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"A DEVICE FOR AUTOMATIC DETECTION OF ELDERLY FALLS"

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Abstract - *Falls by elderly individuals and patients could be dangerous if not caught in time. The idea is to create a fall detection system that, in the event of an emergency, sends an SMS to the involved parties or to the doctor. Continuous monitoring of patients who are unwell and prone to falling is required to reduce falls and the harm they cause. The suggested solution involves creating a prototype of an electronic device that is used to detect falls in older people and those who are at risk for them. In this article, the change in acceleration in three axes—measured using an accelerometer—is used to determine the body position. To measure the tilt angle, the sensor is positioned on the lumbar area. To minimise false alarms, the acceleration values for each axis are compared twice with a threshold and a 20-second delay between comparisons. The threshold voltage values are chosen using experimental techniques. Microcontrollers are used to carry out the algorithm. The GPS receiver, which is configured to track the subject continually, pinpoints the position of the fall. When a fall is detected, the gadget communicates by sending a text message via a GSM modem*

***Key Words*: Fall Detection, GPS , GSM , Accelerometer.**

1. INTRODUCTION

Falls are a primary gamble component of injury for old matured individuals and it is a critical boundary to seniors' free living. They are a main source of injury-related hospitalizations in individuals who matured 65 years or more. As indicated by the past factual results, somewhere around 33% of individuals matured 65 and up fall at least one times each year [1]. After a fall episode happened, a harmed old individual might be left on the ground for a few hours or even days. Habitually, the individual probably won't have the option to ascend with no help or on the other hand support and could require quick clinical thought. Likewise, there is a reality that, feeling of dread toward fall is produced or connected with the fall occasion. So particularly for senior individuals who have encountered falls before, most certainly will tend to stay away from doing everyday proactive tasks. It makes a pessimistic sensation of weakness to them assuming nobody is there. For forestalling the serious results of this fall, persistent or consistent fall identification is required. Human fall discovery framework notice and arranges everyday life exercises of human to distinguish an accidental fall. To distinguish human falls, different sensors and procedures have been utilized to characterize everyday exercises. Specialists have arranged fall location frameworks into three classifications in light of cameras, wearable gadgets, and feeling sensors. Among the wearable gadgets, accelerometer is the most generally utilized strategy to understand a fall. It utilizes the proportion of the speed increase of the body to characterize falls. Clifford et al protected a human body fall location framework utilizing accelerometer, a processor, and a remote transmitter. The processor utilizes accelerometer measurements to decide whether the individual with wearing the gadget is falling and there is a non-development stage followed by the fall. The created reaction is then, at that point, somewhat sent to a transmission beneficiary by a remote transmitter [2].

Research are being attempted to decide human fall utilizing the stance developments. Body direction as stance development is utilized to distinguish a fall utilizing either pose sensors or different accelerometers. Kaluza et al introduced a stance-based fall location calculation utilizing the philosophy of reconstruction of an article's stance. The stance reproduced in a 3D plane by finding the remote labels which were put on body parts (sewn on garments, for example, shoulders, lower legs knees, wrists elbows and hips. Some labels are additionally positioned at explicit positions like bed, seat, couch, table to recognize a few stances, for example, lying on bed or sitting on seat. The fall location calculations use speed increase edges alongside speed profiles. Speed increase is gotten from the developments of the labels. Speed increase and precise speed computation is dependent upon the label's confinement accuracy [3]. Kangas et al utilized a midriff worn tri-hub accelerometer, handset, and microcontroller to foster another fall identifier model in light of fall related effect and end pose [4]. Afterward, Li et al introduced a clever fall location framework utilizing both accelerometer and spinners. By utilizing two tri-pivotal accelerometers at isolated body areas they can perceive four sorts of static stances: standing, twisting, sitting and lying. Movements between these static stances are thought of as powerful advances and if the progress prior to lying stance is not deliberate, a fall is distinguished. Whether movement changes are deliberate or not set in stone by the straight speed increase and rakish speed estimations [5]

1.1 PROBLEM STATEMENT

Design and develop an automated fall detection system that can accurately and promptly detect instances of falls among elderly or at-risk individuals, and promptly alert caregivers or emergency services for timely intervention, with the goal of reducing the risk of injuries and fatalities associated with falls.

1.2 OBJECTIVE

The objective of a fall detection system for elderly individuals is to promptly detect when a fall occurs, notify caregivers or emergency services, and provide assistance to the fallen person to minimize the negative impact of the fall.

2. LITERATURE SURVEY

The article [1] introduces a fall detection and alarm system for elderly individuals that operates through IoT technology. However, a drawback of the system is that it requires the elderly person to carry a mobile phone.

The article [2] highlights that falls in older adults can impede their social life and ability to live independently. Assisted living devices can assist older adults in maintaining their independence at home, which can provide a psychological boost and lessen the burden on caregivers and healthcare providers. However, one drawback of such devices is that they are not wearable.

In the publication [3], it is stated that the elderly population is rapidly increasing worldwide, and many prefer to live independently in their own homes. However, this also makes them more susceptible to emergency situations such as falling or losing consciousness. Falling is a prevalent cause of both fatal and non-fatal injuries among the elderly, and prompt detection and notification of falls can mitigate the harm caused by the impact. Nonetheless, one drawback of such systems is their relatively high cost.

The adoption of information and communication technologies, including mobile phones and wireless sensor networks, is increasingly prevalent in the monitoring field. This is particularly true for detecting emergency situations and monitoring the well-being of elderly individuals, enabling them to live independently in their own homes for as long as possible. This is discussed in the article [4].

3. SYSTEM DESIGN

In this section, we will include all the technicalities of the Project including block diagram, Specifications, selections of proposed system.

3.1 BLOCK DIAGRAM

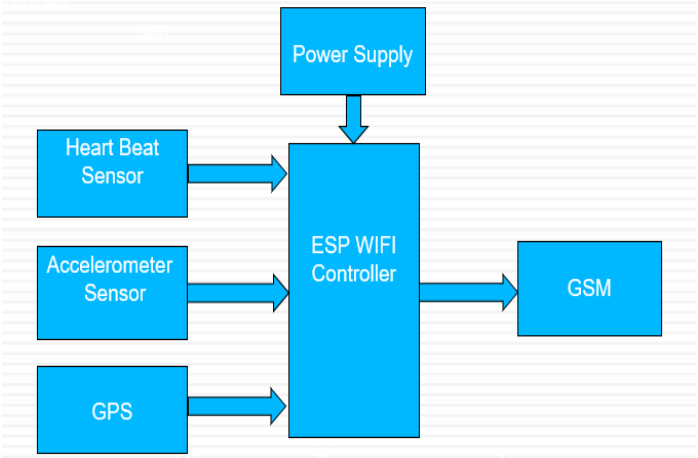

Fig: - System Architecture

3.1.1 ESP WIFI Controller

The WIFI controller is part of the ESP 8266 family and is usually known as the NodeMCU. This controller has both controller and IoT functionality, so it will be used in this project.

Fig -3.1: ESP8266 WIFI Controller

3.1.2 GPS-NEO 6M

The NEO-6M GPS Module is a complete, high-performance GPS receiver with an integrated 25 x 25 x 4mm ceramic antenna that offers powerful satellite tracking capabilities. The module status can be monitored via the power and signal LEDs.

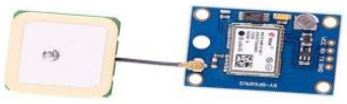

Fig -3.2: GPS-NEO 6M

3.1.3 GSM-800L

It's a small- scale GSM module that can be utilised in a number of Internet of Things(IoT) systems. Nearly all of the functions of a typical mobile phone, including SMS

messaging, calling, GPRS Internet connectivity, and much more, are all possible with this module.

Fig -3.3: GSM-800L

3.1.4 ADXL-345

A low-power, 3-axis MEMS accelerometer module with I2C and SPI interfaces and the sensitivity levels for the ADXL345 range from +/- 2G to +/- 16G. Additionally, it allows output data speeds between 10Hz and 3200Hz.

Fig -3.4: ADXL-345

3.2 IMPLEMENTATION

A fall detection system using accelerometer, GPS, GSM, ESP, WiFi module, and a heart beat sensor could have the following architecture:

1. Sensors: The system would use an accelerometer to detect sudden changes in motion, indicating a fall. A GPS module would be used to track the location of the user, allowing emergency responders to quickly find them. A GSM module would be used to send emergency alerts to caregivers or emergency services. A heart beat sensor would be used to monitor the user's vital signs.

2. Microcontroller: A microcontroller would be used to interface with the various sensors and process the data they produce. It would be responsible for detecting falls, gathering location information, and monitoring the user's vital signs.

3. Wireless Connectivity: The system would use both WiFi and GSM modules for wireless connectivity. The WiFi module would allow the user to connect to the internet and access additional services such as voice assistants or video calls. The GSM module would be used to send emergency alerts to caregivers or emergency services.

4. Power Supply: The system would need a reliable power supply, such as a rechargeable battery, to ensure it is always operational.

5. User Interface: The system could have a user interface, such as a mobile app, to allow caregivers to monitor the user's location and vital signs, and receive alerts if necessary.

Overall, the architecture of a fall detection system using accelerometer, GPS, GSM, ESP, WiFi module, and heart beat sensor would involve multiple components working together to detect falls, monitor vital signs, track location, and send alerts in case of an emergency.

3.3 Software Requirements

3.3.1 Programming Software-Arduino IDE

It is the cross-platform Arduino Integrated Development Environment which is created using C and C++ functions. Programs can be written and uploaded to the boards that are compatible with Arduino as well as other vendor development boards.

3.3 SIMULATION AND RESULT

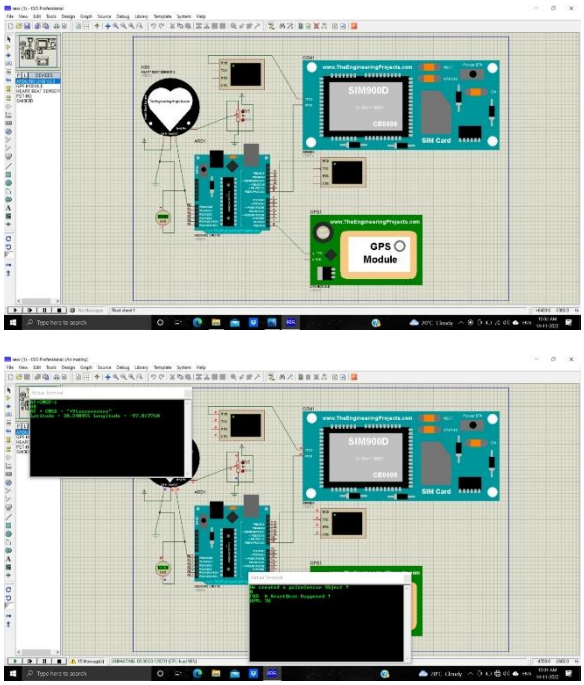

Fig -3.2.1: Simulation Result

4. CONCLUSIONS

With this suggested approach, we can realise our main objective of developing a functional prototype that can detect elderly people's falls. Different sensors have been utilised to continuously track sensor values, and even GPS and GSM have been integrated to send SMS messages and position information when a fall is detected.

5. FUTURE SCOPE

- The future scope of fall detection systems for elderly people includes the incorporation of advanced technologies such as artificial intelligence and machine learning to improve accuracy and reduce false alarms.
- Additionally, the integration of wearable sensors, smart homes, and telemedicine technologies can enhance the effectiveness and accessibility of fall detection systems.

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