A Review: Third Eye for the Blind Using Arduino Uno

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Abstract - In recent years, third eyes for the Blind a tool that uses Arduino attempts to make it easier for those who are blind to navigate their surroundings. This tool helps the user sense their surroundings without relying on visual signals by using ultrasonic sensors to identify the obstructions in front of them with haptic feedback using vibration motors. The Arduino IDE is used to program the Arduino board that is used to build the device. It is made to be small and lightweight so that the user may take it with them wherever they go. The gadget runs on a rechargeable battery, It offers long-term use. The device features haptic feedback, obstacle detection, a GPS module, and a compass that enables users to navigate to specified areas using a straightforward directional indicator. Also, a smartphone app that offers capabilities like voice-guided navigation and the capacity to bookmark and go to regularly visited areas can be used in conjunction with the device. The Third Eye for Blind Utilizing Arduino is an inventive and cost-effective solution that, by giving visually impaired people more freedom and movement, has the potential to dramatically improve their quality of life.

Key Words: Arduino, Ultrasonic Sensors, Haptic Feedback, Vibration Motors, GPS, Navigation, Smartphone App.

1. INTRODUCTION

The World Health Organization evaluated that there are 253 million visually impaired persons in the globe, 36 million of whom are blind. These people encounter several difficulties in their daily life, notably concerning mobility and navigation. Although there are many assistive technologies for the blind, many of them are expensive and may not be readily available to individuals who require them. Third Eyes for the Blind Arduino is a creative and cost-effective answer to this problem. This device's obstacle detection and haptic feedback are intended to make it easier for people who are sight impaired to navigate their surroundings. Ultrasonic sensors, which are used to identify obstructions in front of the user, are integrated into the gadget together with an Arduino board. The device then uses vibration motors to deliver haptic feedback, enabling the user to perceive their environment without relying on visual indicators. A GPS module and a compass are also included in the gadget, enabling users to travel to specified areas with only a straightforward directional indicator. A smartphone app that offers extra functions like voice-guided navigation and the ability to bookmark and navigate to regularly visited areas can also be associated with the device. By giving visually impaired people more independence and mobility, the Third Eye for Blind Utilizing Arduino has the potential to greatly improve their quality of life. It is a practical and economical solution that might have a big influence on the lives of people who use it. We will talk about the Third Eye for Blind Utilizing Arduino's design, development, and implementation in this essay, as well as its possible effects on the lives of those who are blind or visually impaired.

2. LITERATURE SURVEY

Wang et al [1] proposed that an audio-based indoor navigation system for the visually impaired "An Audio-Based Indoor Navigation System for the Visually Impaired," which describes the technology. To give users real-time assistance, the system combines a smartphone app with a network of Bluetooth beacons dispersed across the area. The software gives users step-by-step directions and can even pinpoint nearby attractions like restrooms or elevators. Based on audio signals emitted by the beacons, the system uses machine learning techniques to determine the user's location and direction. The system was successful at directing users through challenging indoor environments, according to the authors' evaluation of its effectiveness in a real-world scenario. The system can greatly increase mobility and independence overall.

Wolpaw et al [2] proposed that brain-computer interfaces (BCIs), are a technological advancement that enables users to operate computers or other devices solely with their brain activity. In addition to discussing prospective uses for BCIs in industries including medical, entertainment, and military operations, they offer a historical perspective on the evolution of BCIs. The various facets of BCIs are covered in the paper, including the kinds of brain signals that can be utilized for control, the various methods for signal gathering and processing, and the difficulties that must be overcome for the technology to be widely employed. Along with addressing the need for a legislative framework to assure the safe and responsible use of BCIs, the authors also address ethical and privacy issues associated with their use.

Shen et al [3] discussed the difficulties that people with vision impairments experience when navigating and spotting obstacles, as well as potential solutions such as smart eyewear. After that, they give a thorough analysis of the literature that has already been written about smart glasses for the blind, covering a range of topics including user interface, software, and hardware. They divide the extant material into three primary groups: assistive communication, navigation and localization, and object recognition and detection. They include a variety of methods for object recognition and detection, including deep learning algorithms, computer vision techniques, and machine learning techniques. The methods for navigation and localization presented use computer vision techniques as well as sensors like GPS and gyroscopes. They also talk about methods for helping people communicate, like using text-to-speech software and haptic stimulation.

Chaitrali et al [4] discussed the obstacles that the visually handicapped encounter daily are numerous. When they visit a strange place, the issue worsens. Only a small number of navigation systems for those with vision loss can deliver dynamic navigation through the audio output. When employed indoors or outdoors, each of these technologies has distinct restrictions. Our blind navigation system focuses on providing speech output for obstruction avoidance and navigation using infrared sensors, RFID, and Android devices. Those who are blind or partially sighted can be guided by the proposed device. Blind people can now travel in the same security and comfort as sighted people thanks to this device. The device is equipped with infrared proximity sensors. Both public structures and walking aids for the blind have RFID tags incorporated into them. The small device is used in conjunction with the white cane. This gadget and an Android phone are connected over Bluetooth. A delivery-focused Android app is created. voice navigation that updates a person's location on the server based on RFID tag scanning. Family members can connect to the server at any moment and use a different program to find the blind individual.

Lahav et al [5] suggested the mental mapping of settings and probable paths for navigating them is necessary for the development of effective orientation and mobility skills. The majority of the information required for this mental mapping comes from the visual channel. Blind people are missing out on this crucial information, which makes it very challenging for them to mentally map out an environment accurately and successfully navigate it. The study's research is founded on the supposition that supplying sufficient spatial information via compensatory sensory channels can improve spatial cognition., as opposed to the (damaged) visual channel, which may make it easier for blind people to mentally map out spaces and, as a result, have more spatial awareness. One of the main goals of the study outlined in this paper was to create a multi-sensory virtual environment to teach blind people about the real-world environments they must navigate (such as schools, workplaces, and public buildings), as well as to conduct a thorough investigation into how blind people learn to navigate spaces using a virtual environment and how this mapping affects blind people's spatial abilities and performance in everyday situations. The report discusses the preliminary results of two case studies that looked at how blind persons learned to interact with their surroundings and provides a summary of the virtual learning environment.

Rajkumar et al [6[ ] proposed that A camera-based assistive text reading framework has been created to help blind people read text labels and product packaging from hand-held objects in their daily lives. To isolate the object from distracting background details or other nearby objects in the camera's field of view, we first describe an efficient motion-based technique that asks the user to shake the object. To extract the region of moving objects, this methodology combines background reduction methods based on Gaussian distributions. Text localization and recognition are applied to the gathered ROI to acquire text details. To focus the text regions from the object ROI automatically, we offer a novel text localization approach that learns gradient characteristics of stroke orientations and distributions of edge pixels in an Ada boost model. The text characters in the translated text sections are identified using optical character recognition software after being binarized. The well-known text codes are output as audio for blind users. The robust reading data sets from ICDAR-2003 and ICDAR-2011 are used to objectively evaluate the efficiency of the suggested text localization technique. Experimental results demonstrate that our algorithm has reached its full potential. Using a dataset and the proof-of-concept example, the plan's effectiveness is compiled by ten blind people.

Awan et al [7[] addressed how the capacity to mentally map out a space influences how one develops structured orienting and movement skills. Most of the information required for cognitive mapping is obtained through the sense of vision. Without this vital information, those with visual impairments find it challenging to map out and navigate unfamiliar spaces. This study aimed to boost the ability of visually impaired individuals to move independently by better understanding their cognitive mapping abilities. Design/Methodology/ Approach: The blind residents of Pakistan's Lahore district made up the population of this quantitative study. 30 visually handicapped people were included in the sample, and the practical sampling technique was used. To collect data online, a self-developed questionnaire with a Cronbach Alpha of 0.78 and 36 items on a five-point Likert scale (strongly agree to strongly disagree) was utilized. Descriptive and inferential statistics were used to analyze the data. Results: The study's findings demonstrated that visually impaired people used haptics and linguistic audition to learn about their physical environment directly or indirectly. In their daily lives, they greatly rely on the use of assistive technology. Implications/ Originality/Value. The study indicated that there is a critical need to evaluate the cognitive mapping skills of individuals with visual impairment through a larger sample size and experimentation to enhance their quality of life by boosting mobility and independence.

Jayachandran et al [8] suggested that the development of computer-based accessible solutions has given the blind and visually impaired numerous new opportunities around the world. Screen readers, an audio feedback-based virtual world, have greatly aided blind individuals in using online apps. Nevertheless, such solutions would not be very helpful to a sizable portion of visually impaired individuals worldwide, especially in the Indian subcontinent. This was primarily caused by the fact that Indian languages require different technology than languages corresponding to other widely spoken languages around the world. In this work, we present the voicemail system architecture that a blind person can utilize to quickly and effectively access emails. This research's contribution has made it possible for blind persons to use a mobile device to send and receive voice-based e-mail messages in their language. The GUI of a conventional mail server has been compared to the GUI of our suggested system. We discovered that our suggested architecture outperforms the current GUIS significantly. In this project, we combine text-to-voice and voice-to-text technology to improve accessibility for blind individuals.

Akanksha et al [9] Suggested that This research describes a camera-based label assistive system that enables blind people to read product names by collecting images of the labels. With speakers connected to the Raspberry Pi model, the portable system can read out written text that is placed in front of the camera and record photographs. The image is passed into the OCR processor on the Raspberry Pi. OCR is used to transform virtually written text-containing images into text data that is machine-readable. The supplied text is then converted to audio using Google Text to Speech Converter (GTTS). The speaker plays audio for the audio-impaired person.

Andreasen et al [10] discussed that it is difficult to hear items in an environment, such as in the use of echolocation. The primary goal of current research is to employ virtual environments (VEs) to instruct novice users in the use of echolocation for navigation. Previous studies have shown that musicians can tell the difference between sound pulses and reflections. This article organizes user VE navigation strategies into categories and suggests design guidelines for VE simulators that can be used for both training and test purposes. The paper also describes new user performance-enhancing technology for VEs. They describe the findings from two user trials, including primary research in which participants were exposed to a spatial orientation task under the influence of early reflections, late reverberation, early reflections-reverberation, and visual stimuli. The sonic interaction design was improved through the pilot study (V). Thanks to the latter study, researchers were able to identify user navigational patterns. This group may have outperformed the other participants in the RR condition since some users (10/26) reported being able to create spatial cognitive maps while doing the exam with auditory echoes.

Pratibha et al [11] suggested that technology is advancing every day in many areas, making it possible to offer versatile Smart Cane (Stick) proposals for blind people. Yet, there isn't a good system that can guide the blind and assist in an emergency. This research suggests a user-friendly device that uses ultrasonic sensors to detect obstructions in the way. In this system, a cane connected to an Android app will be used by a blind person to navigate. By pushing the GSM module's emergency button on their cane, a blind person can make a voice call or send an SMS to a predetermined number. Moreover, Facebook status updates with emergency alerts will notify users. this system creates a clever, user-friendly Android application. The blind person can use their cane as an automated flashlight when walking in a public space at night.

Takumi et al [12] proposed the use of a binaural bone-conducted sound for navigation is suggested. Three features in this system help the user get to their location with accuracy. First, the selection of the device and the ideal contact conditions between the bone-conduction device and the human skull are discussed. Second, it is demonstrated that the selected bone-conduction device replicates the fundamental sound localization performance with binaural sounds by taking into consideration the head-related transfer functions (HRTFs) found in the airborne sound field. Here, it is also acceptable to employ panned sound to accentuate the sound's position. The most important aspect of a voice guiding for the navigation of a visually impaired person is the safety of the navigator, hence research is done to find an appropriate warning sound that the bone-conduction device can create. Using bone-conducted guide announcement and the aforementioned conditions, we then conduct an aural navigation experiment. When speech information that reproduces binaural sounds is used instead of just voice information, it takes less time to get to the target of the navigation route. Consequently, a binaural bone-conducted sound navigation system's usefulness is proven.

Koharwal et al [13] proposed visual limitations, those who suffer from serious conditions are unable to move on their own. These folks are typically left in disadvantaged situations in this rapidly changing society. Several techniques have been employed to assist them and give them some degree of movement comfort. Traditional approaches, such as using trained dogs or a cane, are not sufficient in identifying potential obstacles. Also, controlling and teaching dogs is a difficult undertaking. Certain guiding systems make use of RFID technology. Nevertheless, this technology is not suitable for usage in a public outdoor space. This study proposes the "Navigation System for Blind - Third Eye," an AI-based system. In this work, a straightforward electronic guided embedded vision system that is efficient and flexible is proposed to enable the mobility of blind and visually impaired people both indoors and outdoors. The system makes use of three different kinds of gadgets: Infrared sensors, sonar sensors, and cameras. To categorize the front barrier, a microcontroller processes the reflected data from all devices. This mechanism can be attached to a hat or a little hand stick the size of a pen. The technology assists those with disabilities in becoming extremely independent while also offering an affordable and dependable option. To assist them and give them some degree of comfort in their mobility. Traditional approaches, such as using trained dogs or a cane, are not sufficient in identifying potential obstacles. Also, controlling and teaching dogs is a difficult undertaking. Certain guiding systems make use of RFID technology. Nevertheless, this technology is not suitable for usage in a public outdoor space. This study proposes the "Navigation System for Blind - Third Eye," an AI-based system.

3. CONCLUSIO NS

It is also concluded that with the advent of technologies like machine learning, artificial intelligence, virtual and augmented reality, and sound-based systems, assistive solutions for the visually impaired have gone a long way recently. From navigation and object identification to reading and communication, these technologies have the potential to offer more sophisticated and precise solutions for a variety of helpful functions. These technologies may have certain drawbacks and need to be improved and adapted, however, represent a viable strategy for raising the standard of living for people who are blind. New and inventive technology will probably develop as this field of study progresses, significantly enhancing the usability and independence of those who are visually impaired. Overall, creating assistive technologies for the blind and visually handicapped is a quickly developing field with a bright future. To guarantee that people with visual impairments have access to the most cutting-edge and efficient assistive technologies, it is crucial to maintain funding for research and development in this field.

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