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Implementation Of Finding The Obstacle For Blind People Using Arduino And Ultrasonic Sensor

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Abstract: According to the World Health Organization, approximately 37 million people are blind, highlighting a significant challenge. This project aims to assist individuals facing visual difficulties by detecting objects within a certain range using an Arduino UNO, a buzzer, and an ultrasonic sensor. When an object is detected, the system emits a buzzer sound, alerting the user to the obstacle ahead. This initiative endeavors to enhance the quality of life for the visually impaired by providing an effective means of obstacle detection.

***Index Terms* -** Arduino UNO, Buzzer, Ultrasonic Sensor, Object Detection, Visual Impairment, Assistive Technology.

I. INTRODUCTION

Blindness is a prevalent disability impacting millions globally, with approximately 940 million individuals experiencing vision-related challenges. These individuals often require assistance to perform daily tasks and navigate their surroundings safely. The primary objective of this project is to assist blind individuals by providing a reliable method for detecting obstacles in their path. The Smart Blind Stick is an automated, lowmaintenance, manually operated, costeffective, and user-friendly device designed specifically for visually impaired individuals. It integrates technologies such as the Arduino UNO microcontroller, ultrasonic sensor, and buzzer to enhance its functionality.

The Arduino UNO serves as the device's central controller, known for its rapid and precise calculations. Ultrasonic sensors utilize ultrasonic waves to detect nearby obstacles, allowing the device to identify potential hazards effectively. Programming and coding for the Smart Blind Stick are conducted using embedded C language, facilitating seamless integration of components and functionalities. However, utilizing the device with complete accuracy requires essential training to help users interpret information and respond to real-time feedback effectively. The Smart Blind Stick represents a significant advancement in assistive technology, offering visually impaired individuals increased independence and safety in navigating their surroundings. Through innovative design and technological integration, this device aims to empower individuals with visual impairments to lead more fulfilling and autonomous lives.

II. LITERATURE SURVEY

Till the last few years, there are many new technologies have been developed for visually challenged peoples.

Dhanuja, R., F. Farhana, and G. Savitha [1] proposed a system in which they used ultrasonic sensor which is connecting with arduino and here sensor detects the object and generates sound and indicates the blind people that there is a obstacle.

Ramisetti, Chandu [2] proposed integrating an accident alert mechanism into their blind guide stick, which proves beneficial for visually impaired individuals in identifying accidents or potential hazards. In their approach, they employed ultrasonic sensors to detect obstacles, with Arduino executing the necessary computations and dispatching signals to the appropriate device.

Tirupal, Talari [3] opted for a setup involving either a speaker or microphone to emit sound signals upon detecting obstacles. Utilizing ultrasonic sensors to gauge distances between objects and users, Arduino relayed signals to the speaker, thereby alerting users to potential obstacles.

Gbenga, Dada Emmanuel, Arhyel Ibrahim Shani, and Adebimpe Lateef Adekunle [4] introduced a system featuring ultrasonic sensors interfaced with Arduino, alongside RF transmitters and receivers. Upon obstacle detection, ultrasonic sensors transmitted signals to Arduino, which in turn emitted auditory alerts. Nonetheless, the system incurred higher costs.

Romadhon, A. S., and A. K. Husein [5] utilized Arduino UNO and both ultrasonic and IR sensors to calculate distances between users and objects. Arduino processed sensor data and produced corresponding auditory signals to aid in obstacle detection.

Swain, Kunja Bihari, Rakesh Kumar Patnaik, Suchandra Pal, Raja Rajeswari, Aparna Mishra, and Charusmita Dash [6] devised a comprehensive stick guide model integrating IR sensors, two ultrasonic sensors, Arduino, GPS, and GSM modules. Their system not only detected obstacles but also used GPS to locate blind individuals and GSM modules to share their locations, thereby facilitating safer navigation.

III. METHODOLOGY

Four blocks—a power source, a microprocessor an obstacle detector, and an alarm unit—make up this block diagram.

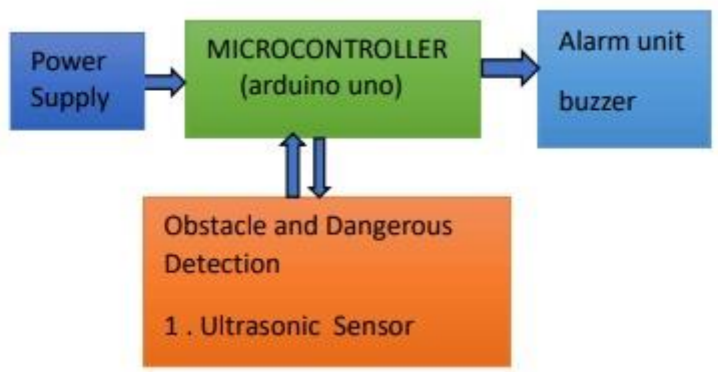

Figure1: Block Diagram

The block diagram outlines the essential components of the electronic circuit, consisting of four main blocks: a power source, a microprocessor (in this case, an Arduino Uno), an obstacle detector, and an alarm unit. Among these, the microcontroller assumes a pivotal role as it orchestrates the functioning of all other elements within the circuit. Specifically designed for embedded applications requiring computational capability and rapid, precise communication with electronic, digital, or analog components, the Arduino Uno serves as the central control unit. The power supply block is equally critical as it furnishes the necessary electrical power to the entire system. Ensuring a stable and reliable power source is fundamental for the proper operation of the circuit. The obstacle detector, comprising sensors such as the ultrasonic sensor, plays a crucial role in identifying impediments in the user's path. When the ultrasonic sensor detects an obstacle, it promptly sends a signal to the microcontroller, which then triggers the alarm unit to alert the user. Typically, the alarm unit may consist of a buzzer or another audible signal device, providing immediate feedback to the user regarding the presence of obstacles.

WORKING:

The blind stick operates as a crucial sensing device designed specifically to aid visually impaired individuals in navigating their surroundings safely and independently. Central to its functionality is a circuitry powered by a stable 5V power supply, ensuring consistent operation of its components. Utilizing ultrasonic and IR sensors, the device detects nearby obstacles and provides real-time feedback to the user via an Arduino UNO microcontroller. The ultrasonic sensor emits high-frequency waves and measures the time it takes for these waves to bounce back from nearby objects. By calculating the elapsed time and considering the speed of sound, the Arduino accurately determines the distance between the user and potential obstacles. Similarly, the IR sensor detects the presence of objects by analyzing the reflection of infrared radiation. Through meticulous data processing, the Arduino interprets sensor inputs and initiates appropriate responses, such as vibrating motors or auditory alerts, to notify the user of impending obstacles. This intricate interplay of sensors and microcontroller technology empowers visually impaired individuals to navigate their environment confidently, enhancing their autonomy and safety in daily activities.

To know the distance of the object: *Distance=speed*time
The speed of the signal travelling through air is 341m/s. The time is calculated between the sending and receiving back the signal. Since the distance travel by the signal is double, it is divided by two Distance=*Distance/2.

CIRCUIT DIAGRAM:

The ultrasonic sensor's Vcc and GND connect to the Arduino Uno's 5V and GND, while its Trig and Echo pins link to D7 and D8, respectively.

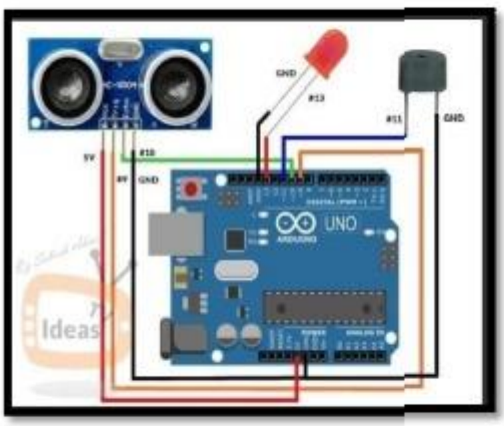

Figure2: Circuit Diagram

For the piezoelectric buzzer, its positive terminal connects to D5, and the negative terminal to GND. To control the vibration motor (2.5V to 4V) via the Arduino .Transistor functions as a switch. The transistor's base is linked to a digital pin on the Uno, allowing current flow to power the motor when activated. Careful consideration of transistor configuration and power limits ensures efficient and safe operation of the blind stick's components.

IV. RESULTS AND DISCUSSION

Figure3: Blind Stick

Many obstacles confront visually impaired individuals during their daily travels, with collisions involving motorcycles and bicycles being particularly prevalent. The detection range of our device spans from 1 meter to 1.5 meters in front, allowing it to sense obstacles within the direction of the ultrasonic sensor. The alert system is meticulously designed to offer varying ranges of alerts, enabling users to discern obstacles easily through distinct buzzer sounds and accompanying vibrations.

V. CONCLUSION

Our study underscores the efficacy of employing ultrasonic sensors to aid visually impaired individuals in obstacle detection. The paper elucidates the system's structure and research methodology. The Blind Project represents a groundbreaking innovation that empowers visually impaired individuals to navigate confidently, leveraging a wearable band emitting ultrasonic waves to alert them through buzzer sounds or vibrations. This system facilitates independent travel for the visually impaired, enabling them to lead fulfilling lives without relying on external assistance.

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