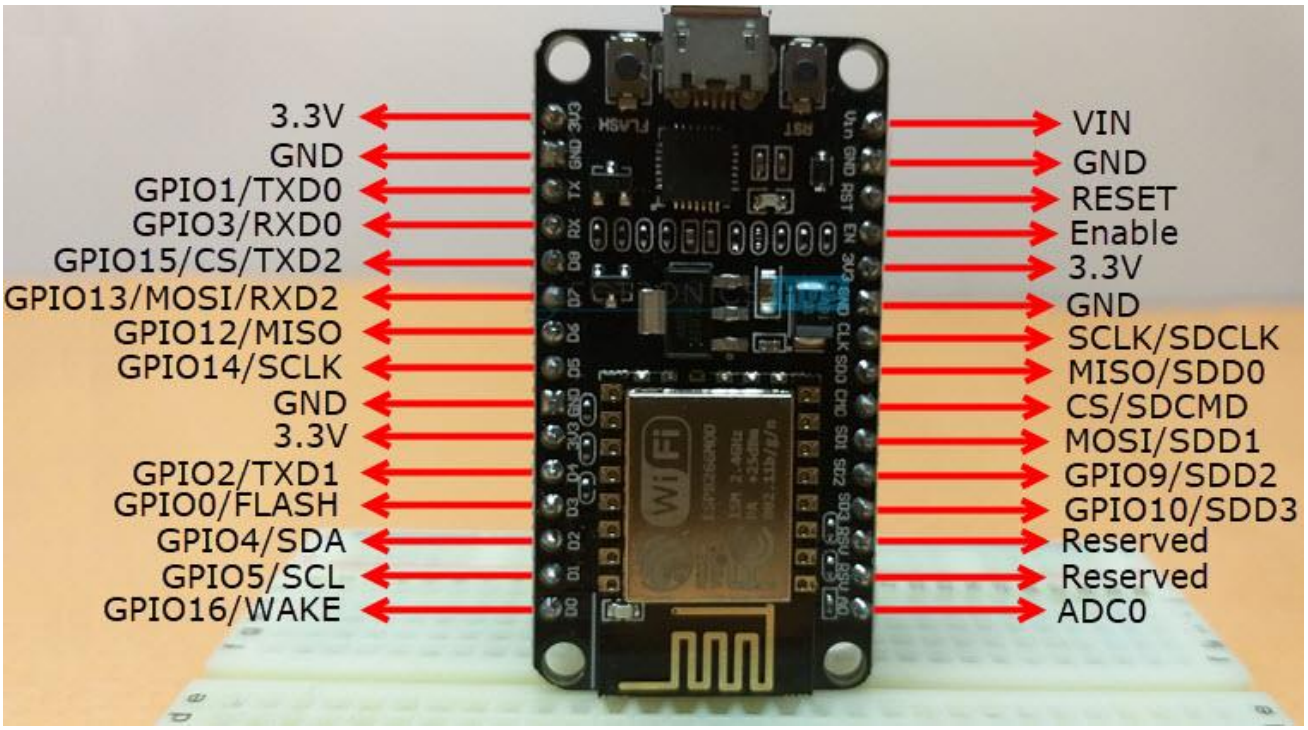
BLOCK DIAGRAM



NodeMCU



Necessity of the product:

Elderly people are at a higher risk of falls, health problems, and social isolation. They may also have difficulty taking care of themselves and managing their medication. This can lead to a decline in their health and quality of life.

Methodology and technology used:

1. When considering kinematic changes on a body during fall, there are some characteristics that remain same across all falls, irrespective of body mass. While falling, the centre of mass of the body essentially undergoes free fall (acceleration is equal to 9.8 m/s2 (g)).
However, considering the fall doesn't happen vertically, the net acceleration of the body is less than g during the falling process.
But on impact, the shock absorbed by the accelerometer is much greater than g, around 2.25g to 2.45g.
**This change in acceleration value is detected over a very small period.

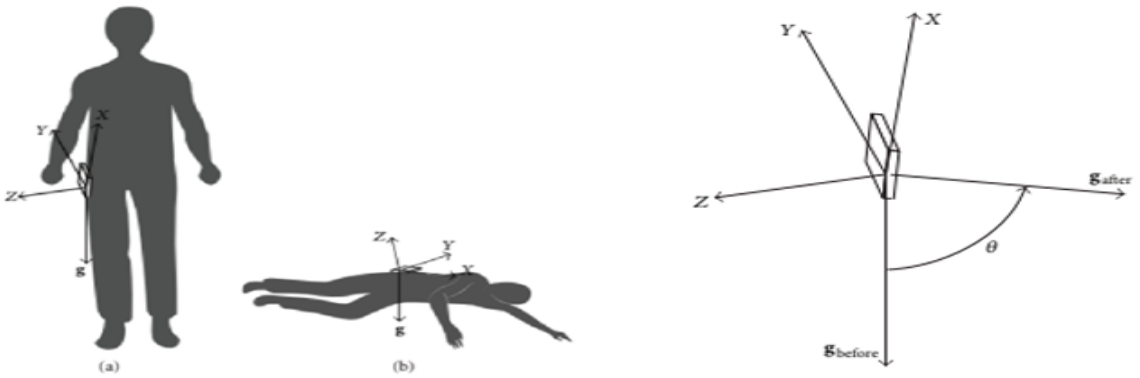
2. Additionally during fall, the orientation of the body changes by about 90o
relative to a fixed axes system. This factor is unique to fall only.
Thus, if we were to combine this rotational aspect with the acceleration aspect, the algorithm would be much more accurate in detecting falls.

Programming involved in this project mainly is in the form of the arduino C++ code. The main challenge in the implementation of this project is the direction needed to coordinate all the sensor to achieve parallelism.
Another factor to consider is the serial communication between the Accelerometer and gyroscope with the NodeMCU.
We use an I2C communication with the sensor to communicate and ask for the required data.
● The Communication with Telegram is done with the <UniversalTelegramBot.h> which has convenient features and stores the telegram api request format in it.
● A'GET' request is sent to the telegram api server as a HTTP request, to check if there are any new messages.
● The println is a defined function in the <client.h> in the ESP8266 Library which is used to send those requests to the www

Outcome:

* Increased safety and security for elderly people
* Improved health monitoring and management possibility
* Reduced risk of falls and other health problems
* Increased social interaction and support
* Peace of mind for caregivers

Working of the system



Hence to detect a fall:

1. Consider a matrix of say 30 data values taken every 50ms apart.
2. A curve can be fit into the data using Forward NGIF.
3. The "Jerk" of the acceleration i.e. the differentiation with respect to time is to be measured after a new cycle of sensor reading.
4. The jerk measured should change quickly two times in the span of a few tenths of seconds and this can be interpreted as a fall.
5. The gyroscope reading is taken up to detect and abnormal change in the axes and if this returns true too then the fall is said to be confirmed.
6. A button must be added to prevent any 'False Positives' i.e. no fall but a fall is detected but no actual fall has occurred, and also for 'True Negatives' i.e. an actual fall has occurred but the system has not activated.