A Survey on Smart Devices for Object and Fall Detection

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Abstract - — *Elderly falls almost invariably result in major health problems, as well as a loss of physical fitness. As technology advances, we have more options for protecting the elderly. The use of low-power components allows for the creation of a wearable alerting device. Sensors have made sensor system design and deployment easier. The Global Positioning System (GPS) makes it easier to find the elderly. If you fall, we're constructing a fall detector with sensors and a microcontroller that will send an SMS to concerned people with your location so they can get help right away. We are developing an object detector that will inform the user of impediments when their vision acuity deteriorates with age, and it can also be utilized by blind persons.*

***Key Words*: Smart Glasses, Ultrasonic Sensors, Blind People, Object detection, Accelerometer, Gyroscope**

1.INTRODUCTION

Falling is one of the most dangerous things that may happen to an aged person. With the ever-increasing elderly population, there is a pressing need for the development of fall detection systems, which is why we are offering a cheap fall detector that can not only deliver a fall warning but also the location where the fall occurred. Because we believe that prevention is always better than treatment, we've also included obstacle detection in our project. Smart glasses are a representation of this. A pair of glasses with an obstacle detecting module in the center, a processing unit, and an output device make up this device. Traditional navigation devices, such as the blind cane, determine direction by tapping the ground or walking around the object; the structure is simple, single function, easy to use; however, the secondary effect is not readily apparent; in fact, when using the blind, many problems arise, such as poor road conditions, uneven surfaces, and hanging in front of obstacles; ordinary cane cannot be proven accurate, posing a serious threat to the safety of blind Travellers. A smart ultrasonic glasses for blind people consists of a pair of wearable glasses, ultrasonic sensors for detecting obstacles in the blind man's path, a buzzer to give sound in the direction of the obstacle from the man, a central processing unit consisting of Arduino NANO which takes the information from the sensor about the obstacle distance and processes the information according to the coding done and sends the output through the buzzer, and power supply is provided by a battery. The sensor is placed between the top bar and bridge of the optical glasses. All of the components are wired to the central unit by single strand copper wires, and the central unit is powered by a USB connection. Ultrasonic sensors will be the ideal sensors to utilize since ultrasound has a strong point, the energy consumption of a slow wave travelling in the medium over a relatively long distance. As a result, it is frequently used to measure distances across long distances. At the same time, ultrasound for objects in the dark, dust, smoke, electromagnetic interference, poisonous, and other hard situations has a degree of adaptability, with a wide variety of applications. The ultrasonic sensor is attached to the glasses in a perpendicular position. As the blind man approaches the obstruction, the distance sent by the sensors to the central unit decreases. Many navigation devices now include seeing-eye guide dogs, guide dogs who can see to some extent, despite the fact that the journey is to protect the safety of the blind. However, there are still some issues: training a guide dog is more difficult, and it usually takes 3-6 months; however, training a skilled guide dog takes about two years; in addition, with dog daily life consumer spending, the cost it takes to reach the million; and guide dogs have a limited life cycle. ultrasonic glasses according to the requirements are relatively inexpensive, resulting in a device that is affordable to everyone. These smart glasses are quite simple to use and comprehend. If a blind person uses it for 2-3 times, he or she will understand how it works and will be able to handle it effortlessly

2.PROPOSED PROTOCOL

If a fall is detected, an alert is triggered, and the system responds immediately by sending a warning and location to the person responsible for the old person's care. A gyroscope and an accelerometer sensor are included within the MPU6050 sensor module. The gyroscope determines the direction, while the accelerometer offers angle information such as X, Y, and Z-axis data. The magnitude of the acceleration will be compared to the threshold value to detect the fall. If a fall is detected, the gadget sends an email and a notification to the individual concerned. To deliver a notification with the IoT App, a Node MCU ESP8266 is utilized as a microcontroller and Wi-Fi module. The processing unit is coupled to the obstacle detecting module and the output device. A ultrasonic sensor serves as the obstacle detection module, while a control module serves as the processing unit, and a buzzer serves as the output unit. The control unit activates the ultrasonic sensors, which gather information about the barrier in front of the man, analyses it, and then provides the result through the buzzer. In this project, a sensor detects an object from a distance, and if it is within 30 cm, it emits a sound and alerts the user; if it is closer, it emits a louder sound.

3.LITERATURE REVIEW

Diverse review publications provide an overview of the evolution of fall detection from various perspectives. It is vital to re-illustrate the trends and progress on a regular basis due to the rapid development of smart sensors and related analytical methodologies. From 2014 through 2020, we selected the most highly referenced review papers. The trends, problems, and advancement in this discipline are demonstrated in these selected review papers. **Author-Chaudhuri et al. (2014)** examined fall detection devices for persons of all ages from a variety of viewpoints, including background, objectives, data sources, eligibility criteria, and intervention approaches. A total of almost 100 papers were chosen and examined. The studies were separated into groups based on a variety of factors, including the age of the individuals, the technique of evaluation, and the equipment employed in detecting systems. They pointed out that the majority of the research were based on made-up data. [1] **Author -Zhang et al (2015)** conducted another survey that focused on vision-based fall detection systems and their corresponding benchmark data sets, which have not been covered in previous evaluations. Individual single RGB cameras, infrared cameras, depth cameras, and 3D-based systems using camera arrays were classified as vision-based approaches to fall detection. Because such systems rely on a large number of cameras positioned from various angles, occlusion issues are often mitigated, resulting in lower false alarm rates. Depth cameras have grown in popularity because, unlike RGB camera arrays, they do not require extensive calibration and are less obtrusive in terms of privacy**. Zhang et al.** (2015) also looked at various fall detection systems based on the individuals' activity/inactivity, shape (width-to-height ratio), and motion. While the review provides an in-depth look into vision-based systems[2], The benchmark data sets acquired by Microsoft Kinect and related cameras were examined by Author**-Cai et al** (2017). They looked at 46 publicly available RGB-D data sets, with 20 of them being widely used and acknowledged. They compared and emphasized the properties of all data sets in terms of application appropriateness. Electronics have become more compact and less expensive as a result of continual and rapid development. [3] Author**-Igual et al** (2013), for example, found that low-cost cameras and accelerometers embedded in cellphones may be the most practical technology solution for fall detection research. **Igual et al.** (2013) [4]identified two significant trends in how research in this subject is evolving, notably the use of vision and smartphone-based sensors for input and machine learning for data processing. In addition, they identified three major challenges: I real-world deployment performance, (ii) usability, and (iii) acceptance. The term "usability" refers to how useful a technology is to elderly people. Falin Wu is the author of this piece. She proposed a method and system for fall detection in this research, which is based on a combination of information collected from several sensors in the wearable device. [5] **Author Yuxi Wang** proposes WiFall, a device-free fall detection system that uses Channel State Information as an indicator in this work. WiFall is designed to detect old people falling, but it can also detect other actions. In extensively deployed off-the-shelf WiFi infrastructure, WiFall takes advantage of the physical layer Channel State Information (CSI). To show the WiFall servers' viability and effectiveness, we use commodity 802.11 laptops. 11n NICs and do extensive tests in three different situations with varied Tx-Rx configurations. WiFall's experimental results suggest that it can detect falls with reasonable accuracy and a low false alarm rate. At this time, WiFall is capable of detecting the most typical daily behaviors such as walking, sitting, standing up, and falling. In the future, we will consider more particular activities. WiFall is currently developed for and tested with only one single person in the area of interest, similar to other device-free activity identification systems that use wireless signals. It is now difficult to distinguish a person's activity from that of other users. When numerous persons are doing different things at the same time, their movements will have a mutual effect on signal transmission. When only one person is undertaking activities, the positions of other items will also have an impact on the signal propagation paths. As a result, proposing a comprehensive propagation model that takes into account the interaction between signal fluctuation and numerous human activities is not straightforward. Meanwhile, because there are numerous combinations when considering different numbers, activities, and positions of objects, building the training database using learning methods is too expensive. Nonetheless, we continue to believe that WiFall may be used to critical use cases and that wireless technologies will greatly benefit the human healthcare industry. [6] **Himadri Nath Saha** is the author (2016) To help visually impaired persons overcome their difficulties, this study introduces a Smart Vision system that gives them with quick and easy support. The major goal of this project is to create a low-cost, reliable, portable, and user-friendly solution for persons who are visually impaired. The product will be an assistive buddy for visually impaired users, with functions such as voicing out the current date and time, current weather, top 10 news items for the day, OCR, colour detection, and obstacle detection using ultrasonic sensors. The Smart Vision System's trial results suggest that it can significantly improve the user's experience. As a result, it can be used as a consumer device to assist visually impaired persons. [7]**Author-Jinqiang Bai** (2018) This research offers a revolutionary ETA (Electronic Travel Aids)-smart guiding device in the shape of a pair of eyeglasses for giving these people efficient and safe assistance to overcome the problem of travelling for the sight impaired. A unique multi-sensor fusion based obstacle avoiding method is proposed, which uses both the depth sensor and the ultrasonic sensor to overcome the issues of recognizing small impediments and transparent obstacles, such as the French door. Three types of audio signals have been developed for completely blind people to help them determine which way to travel. Visual augmentation that uses the AR (Augment Reality) approach and incorporates the traversable direction is used for persons who are nearsighted. The prototype, which consists of a pair of display glasses and a number of low-cost sensors, has been constructed, and its efficiency and accuracy have been evaluated by a number of people. [8] **Ankita Bhuniya** is the author (2017) presented a study on smart eyewear obstacle detection, Blind mobility is one of the most significant obstacles that visually impaired people face in their daily lives. The loss of their eyesight severely limits their lives and activities. In their long-term investigation, they usually navigate using a blind navigation system or their gathered memories. The major goal of this project is to create a low-cost, dependable, portable, user-friendly, low-power, and robust navigation solution. This paper (Smart Glasses for Blind People) is intended for people who are visually challenged. It features a built-in sensor that sends out ultrasonic waves in the direction the person is moving by scanning at a maximum range of 5-6 meters and 30 degrees. The sensor identifies the impediment and communicates the information to the gadget, which generates an automated voice in the earphone attached to the person's ear. [23] **G. Sahithya, K. Sahithya**, **K. Sahithya, K. Sahith** (2019) They describe an electronic gadget for obstacle detection and facial recognition to aid visually impaired individuals in social interactions in this paper. Blind persons have poor eyesight, making it difficult for them to notice others in society, and this device assists the user in walking without clashing with any impediments in their way. The device is a pair of smart glasses with an ultrasonic sensor, a Raspberry Pi camera, and a Raspberry Pi installed. The ultrasonic sensors are connected to a Raspberry Pi, which receives data signals from the sensors for additional processing and detects impediments up to 1000cm away from the user. According to the database list, a Pi camera is used to recognize the person in front of the sight impaired The aforementioned survey studies primarily focus on the many types of sensors that can be utilized for fall detection and obstacle detection.

4. CONCLUSIONS

The fall detector may detect a physically challenged person's fall and send a notification to the concerned person/doctor along with the location. Also, in sectors such as glassware, it can be used to detect falls of fragile items to prevent damage. As people's vision deteriorates with age, smart glasses can be used to detect impediments in front of them and inform the user, preventing collisions and reducing injuries. It can also be utilized by those who are blind.

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