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Intelligent Walking Stick for Blind People Using Arduino

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ABSTRACT
Nowadays the blind and impaired people are suffering a lot because there are so many struggles for blind peoples to reach their destination and also there are dangerous risks that blind persons must face. To avoid uncomfortable walking experience, we have designed a smart electronic walking stick for blind people. Our paper proposes a low-cost walking stick based on latest technology and a new implementation are made for efficient interface for blind people. Basically, the ultrasonic sensor is implemented in the walking stick for detecting the obstacles in front of the blind/impaired persons. If there are any obstacles, it will alert the blind person to avoid that obstacles and the alert in the form of voice module daily in different aspects in order to provide flexible and safe movement for the people. Using this blind stick , a person can walk more confidently. The another LDR sensor are used in the stick to identify the day and night for the blind people. The microcontroller (Arduino Uno R3) to receive the sensor signals and process them to short pulses to the Arduino pins where voice module is connected. This device will be best solution to overcome their difficulties and help them to live the better life**.**
Keywords: Smart Stick, Arduino Uno, Ultra Sonic Sensors LDR Sensor, Buzzer(Voice Module)

I.   INTRODUCTION

Visually impaired persons have difficulty to interact and feel their environment. They have little contact with surroundings. Physical movement is a challenge for visually impaired persons, because it can become tricky to distinguish obstacles appearing in front of them, and they are not able to move from one place to another. They depend on their families for mobility and financial support. Over the last decades, research has been conducted for new devices to design a good and reliable system for visually impaired persons to detect obstacles and warn them at danger places. Smart walking stick is specially designed to detect obstacles which may help the blind to move safety. The alarm will keep the user alert and considerably reduce accidents. This system presents a concept to provide a smart electronic aid for blind people, both in public and private space. The proposed system contains the Ultrasonic sensor, LDR, and Buzzer. The Stick measures the distance between the objects and smart walking stick by using an ultrasonic sensor. When any objects or obstacles come in range of an ultrasonic sensor then the buzzer will alarm the user. The smart walking stick is a simple and purely mechanical device to detect the obstacles on the ground. This device is light in weight and portable. But its range is limited due to its own size. It provides the best travel aid for the person. The blind person can move from one place to another independently without the others help. The main aim of the system is to provide a best environment for the blind persons which gives a sense of vision by providing the information about their surroundings and objects around them.

Our proposed project first uses ultrasonic sensor to detect obstacles without touching it using ultrasonic waves. On sensing obstacles the sensor passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough. If the obstacle is far the circuit does nothing but If the obstacle is close the microcontroller sends a signal to sound a buzzer. Ultrasonic sensor is used to detect any obstacle in front of blind person.

It has Detection Distance of 2cm-450cm so whenever there is some obstacle in this range it will alert the blind person. One more feature is that it allows the blind person to detect if there is light or darkness in the room. The darkness and light can be detect by using the LDR sensor. An LDR or light dependent resistor is also known as photo resistor, photocell, photoconductor. It is a one type of resistor whose resistance varies depending on the amount of light falling on its surface.

In this technology controlled world, where people strive to live independently, this project proposes an ultrasonic stick for blind people to help them gain personal independence. Since this is economical and not bulky, one can make use of it easily.

II. LITERATURE SURVEY

In[1], Intelligent device is represented for visually challenged people to guide them to reach their destination place safely without facing any difficulties. It consists of Raspberry Pi and PIC as the controller, Global Positioning System (GPS) along with sensors like Ultrasonic and other supportive sensors and an Android-based Application (APP). In[2], White stick with the ultrasonic sensor, IR sensor and various other equipped technologies (Arduino IC, sensors etc.) is the boon for blind people. The application of ultrasonic ranging scheme along with location tracing (GPS Module) for producing electronic walking stick with improved features for the blinds is a technological advancement. In[3], Deals with an innovative design of Intelligent White-Cane that is capable of tracking and signal receptor services. A model of smart white-cane has been designed at our end whereby its smartness has extra unique features such as Navigation system to better guide family members of blind one to be known for his location. In[4], Present a novel low-cost yet durable and accurate smart stick to assist visually impaired people while they walk in indoor/outdoor unstructured environments. There is a large group of people who have difficulties in their daily routine work due to losing their eyesight. Walking with confidence is one of them which may have different challenges in different environments. In[5], A stick guide model represented for visually impaired person to guide in their way, which consist of a Global Positioning System(GPS) and a Global System for Mobile Communication(GSM) modules along with sensors like Ultrasonic and Infrared sensor.

Over the last decades, research has been conducted for new devices to design a good and reliable system for visually impaired persons to detect obstacles and warn them at danger places. There are some systems which has some deficiencies. A Navbelt was developed by Shovalet. al [6], an obstacle avoidance wearable portable computer which is only for indoor navigation. Navbelt was equipped with two modes, in the first one the system information was translated to audio in different sounds. One sound for free for travel direction and other for blocked, it was difficult for the person to differentiate the sounds.

III. SYSTEM DESIGN
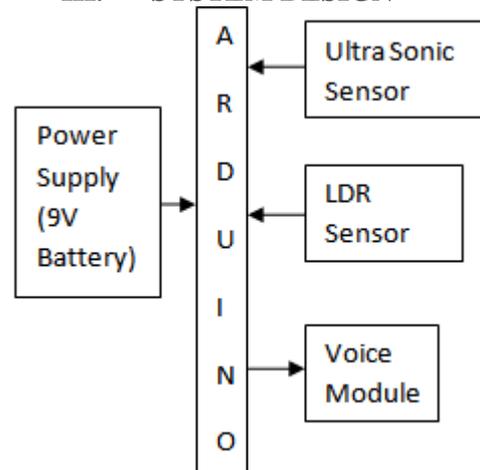
Fig 1. System Architecture

The usage of smart blind stick is used to help the blind people. The stick help the blind people to interact with the physical world like a normal people and they don't need to depend on other.

The above figure shows the Arduino UNO microcontroller are connected to the 9V battery, voice module, ultrasonic sensor and LDR sensor. The connection were made by using the jumper wires.

The hardware requirements:-
* Ardunio UNO (Micro Controller)
* Battery(9V)
* Buzzer(Voice Module)
* Jumper Wires
* Ultrasonic Sensor HC-SR04
* LDR Sensor

The software requirements:-
* Arduino IDE
* Programming Language: C/C++

A. Ultrasonic sensors

Ultrasonic sensors are used in pair as transceivers. One device which emits sound waves is called as transmitter and other who receives echo is known as receiver. These sensors work on a principle similar to radar or sonar which detects the object with the help of echoes from sound waves. This detect the object and alarm to warn the blind people.

Fig 2. UltraSonic Sensor model

B. LDR Sensor

In order to detect the intensity of light or darkness, we use a sensor called an LDR (light dependent resistor). The LDR is a special type of resistor that allows higher voltages to pass through it (low resistance) whenever there is a high intensity of light, and passes a low voltage (high resistance) whenever it is dark. It is connected to the Arduino and in darkness it make alarm to help the blind to know the day and night.
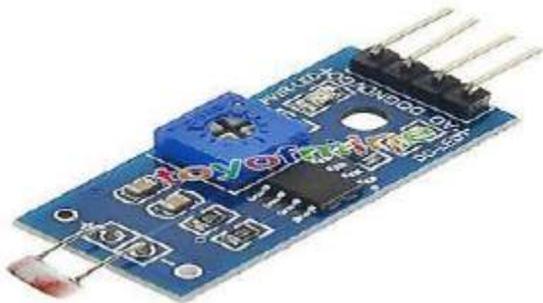
Fig 3. LDR Sensor Model

IV. WORKING PROCESS

The Arduino is coded using Arduino IDE software. Based on the function of the Arduino the program was logically coded in the Arduino IDE software and checked for the errors. If there is any error it will be displayed in the message box. After removing the errors, the sketch can be compiled and run successfully. Finally, the sketch is uploaded into the Arduino controller through USB serial interface.

We here propose an advanced blind stick that allows visually challenged people to navigate with ease using advanced technology. The blind stick is integrated with ultrasonic sensor along with light sensing. Our proposed project first uses ultrasonic sensors to detect obstacles ahead using ultrasonic waves. On sensing obstacles the sensor passes this data to the arduino Uno. The arduino uno then processes this data and calculates if the obstacle is close enough. If the obstacle is not that close the circuit does nothing. If the obstacle is

close the arduino Uno sends a warning in the form of voice. It also detects and sounds that object is detected to alert the blind. If the obstacle is close the arduino uno sends a warning through voice message. Light detection is done by LDR sensor. One more feature is that it allows the blind to detect if there is light or darkness in the room. If the LDR sensors does not receive light rays it alerts the blind person using the speaker. The alert message is you are entering into dark region.

In this project , Arduino is stated as the heart of the project.

Fig 4. Arduino with battery

V. CONCLUSION

Blind people face lot of difficulties while travelling from one place to another. With the intention to help the blind, their difficulties, the smart blind stick is proposed. The system consists of an LDR sensor to detect day and night and ultrasonic sensor to obstacle detection. The proposed system takes the blind person to reach the destination without any struggle in their path. The voice module were used to make sound with comment to warn them. After testing, the system proposed in this paper helps users walk in a relatively safe environment reliably, such as indoors, parks, and schools.

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