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SMART STICK FOR VISUALLY CHALLENGED INDIVIDUALS USING ARDUINO

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ABSTRACT

The purpose of the Smart Blind Stick is to assist those who are blind or visually impaired by identifying objects, stairs, etc. and providing them with the necessary information. The Smart Blind Stick project aims to develop an innovative assistive device to enhance the mobility and spatial awareness of visually impaired individuals. This project integrates various sensor technologies, such as ultrasonic sensors, soil moisture sensor, LDR sensor and color detecting sensor. The stick is equipped with an ultrasonic sensor at the front to detect obstacles within a range of up to 100cm. When an object is detected, the stick alerts the user through voice module with the help of speaker. Additionally, a soil moisture sensor is employed to detect slippery areas. The device also includes a night light feature activated by ambient light sensors, enhancing usability in low light conditions.

As a result, the proposed system that will assist visually defective people by avoiding obstacles/stairs through object detection, to lead a life like other normal people in the world. If there is an obstacle in the user's path, the system will track it, and convey to that user about it. This reduces human efforts and gives better understanding of the surrounding. Moreover, it gives visually impaired people the chance to walk around independently without the assistance of others. The smart stick is therefore a suggested way to assist those who are blind or visually impaired in their daily lives without the assistance of others.

Keywords:
Arduino UNO, Ultrasonic sensor, LDR sensor, Soil moisture sensor, Color detecting sensor, Voice module.

INTRODUCTION

A computing device that performs a single, narrowly focused task is known as an embedded system. Examples of embedded systems are devices like mobile phones, fax machines, air conditioners, VHS and DVD players, printers, and so on. In addition to embedded software that is run by the processor to fulfill the particular demand of the application, each of these appliances will have a CPU and specialized hardware to meet those needs. Another term for embedded software is "firmware." Currently, severe vision impairments prevent people with visual impairments from traveling alone. For all other everyday tasks, including walking outside, they require assistance. Since most navigational tasks rely on visual information, visually impaired people are hindered by their inability to obtain essential information about their surroundings and atmosphere. Our proposal involves developing a system that aims to eliminate blindness-related challenges and empower individuals to do daily tasks independently. A stick can act as a support system for blind individuals by helping them navigate while they walk or work.The Voice module which is placed in the smart stick gets activated and produces a sound through speaker when any obstacle/stair, slippery area is detected.

LITERATURE SURVEY

[1] Krupal Jivrajani; Shobhit K. Patel; Chandrasinh Parmar; Jaymit Surve, Kawsar Ahmed; Francis M. Bui; Fahad Ahmed Al-Zahrani. A IOT-Based Smart Stick for Visually Impaired Person, IEEE, 2023.In this proposed system visually impaired people are facing difficulties during day-to-day activities in terms of traveling and receiving accurate information from their surroundings People who are visually challenged must rely on others most of the time. The stick actually helps to detect the obstacles faced in day-to-day life.This project integrates various sensor technologies, such as ultrasonic sensors for detecting the obstacles, soil moisture sensor for detecting the slippery areas,

LDR sensor for light assurance during night times and colour detecting sensor for the detecting the currency. All these sensors alerts the user through voice module with help of a speaker.Furthermore, it also provides an opportunity for visually impaired people to move from one place to another without being assisted by others.

[2] Usman Masud; Tareq Saeed; Hunida M. Malaikah; Fezan Ul Islam; Ghulam Abbas.Smart Assistive System for Visually Impaired People Obstruction Avoidance Through Object Detection and Classification, IEEE, 2022. The Raspberry Pi 4B, camera, ultrasonic sensor, and Arduino mounted on the person's stick are all used in the suggested method.The suggested research identifies the barriers with a remarkably high degree of efficiency while requiring only basic computations for operation. Eventually, a prototype for the Blind Walking Stick was created, which could be utilized to assist the blind manually. Its goal is to provide answers to the issues that arise when employing blind people in daily life. The technology also employs safety precautions to keep them safe. This project aims to facilitate walking for all blind individuals wherever they choose. The purpose of the action was to facilitate travel for the blind. It is used to make moving easier and safer for blind people with impairments.

[3] Vanitha Kunta; Charitha Tuniki; U. Sairam. Multi-functional blind stick for Visually Impaired People, IEEE (Institute of Electrical and Electronics Engineers),2020. In the proposed system digital and analog pins of the Arduino are connected to these components via jumper wires. According to the suggested system, it runs on an input voltage between 9V and 12V and has the following properties. Audio and vibration alerts can be issued as needed to warn of impediments of various sizes. Users receive an alarm when they come into contact with moist or wet surfaces. The GPS Module and GSM Module are functional and are able to send messages and give out accurate location of the user. Finally using the IR and the ultrasonic sensors and are able to detect the obstacles.

EXISTING METHOD

This blind stick's function is to serve as a specialized sensing tool for the visually impaired. The circuit keeps the power supply's output constant and supplies a 5V power supply for the circuit. Ultrasonic sensors are commonly utilized for object and stair detection. The suggested project initially employs ultrasonic sensors to use ultrasonic waves to identify stairs or other impediments up ahead. The circuit does nothing if the stair or obstruction is not that close. If the obstacle/stair is close enough the Arduino UNO sends a warning in the form of a sound. To determine the distance of an object/stair, calculate the distance between sending the signal and receiving back the signal. GSM module is used by the blind person to contact mobile numbers stored in the SIM card in case of any emergency. As any unforeseen condition occurs the emergency button can be pressed, which is connected to the top of the Stick. The blind person can send emergency messages or make an emergency call at risk, to his guardian through the GSM module.

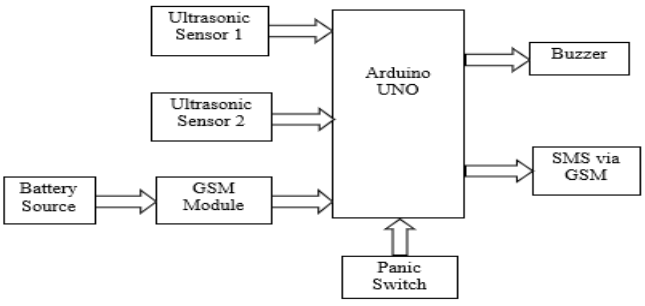

Figure1. Schematic Block diagram for existing model

PROPOSED METHOD

The work behind the blind stick is that it is used for special purposes as a sensing device for blind people. The circuit provides a 5V power supply for the circuit and maintains its output of the power supply at a constant level. Ultrasonic sensors are commonly utilized for object and stair detection. The

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suggested project initially employs ultrasonic sensors to use ultrasonic waves to identify stairs or other impediments up ahead. The circuit does nothing if the stair or obstruction is not that close.

If the obstacle/stair is close enough the Arduino UNO sends a warning in the form of a voice through speaker saying that ”Be careful !Obstacle is detected”. If any slippery area is identified, then it alerts the users through a voice command saying “Alert! Slippery area is identified”. Besides this, it also consists of Color detecting sensor which helps the blind people to identify different currency notes. When a currency note is placed near the sensor, it gives the output through the voice module with the help of a speaker. Sayings like "It's a 50 rupee note," "It's a 100 rupee note”,etc. It serves a specific function as a blind person's sensing equipment. The circuit keeps the power supply's output constant and supplies a 5V power supply for the circuit. Ultrasonic sensors are commonly utilized for object and stair detection. The suggested project initially employs ultrasonic sensors to use ultrasonic waves to identify stairs or other impediments up ahead. The circuit does nothing if the stair or obstruction is not that close.

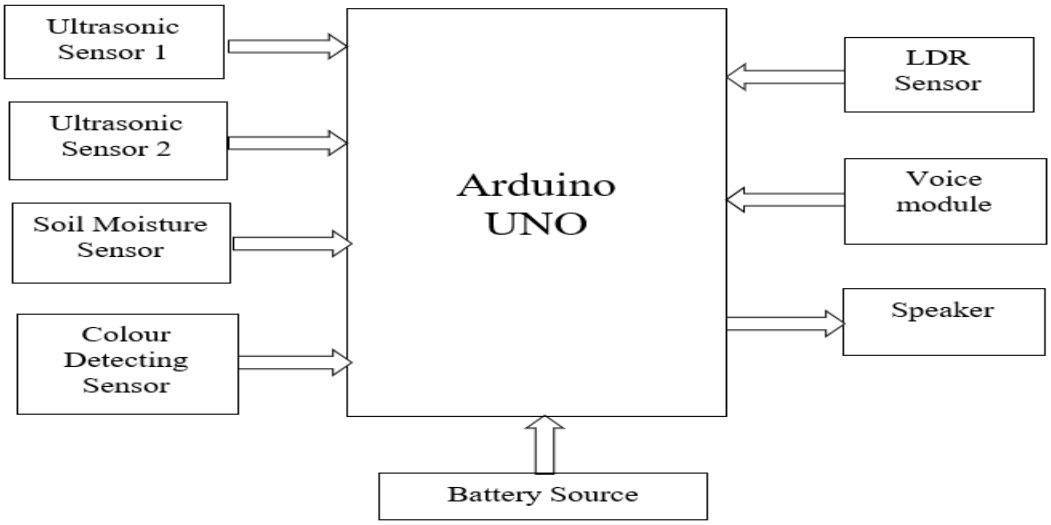

Figure 2. Schematic Block diagram for proposed model

Arduino UNO

The Arduino Uno uses the Microchip ATmega328P microcontroller as its core component. It can be interfaced with a variety of expansion boards (shields) and other circuits by means of digital and analog input/output (I/O) pins. It is a physical board that can be programmed (often called a microcontroller) and includes a software interface, called an IDE (Integrated Development Environment), which allows you to upload software code to the board using the USB cable. An external 9-volt battery or a USB cable can power it, but it accepts voltages between 7 and 20 volts.

Ultrasonic sensor

Ultrasonic sensors measure distances between themselves and objects using ultrasonic sound waves. Ultrasonic sensors measure proximity by sending and receiving ultrasonic pulses sent from a transducer. Sound waves that travel at high frequencies are reflected by surfaces to produce a unique echo pattern. A sound wave is sent out by an ultrasonic sensor at a frequency that is higher than that of human hearing. To receive and send ultrasonic sounds, the sensor's transducer acts as a microphone. Time lapses between the sending and receiving of ultrasonic pulses determine the distance between a sensor and a target. In order to detect obstacles or objects, an ultrasonic pulse is sent out at 40kHz and bounced back if there is an obstacle in the way.

Soil Moisture Sensor

A soil moisture sensor is a device that measures the volumetric water content in soil. This device is critical in a variety of applications, including agriculture, irrigation management, environmental monitoring, and research, as it enables more effective water use and a better understanding of soil

health and plant development conditions. A soil moisture sensor coupled into a blind stick project can help visually impaired people detect wetness on surfaces, improving safety and mobility in a variety of settings. A soil moisture sensor normally operates on the basis of electrical conductivity. It uses two probes to send a current through the soil (or any other media it comes into touch with) and then measures the resistance to that current. The presence of water reduces resistance since it conducts electricity.

Color Detecting Sensor

A color detection sensor for a blind stick project designed to detect cash notes would most likely include a sensor capable of recognising different colors and transferring that information into actionable feedback for the user. The color detection sensor for the blind stick project is intended to identify and distinguish between various cash notes based on their varied colors. It uses powerful color recognition technology to interpret the colors of various currencies. When the sensor detects a currency note, it offers the user with feedback in the form of aural or tactile signals, allowing them to easily identify and distinguish between denominations.

LDR Sensor

An LDR (Light Dependent Resistor), often known as a photo resistor, is a type of resistor whose resistance changes based on how much light falls on its surface. The resistance lowers as the light intensity increases, and increases as the light intensity drops. This feature makes LDRs helpful in light sensing circuits, which are commonly used in devices such as night lights, outdoor clocks, street lighting, and many sorts of sensors that respond to the presence or absence of light. The LDR is typically made of a high-resistance semiconductor material that absorbs photons. Depending on the number and energy of the absorbed photons, more or fewer charge carriers are released in the material, lowering its resistance. The most popular type of LDR is a cadmium sulphide (CdS) photocell, which detects visible light but has a slower response time than other light-sensing technologies.

Battery

Typically, electric batteries consist of electrochemical cells connected to external connections for the purpose of powering electrical devices. Positive terminals of a battery are cathodes, while negative terminals are anodes. Electrons flow from the negative terminal to the positive terminal through an external electric circuit. The free-energy difference generated by the redox reaction between the reactants and products of a battery is then delivered to the external circuit as electrical energy when the battery is connected to an external electric load.

Voice module

A voice module is an electronic component or system designed to add audio playback and voice recognition capabilities to devices. It typically includes a microcontroller, sound processing circuitry, and memory for storing audio files. These modules can be used in various applications, including toys, home automation systems, interactive kiosks, and consumer electronics, enabling them to respond to voice commands or provide auditory feedback to users. Some voice modules offer features like text-to-speech, speech-to-text conversion, and connectivity options like Bluetooth or Wi-Fi for extended functionality.

Speaker

Speakers are the type of transducers by use electromagnetic waves that convert electromagnetic waves into sound waves. It is used to connect to a computer system which creates a sound that is considered an output part of computer systems. here the user may give an audio input to the systems which is either in analog or digital form to create analog electromagnetic waves (analog speaker) to give sound waves as an output.

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IMPLEMENTATION

Figure 3. Smart Blind Stick

RESULT ANALYSIS

By using the proposed system, the obstacles and stairs are detected. In order to evaluate the proposed method's performance, experiments were conducted. Here we are present a traveling aid that will make everyday life easier for the visually impaired. It has already been mentioned that sensor circuits provide information about the environment. The Voice module alerts the user with the help of a speaker when the person is in an emergency.

Figure 4. Obstacle Detection using Smart Blind stick

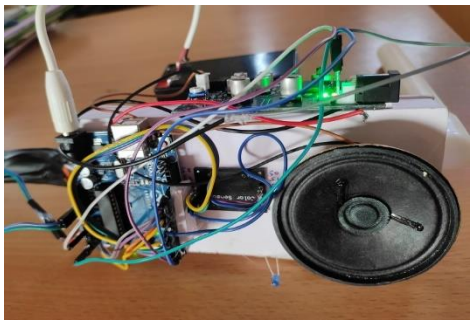

Figure 5. Currency Detection using Color Sensor

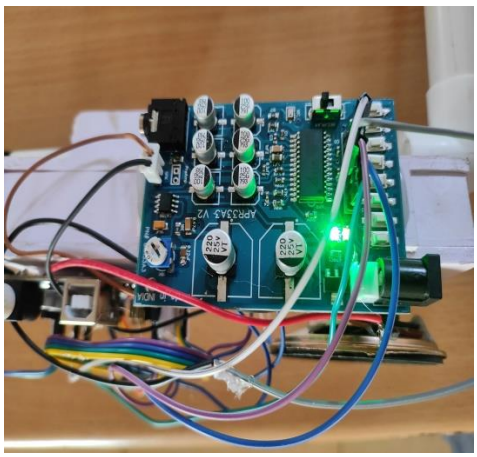

Figure 6. Voice module alerting a Blind person

CONCLUSION

In this paper, The proposed system presents an electronic subsystem for obstacle detection. This system will assist visually impaired people by avoiding obstacles/stairs in their way, to lead a life like other normal people in the world. The Smart Stick for Blind is able to detect obstacles in front of the user. Additionally it also detects the slippery areas infront of the user, automatically led gets ON through LDR in darker areas and it distinguishes different currency notes with the help of colour detecting sensor. Here the voice module alerts the user with the help of a speaker when the person is in an emergency. It is therefore capable of guiding a visually impaired person in navigating his environment. This reduces human effort and it provides an opportunity for visually impaired people to move from one place to another without being assisted by others. Therefore, the smart stick is user-friendly, has quick response, has very low power consumption and it is easy to hold by the user.

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