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IOT-BASED FALL DETECTION SYSTEM FOR ENHANCED SAFETY

[#1] KOTICHINTHALA NEETHIKA, Assistant Professor
[#2] SAMALA KAVERI
[#3] PANTHULUGARI VIDYA
Department of Electronics & Communication Engineering,
SREE CHAITANYA INSTITUTE OF TECHNOLOGICAL SCIENCES, KARIMNAGAR, TS.

ABSTRACT: Tragedies involving the elderly occur more frequently than previously believed, according to statistics. Serious injuries or even death might result from these types of incidents. Unexpectedly, falls account for 70% of fatalities in the 75+ age group. "More than 90% of hip fractures are a result of falls, primarily affecting individuals aged 70 and above." An annual incidence of falls among the elderly is around 33% in the community and 60% in nursing facilities, according to a research published in the American Family Physician in 2000. This data originated from the White House Medical Clinic in Washington, DC, and was obtained by Colonel George F. Fuller, USA.. Using statistics, we must devise a strategy to inform the public and secure the necessary assistance in these instances. The purpose of this project is to develop a multi-sensory device that can detect falls and provide assistance to the individual who experienced them. Along with the user's speed and direction, the device measures their weight. It has a microcontroller, a measurement system, a load detecting element, and a Wi-Fi module all rolled into one.To classify an event as a fall, it is necessary to capture, transmit, and monitor any modifications to the initial data pertaining to velocity, trajectory, or mass. A multitude of signals are sent and received by the microcontroller when the alarm goes off, informing the appropriate parties.A minor shift in the probability of an event can be misinterpreted as a "decline," leading to erroneous alerts and unnecessary anxiety. In case anything like this were to happen, the device had a safety button, often known as the "nap button," built into it. You can set the button to disable the sensor system for a specific duration.If the individual in issue requires the use of a wheelchair, the gadget in question is designed to be fastened or secured to the wheelchair. Along with it, you receive a smart device. With this one-of-a-kind device, users can immediately summon assistance while simultaneously preventing larger and more widespread damage.

KEYWORDS: Monitoring, Transmitted, Threshold, Mobile system, Internet of things, Technologies, Services, Health care, Mechanism

1.INTRODUCTION

Enhanced susceptibility to falls is among the myriad health concerns that the geriatric population encounters. Generally, when these things do transpire, they are quite disastrous. It is customary to offer continuous care for individuals who are at risk of falling; however, it is important to remember that falls cannot always be predicted or prevented.

A.Causes of falls in older persons

Preexisting conditions are the leading cause of accidents among the elderly.

A multitude of medical conditions may give rise to these symptoms, encompassing neurological, muscular, and sensory impairments; excessive fatigue; arthritis, dementia, diabetes, malnutrition, anemia, arrhythmia, fluctuations in body mass index, urinary tract complications, insomnia, cardiovascular diseases, and numerous others.

The leading causes of falls are slips, trips, and stumbles, which can be triggered by an assortment of environmental factors, including overly tight footwear, dimly illuminated areas, or uneven ground surfaces.Additionally, several medications have been associated with an increased risk of falls among patients aged 70 and older. Nonsteroidal anti-inflammatory drugs, sedatives, antihypertensives, antidepressants, diuretics, and hypnotics are some potential medications that may be considered. Physicians commonly utilize the Morse Fall Scale (MFS) to ascertain risk factors and diagnose complications.

B. Repercussions of falls in older persons

In 1986, accidents caused more than 8,000

fatalities among adults aged 65 and older in the United States alone. It is expected that by the time individuals attain the age of 85, falls will constitute the predominant cause of fatal accidents.Berg RL et al. (1992) were members of the National Academy of Sciences and Institute of Medicine of the United States. Physically and mentally, you are susceptible to the effects of a fall.Whether an individual experiences physical or heath consequences is contingent upon their individual susceptibility. To be frail is to be readily broken and fragile.Using the phrase "syndrome of physiological decline in late life" provides greater scope and depth.

Physical consequences

Physical repercussions following a fall are those that require urgent medical attention or have an immediate impact on an individual's health. A break in which this occurs is referred to as an exposed fracture. Internal bleeding injuries can manifest in a variety of ways, from minor cuts and bruises to more severe complications such as closed fractures, blood sprains, and bleeding in the brain, peritoneum, mesentery, and onion, among others. These outcomes typically diminish the individual's overall efficacy. The majority of injuries affect the most vulnerable individuals.

Psychological consequences

Numerous individuals experience a loss of self-confidence subsequent to an error, even in a fundamental activity such as ambulation. Increased dependence on family members may exacerbate manifestations of social anxiety and poor self-esteem. A concerned reaction hinders the majority of individuals from performing mundane tasks independently. Irrational emotional distress and wrath are exacerbated by it. Mental distress is being endured by the patient as a result of the recurring accidents, which evoke recollections of their injuries.

Problem definition

As stated previously, an automated mechanism for detecting accidents is vital. Typically, observers maintain a stationary position while absorbing a given scene.

Their comatose state renders them incapable of soliciting assistance. Neglecting to seek medical assistance promptly following a fall is a prominent contributor to fatalities as it results in irreversible complications, including internal hemorrhaging.

In the event of a catastrophe, autonomous monitoring systems can aid in the prevention of injuries that necessitate medical attention. Using contact-based or wearable sensors, a communication system notifies guardians and other critical individuals in the event that an individual falls.

Reviewofexistingsystems

Academics have developed considerable interest in accidents. As a consequence, the availability of fall detection devices has increased exponentially. To record these impacts, a variety of instruments are being employed. While there may be variations in the level of precision among these devices, they all employ distinct methodologies to identify accidents and minimize false alarms. Installing accident detection systems can be accomplished through a variety of means.

Design of a Fall Detection and PreventionSystem for the Elderly

By utilizing a sensor-adorned wearable device, this system is capable of differentiating accidents from other incidents. The device establishes a connection with a pre-configured mobile device or computer via Bluetooth. As soon as an individual descends, alarms and sirens are triggered. It is possible to perceive, feel, and hear the signals emitted by this object. A study paper titled "Design of a Fall Detection and Prevention System for the Elderly" was presented at the EE 4BI6 Electrical Engineering Biomedical Capstones event on April 23, 2010, at McMaster University in Hamilton, Ontario, Canada. B. Nguyen and J. Tomkun.

An Advanced Mobile System for Indoor Patients Monitoring

Using this method, an elderly person with a cardiac condition can be monitored by a smart device. Patients are afforded unrestricted mobility while their pulse rates are consistently monitored by the device. Accelerometer monitors facilitate the monitoring of patients' movements and

contribute to the identification of accidents. A primary advantage of this novel approach is the reduction in the duration of separation between caregivers and patients. As a consequence, the system employs continuous electrocardiogram tracking and accelerometers to identify and communicate data modifications that elicit alarm signals. The device reduces the frequency of false notifications significantly. G. Sannino and G.D. Pietro presented an innovative mobile patient monitoring system during the 2nd International Conference on Networking and Information Technology (ICNIT2011).

PerFallD

This approach will exclusively operate on devices that

Refer to the proceedings of the 2010 PERCOM Workshops, an international conference on pervasive computing and communications held in Germany, for additional information. The exact numbers are 292-297.

Avideosurveillanceapplicationforelderly monitoring using a dataset of videos

Accidents are detected by this system utilizing the k-NN method, also referred to as the k-Nearest Neighbor algorithm. It captures information that precisely determines the location and body orientation of the user. An additional determinant of a person's susceptibility to falling is their velocity. Notwithstanding the apparent feasibility of the approach, empirical evidence indicates that it falls short in promptly identifying issues. To achieve a certain result, a minimum of eight projectiles will be required. Nevertheless, the fall detection system is efficient. "Intelligent Video Surveillance for Monitoring Elderly in Home Environments." That was the title of the presentation delivered at the 2007 IEEE 9th Workshop on Multimedia Signal Processing by A.H. Nasution and S. Emmanuel!

2.SYSTEM ARCHITECTURE

The proposed method is predicated on the utilization of wearable technology for accident detection. In addition to monitoring the individual's vital signs, the device documents any fluctuations in their elevation, velocity, or orientation. Alarms sound and emergency contacts are contacted as soon as these modifications are committed.

Three sensors collaborate to achieve accuracy and precision. Upon any alteration in the standard values, an immediate report is generated by the load sensor, accelerometer, and gyroscope. The device provides resting information once it has been configured to operate ordinarily. Large changes in mass, velocity, or direction constitute falls, and their magnitudes are subsequently compared to the established thresholds.

However, deviations in measurements are frequently ascribed to an assortment of ambiguous factors rather than a decline. To deactivate the alert, the user is required to simply press the "nap-button" on the device.

A.Components of the system

Here is a comprehensive explanation of the function and operation of each sensor:

Accelerometer- An individual's post-fall demeanor significantly influences the frequency of their falls. Several additional factors are taken into account when determining the precision of the recommended instruments.Accelerometers measure the rate of change of the velocity of an object with respect to a specific axis. In addition, it is capable of determining the magnitude and orientation of the motion.

Gyroscope- In addition to determining the pace of an angle, the gyroscope also detects the tilt and direction of an object. As a consequence, any alterations in the motion of the individual donning the item are documented.

Load cell sensor- The burden sensor is the third and final monitor in the system. A transducer is responsible for converting tension into an electrical signal.

B.Overview

An exhaustive depiction of the device's operation is illustrated in the subsequent diagram:

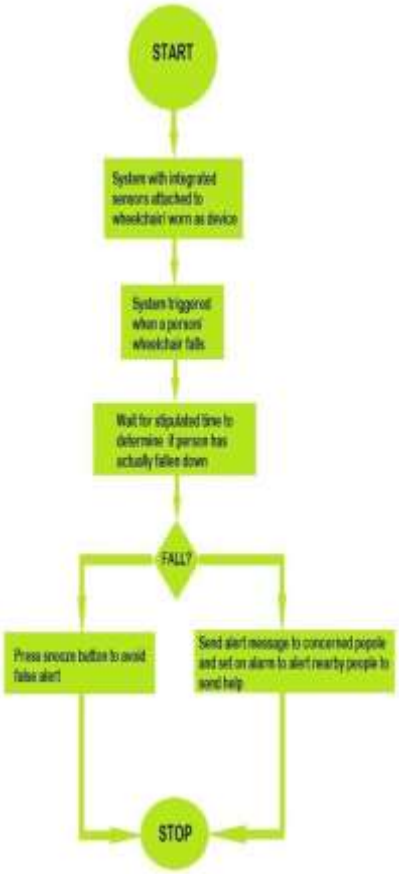

Figure1showstheflowchartofworking

Algorithm

Utilizing an algorithm that prioritizes predetermined thresholds, this technique operates. The threshold values are established by the installer subsequent to conducting extensive testing. As previously stated, identification characteristics consist of an individual's mass, velocity, orientation, and vital indicators. This method is constructed by combining acceleration and rotation angle data. After recording the aforementioned measurements, they are compared to the reference data. A person is considered to have fallen legally when the measurements change significantly due to the impact with the ground.

3.RESULT

Figure 2 System Switch-on

The diagram encompasses the system's name and illustrates how the Arduino is connected to each sensor upon activation. The system is currently linked to Wi-Fi in order to notify the designated individual who has been designated to assist in the event of an emergency.

Figure 3Connecting to Wi-Fi

The system is now capable of identifying incidents caused by human actions. As illustrated in the accompanying image, the apparatus emits an alarm.

Figure 4 Fall Detected

An alarm is triggered in the event of an accident, requesting assistance from nearby locations. The individual has ample time to deactivate the alarm, even in the event of a simulated one, thereby preventing the guardian from receiving a notification. This indicates that our model can identify accidents with precision.

4.CONCLUSION

Through incident detection, the device is capable of delivering critical care to the user.However, when employing the device, it is imperative to take into account the individual preferences of each user. By replacing threshold approaches with machine learning methodologies, it is possible that the effectiveness of the device in halting robotics

could be improved. In addition to other considerations, the device must account for a variety of user health concerns. This topic is of great scholarly interest, and numerous investigations are at present attempting to identify the most efficient technique for detecting and preventing dangers.The integration of sensors into the methodology outlined in the research could potentially enhance the overall efficiency of the system.

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