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Third Vision for Blinds

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Abstract: ***This paper introduces a third vision system designed to assist visually impaired individuals in detecting obstacles and dangers during walking, as well as identifying the world around them. The proposed solution acts as an artificial vision and alarm unit, consisting of three sensors (ultrasonic, water, and heat flame), and a microcontroller (Arduino Uno R3) to process sensor signals into short pulses for the Arduino pins to activate buzzers and LED bulbs. Our project aims to provide an affordable and lightweight smart stick suitable for most blind people, making it accessible to all segments of society and their families in need.***

Keyword: Third Vision, Blind People, Arduino Uno, Ultrasonic Sensor, Water Sensor, Heat Flame Sensor.

I. INTRODUCTION

Third vision for blinds for visually impaired individuals is an important innovation in assistive technology. For those with visual disabilities, daily activities can be challenging and dangerous, as vision plays a crucial role in most tasks. The current white stick used by blind individuals provides some guidance while walking, but it is not efficient or helpful enough. This is where the third vision for blinds comes in as a proposed solution to address the difficulties in detecting obstacles and dangers in front of individuals with visual disabilities. Third vision for blinds system is designed to act like an artificial vision and alarm unit, integrating ultrasonic sensors, a water sensor, a heat flame sensor, a buzzer, and a LED bulb. The ultrasonic sensors use ultrasonic waves to detect obstacles ahead, while the water and heat flame sensors detect the presence of water or flames. Upon sensing an obstacle or potential danger, the sensor passes this data to the microcontroller, which processes the data and determines if the obstacle or danger is within a set range. If the obstacle is too close, the microcontroller sends a signal to sound a buzzer and alerts the individual of potential danger. Additionally, if the water or heat flame sensor detects the presence of water or flames, it sounds a different buzzer to alert the individual. Our proposed smart stick is more efficient and helpful than the traditional white stick. It provides an alarm alert if any hurdles or potential dangers are detected within the set range, thus helping individuals with visual disabilities navigate and avoid potential hazards. Furthermore, it is light in weight, affordable, and suitable for most blind individuals, making it accessible to all segments of society and their families who need them. The benefits of our proposed smart stick for visually impaired individuals are many. It provides a sense of independence and increased mobility, making daily activities easier and less dangerous. It also helps in navigating through unfamiliar environments, such as new workplaces or buildings. Moreover, it can improve the overall quality of life for those with visual disabilities and provide peace of mind to their families.

II. HARDWARE COMPONENTS

A. Arduino UNO R3

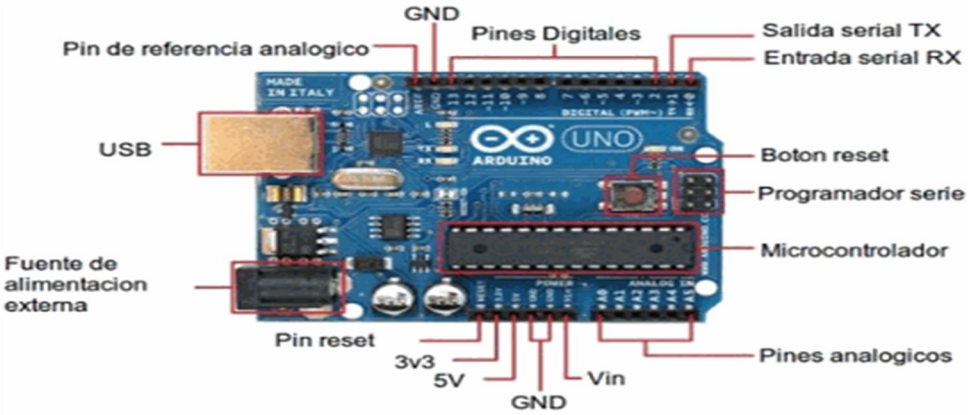


Fig 1. Arduino Uno R3

The Arduino UNO R3 is a microcontroller board that is based on ATmega328p. It has 20 pins, out of which 16 are digital input and output pins, and 6 are analog input pins. It also has a 16MHz quartz crystal, a power jack, an ICSP header, and a reset button. As compared to a PIC microcontroller, it is much easier to use with Arduino since it is user-friendly. The operating voltage is 5V, and it can be directly connected to a computer with a USB cable, powered with an AC-DC adapter, or battery. Arduino is a free and open-source programmable circuit board that can be used in both basic and advanced makerspace projects. This board has a microprocessor that can detect and control physical objects. By responding to sensors and inputs, the Arduino can communicate with a wide range of outputs, including sensors, LEDs, motors, and displays. Arduino is a popular choice for makers and maker spaces looking to develop interactive hardware projects due to its versatility and low cost. Arduino was introduced in 2005 in Italy by Massimo Banzi as a way for non-engineers to have access to a low-cost, simple tool for developing hardware projects. Since the board is open-source, it is released under a Creative Commons license that allows anyone to produce their own board. If you search the internet, you will find that there are numerous Arduino-compatible clones and versions available, but only the official boards have "Arduino" in their name. One of the most popular Arduino boards available is the Arduino Uno. While it was not the first board to be released, it remains the most actively used and widely documented on the market. Due to its high popularity, the Arduino Uno has a plethora of project tutorials and forums available online to help you get started or out of a jam. We are big fans of the Uno because of its excellent features and ease of use.

B. Ultrasonic Sensor



Fig 2. Ultrasonic Sensor

The ultrasonic sensor module reads the distance between the module and obstacle surfaces, sending that data to the Arduino Uno microcontroller. Based on the programmed algorithm, the microcontroller detects the position of obstacles in front of the blind user, calculates the distance within the set range, and alerts the user if they need to move in a different direction. If an obstacle is detected in front of the user, the microcontroller receives signals according to the programming and starts the buzzer to sound an alert.

Ultrasonic sensing elements, sometimes called transceivers or transducers, function similarly to measuring or navigational devices. They decode echoes from radio or sound waves to calculate the properties of a target. Inaudible sensors generate high-frequency sound waves and analyze their echoes to calculate the distance between the sensor and object. The sensor uses multiple detectors to calculate speed and direction based on relative distances between obstacles. After receiving the echo, the sound waves are converted back into electrical energy using an electrical device that turns voltage into sound in the inaudible range, which is over 18,000 hertz.

C. Water Sensor



Fig 3. Water Sensor

This is a simple and portable water level/water droplet sensor that provides high-cost performance. It offers complete water yield and analog conversion, and the output value can be applied to your custom function. The sensor has low power consumption and high sensitivity, and it can perform better when used with an Arduino 328 controller and sensor relay shield. The Water Sensor water level sensor is an easy-to-use and cost-effective high-level/drop recognition sensor. It is obtained by having a series of parallel wires exposed traces that measure droplets/water volume to determine the water level. It is easy to complete water-to-analog signal conversion, and the output analog values can be directly read from the Arduino development board to achieve the level alarm effect. The water sensor module reads the water level/water and sends that data to the Arduino Uno microcontroller. According to the programming, the microcontroller will detect if there is water in front of the blind user and alert the user whether or not they need to move in a different direction. If water is detected in front of the blind user, the microcontroller (Arduino Uno) will receive signals according to the programming, and the buzzer will start alarming or producing alert sounds.

D. Heat Flame Sensor

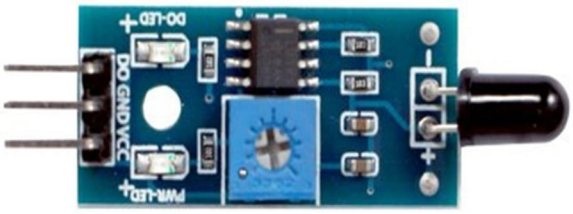


Fig 4. Heat flame Sensor

The Heat Flame Sensor is used as an obstacle detector by transmitting infrared waves that hit an object and reflect back to the sensor. The sensor detects wavelengths ranging from 700nm to 1mm. The IR output varies depending on the infrared rays that have been received. Since this variation cannot be analysed directly, the output is provided for comparative circuit analysis. If the IR receiver does not receive any signal, the output of the comparator goes low, and the LED does not glow. On the other hand, if the IR receiver detects a signal, the output goes high, and the LED starts glowing. The Heat Flame Sensor is a useful component in many applications, including obstacle detection, fire detection, and gas leak detection. It is commonly used in industries and homes to ensure safety by detecting potential hazards.

E. Buzzer



Fig 5. Buzzer

An Arduino buzzer, also known as a piezo buzzer, is a small speaker that can be directly connected to a microcontroller like the Arduino Uno. When sensors (ultrasonic sensor, water sensor, and heat flame sensor) detect any obstacles in front of a blind user, the buzzer works as an alarm unit, alerting the user through its sound. By sounding an alarm, the user can be aware of potential hazards ahead and take the necessary steps to avoid them. The buzzer can be programmed to produce sound at a frequency that is set by the user. It operates based on the reverse of the piezoelectric effect, where the piezoelectric crystal vibrates and produces sound waves. This vibration generates sound waves that travel through the air and can be heard by the user. The Arduino buzzer is an important component in the smart stick system for assisting blind people. It serves as an effective alert system and enhances the safety and mobility of visually impaired individuals.

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III. WORKING

The proposed blind stick system is equipped with three sensors - an ultrasonic sensor, a water sensor, and a heat flame sensor - that are connected to a microcontroller (Arduino Uno R3) along with a buzzer, an LED bulb, a battery, a switch, and some jumping wires. All the components are seamlessly integrated with the microcontroller using the jumping wires. When the ultrasonic sensor detects any obstacles ahead using ultrasonic waves, it sends the data to the microcontroller. Similarly, the water sensor and heat flame sensor work in tandem with the ultrasonic sensor. The microcontroller processes this data and determines the proximity of the obstacle. If the obstacle is far enough, the circuit does nothing. If the obstacle is close, the microcontroller triggers a signal to sound the buzzer, and the buzzer starts alarming. This system serves as an artificial vision and alarm unit, which provides visually impaired people with a reliable and efficient tool for obstacle detection and warning. The ultrasonic sensor helps detect any physical barriers, while the water sensor and heat flame sensor can detect potential hazards like water puddles or fire. The system is designed to be lightweight, cost-effective, and easy to use, making it accessible to all segments of society.

IV. CONCLUSION

It is important to note that the primary objective of this study, which is to design and implement "Third Vision for Blinds", has been successfully accomplished. The Smart Stick serves as a fundamental platform for future assistive devices that aid visually impaired individuals in safely navigating both indoor and outdoor environments. It is effective, affordable, and a necessary solution in developing countries like India where cost-effective solutions are needed to ensure that most individuals can have access to such a device. The device developed in this study has the capability to detect obstacles, heat flames, and water, while also ensuring the user's safety. This project aims to assist all blind individuals worldwide in making it easier for them to move around independently. It is designed to facilitate movement and increase safety for individuals with disabilities that are blind. What sets our solution apart from others is the incorporation of additional sensors that aid in detecting heat flames, water, and obstacles, thereby minimizing problems and difficulties faced by visually impaired individuals. The stick is very affordable and offers numerous features such as quick reaction time, fast sensor sensing, and an adjustable range for detecting obstacles based on the user's requirements. The stick is lightweight, easy to handle, easy to use, and equipped with a rechargeable or removable battery. It is a gadget/product and project idea for the future, catering to the needs of blind individuals. Third vision for blinds system is a highly beneficial and innovative solution designed to aid visually impaired individuals in navigating their surroundings with greater ease and safety. With the incorporation of various sensors, the device can detect obstacles, heat flames, and water, providing real-time alerts to the user, ensuring their safety, and promoting independent movement.

V. ACKNOWLEDGEMENT

We would like to express our heartfelt gratitude to our research guide, Mr. Rajat Kumar, from the Department of Computer Science and Information Technology at Dronacharya Group of Institutions, Greater Noida. He has been an incredible mentor throughout our project on the topic of "THIRD VISION FOR BLINDS," providing us with invaluable guidance, motivation, and support. His expertise and insightful feedback have been instrumental in shaping our project and helping us achieve our objectives. He has been a constant source of encouragement, pushing us to explore new ideas and approaches and challenging us to think critically and creatively. We are extremely grateful for the golden opportunity he has given us to work on this wonderful project, which has enabled us to develop our skills and knowledge in this field. Mr. Rajat Kumar's guidance has been instrumental in helping us realize the full potential of our project and has inspired us to continue our pursuit of knowledge and innovation. Once again, we extend our sincere thanks to Mr. Rajat Kumar for his invaluable support and guidance throughout our project.

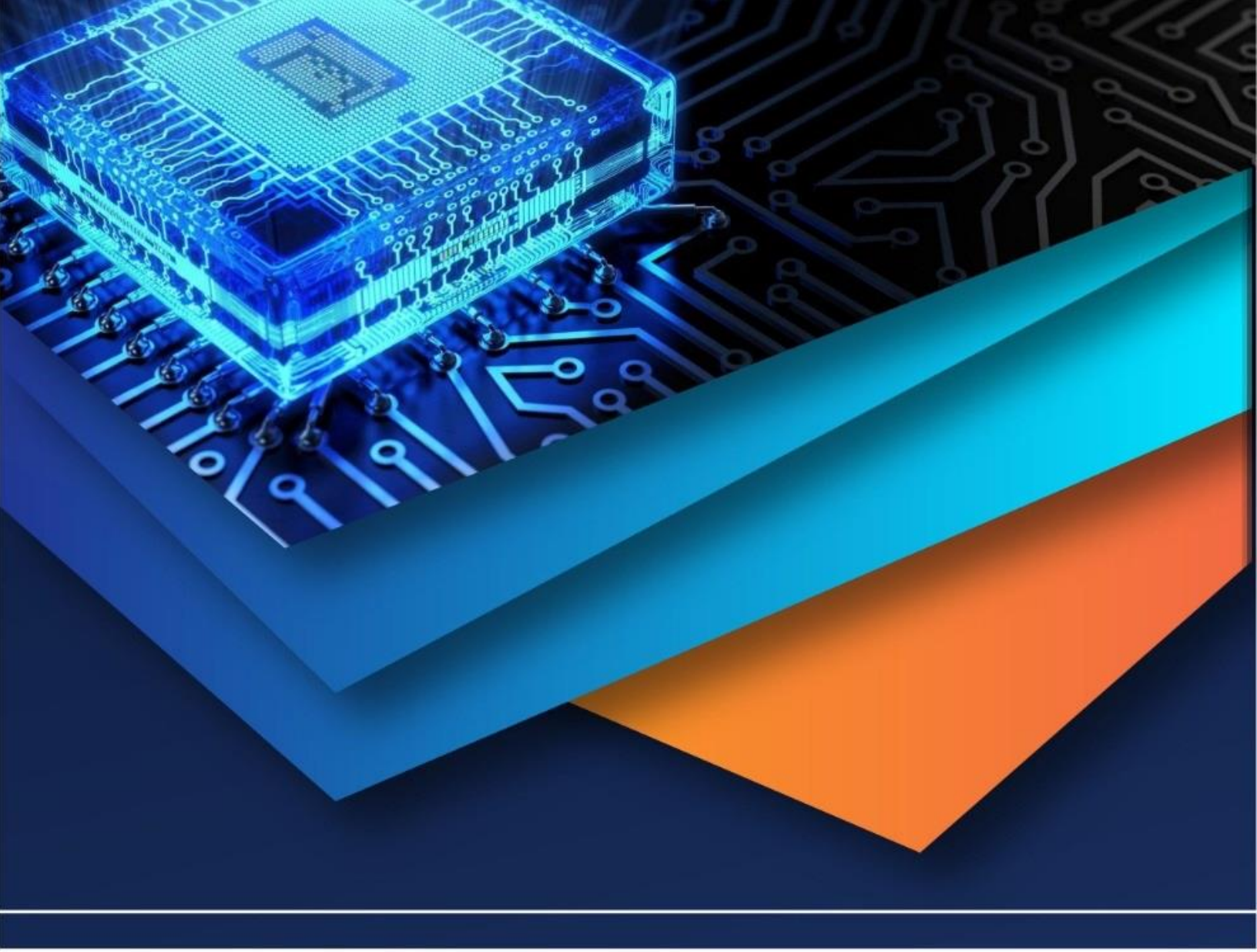
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