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An Invention of a Smart Blind Stick Using IOT

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ABSTRACT – This paper describes an Internet of Things-based blind stick development that attempts to overcome the limitations of traditional blind sticks. The main aim is to improve security and help for people who have vision impairments. By utilizing cutting-edge technologies like Arduino, ultrasonic sensors, moisture sensors, buzzers, and rechargeable batteries, this invention tackles the problems faced by the visualized community. A proactive and dynamic navigating approach is provided by the inventive design, which combines electrical and sensor components. By giving users instant feedback on their surroundings, the obstacle detection feature encourages them to explore their surroundings in a safer and more self-assured manner. The soil moisture sensor will give the user a distinctive signal when it comes into contact with water that can be differentiated from the signal generated by an obstruction. For visually impaired people who want more mobility and independence, the blind stick with IoT (infrared or ultrasonic sensors) is a highly recommended tool. By giving users instant feedback on their surroundings, the obstacle and moisture detection functions encourage safer and more self-assured exploration of their surroundings.

KEYWORDS: Internet of Things, Blind stick, Vision Impairments, Signal, Sensor

1.0 INTRODUCTION

Blind people primarily used dogs and sticks for navigation in the past. The inability to receive information without touching the objects at the end of the stick is a downside of the white cane. Researchers have created intelligent devices to address the challenges posed by use a stick. In order to identify different limits and vibrate to notify the user, these systems use infrared or ultrasonic sensors. [11]

The visually challenged people in Malaysia has substantial obstacles in their daily navigation. Based on the 2022 statistics provided by the Social Welfare Department, Malaysia has a total of 52,027 officially registered individuals who are visually impaired (Peter, 2023). The National Eye Survey III (NES III) done by the Health Ministry reveals that a significant number of Malaysians aged 50 and over, up to 160,000 individuals, have impaired vision and Among them, 8% are classified as blind ("National survey shows fewer cases of blindness in those over 50," 2023). In the year 2020, a total of 2,460 children visited the clinic, out of whom 549 children (22.3% of the total) had visual impairment. During the presentation, it was found that 73.2% of the children with visual impairments were diagnosed with complete loss of vision. Among these children, 62.8% were less than one year old. Out of all cases of vision impairment, 38.4% were caused by conditions that could be treated, and 31.1% could have been prevented as reported in (Teoh et al., 2022).

A significant number of these individuals depend on assistance devices such as white canes to autonomously traverse their environment. Nevertheless, conventional blind sticks often fail to provide extensive environmental information, so exposing users to barriers and dangers. The insufficiency is evident in the data that demonstrates a significant frequency of accidents and injuries among persons with vision impairments as a result of environmental dangers. Risks from the environment play an important role in creating accidents among people with visual impairments (Swenor et al., 2016). According to the study, 65% of the visually impaired people surveyed reported experiencing accidents caused by environmental dangers (Lundälv & Thodelius, 2021). Individuals with vision impairments are more prone to accidents on highways and streets. According to Malaysian Institute of automobile Safety Research (MIROS) data, visually impaired pedestrians are 2.5 times more likely to be involved in traffic accidents than pedestrians with normal eyesight (Norzam et al., 2023). Falls are a common hazard for visually impaired people, especially in new or busy environments. According to the National Institutes of Health (NIH), people with visual impairments are more likely to fall than the general population. Inadequate environmental awareness may lead to accidents involving barriers such as furniture, entrances, and objects suspended at a low height. According to a study by (Darabont et al., 2020), obstacle collisions were a leading cause of injury among visually impaired people.

Individuals with vision impairments encounter challenges when it comes to safely and autonomously exploring their surroundings. Conventional white canes provide limited aid and depend exclusively on the sense of touch to identify obstacles and potential dangers. This can result in diminished situational awareness and heighten the likelihood of accidents and injury. To address this matter, a solution is necessary that provides immediate feedback on the user's surroundings and integrates supplementary security measures. The development of blind stick using IOT, equipped with vibration signals, auditory signals, an S.O.S emergency button, a water sensor, and a buzzer, was specifically developed to tackle these difficulties and offer a comprehensive aid for those with vision impairments.

2.0 MATERIALS AND METHODS

Figure 1 illustrates the process for developing a blind stick, Figure 2 depicts a schematic of a smart blind stick, while Figure 3 displays the electronic components of the smart blind stick, which is connected to an Arduino Uno and an ultrasonic sensor.

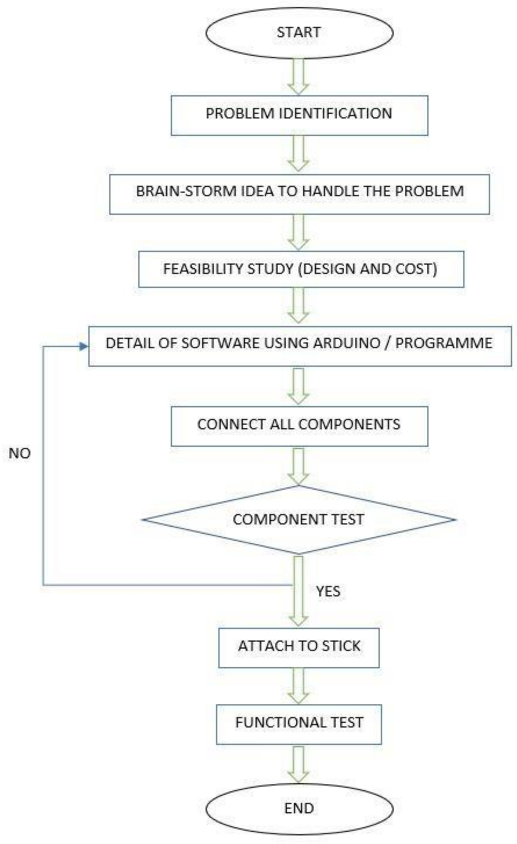

Figure 1. The methodology of development of a smart blind stick

Figure 2. 3D drawing of a smart blind stick

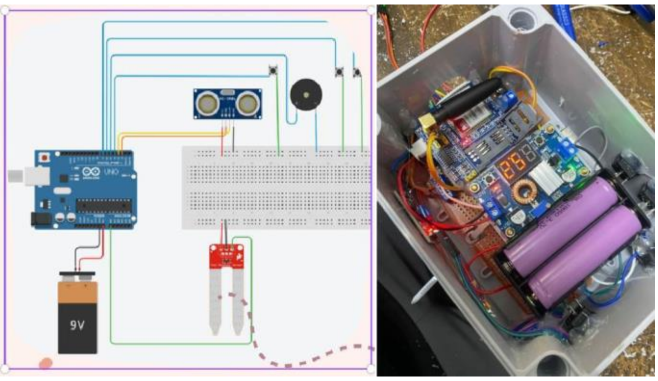

Figure 3. The circuit of smart blind stick connect with Arduino Uno and ultrasonic sensor

3.0 RESULTS AND DISCUSSION

Testing has been undertaken to enhance the performance and dependability of this intelligent blind stick, yielding a substantial amount of critical data that is essential for further improvement. This segment is devoted to the data analysis that was obtained through testing, which included the detection of ultrasonic obstacles and the sensing of moisture. In addition to water sensors, we used ultrasonic sensors. A buzzer that sounds an alarm is connected to these sensors. [12]

3.1 Ultrasonic Sensor

This research is aimed to design a smart blind stick based on ultrasonic sensor so that it can be used as a useful device for visually impaired peoples. A buzzer is attached and will make sounds as an alert if detects any obstacle in the path of the smart blind stick. This system can detect any obstacle within the range of 5-60cm. [9]

Obstacles has been located at various distances from the blind stick and the output voltage received on the ECHO pins of the sensors are recorded. Figure 4 shows distance versus voltage graph. The graph shows that with the increase of distance of the obstacles from the blind stick effects in the decrease of the output voltage. From 5-60 cm can be chosen as linear working range of the proposed blind stick. [9]

Figure 4. Ultrasonic Sensor

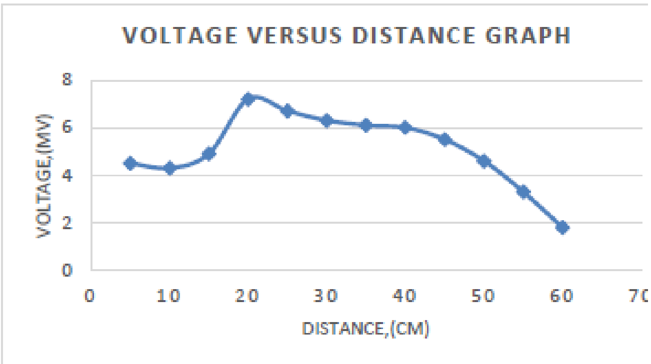

Figure 5. Voltage Versus Distance Graph

Figure 6. Ultrasonic Detection

3.2 Moisture Detection

Moisture may be seen on a little puddle. Upon contact with water, the soil moisture sensor will provide a distinct signal to the user, distinguishable from the signal produced by an impediment. When the water level reaches the third line, which is at a height of 2.1cm, a distinct signal is emitted to indicate to the user that the moisture level is no longer low as shown in Figure 7.

Figure 7. Moisture Detection

The smart blind stick incorporates a novel feature by integrating a sensor at the base of the rod, which detects the presence of water. When the user encounters a wet location, such as a puddle, the sensor triggers a vibration or sound signal to alert the user. Individuals with vision impairments have challenges when it comes to safely and autonomously exploring their surroundings. Conventional white canes provide minimal aid and depend exclusively on the sense of touch to identify obstacles and potential dangers. This might result in diminished situational awareness and heighten the likelihood of accidents and injury. [10]

In order to tackle this issue, the resolution that supplies instantaneous information on the user's environment and incorporates additional levels of protection. The intelligent cane incorporates a vibrating signal, auditory signal, emergency button, water sensor, and buzzer to effectively tackle these difficulties and offer a comprehensive instrument for those with vision impairments.

4.0 CONCLUSION

As a conclusion, the development of the smart blind stick was necessitated by the lack of existing initiatives to provide independent blind folks with a feeling of safety during outside excursions. A significant proportion of individuals depend on canes to assist them in their everyday activities. This project utilizes a vibrator motor for the vibration warning and ultrasonic sensors for measuring distance. Overall, this equipment is a worthwhile purchase for anyone who are visually impaired. The blind stick using IoT is a highly recommended tool for individuals with visual impairments who desire increased mobility and freedom. The innovative design incorporates electrical and sensor components to provide a proactive and dynamic navigating approach. The obstacle detection function provides immediate feedback on the user's environment, promoting a safer and more confident exploration of their surroundings. Ultrasonic or infrared sensors are frequently utilized. As recommendation, the integration of GPS enables real-time navigation and the ability to send SOS SMS messages. Thus, the aim is to encourage both convenient transportation and the enhancement of independent navigation abilities. The intelligent cane, including customizable sensitivity, small size, and immediate environmental notifications, is a very important and powerful tool that greatly enhances the overall quality of life for those with visual impairments. With a clear quick response time, this system offers a sturdy, affordable, small, low-power, and dependable navigation solution. Despite being hardwired, the sensor and component unit is lightweight [13].

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