

Smart Blind Walking Stick using Arduino

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While such systems are suitable for outdoor navigation, due to the need for a line of sight access to satellites, they still need additional components to improve on the resolution and proximity detection to prevent collision of the blind persons with other objects. In this system, the walking stick is an alternative to the traditional walking stick. Here, Arduino MEGA 2560, ultrasonic sensor, IR sensor and voltage regulator are used. The ultrasonic sensor is used to detect the object in the front of the person by measuring the distance between the object and the stick for left and right object detection, IR sensor is used which is very small in range. So it detects the objects which are very close.

II. Working Principle

The main part of the system is the microcontroller that controls the other components in the system. When the ultrasonic sensors detect any objects or obstacle in the 180-degree path it will activate the buzzer and vibrate the motor.

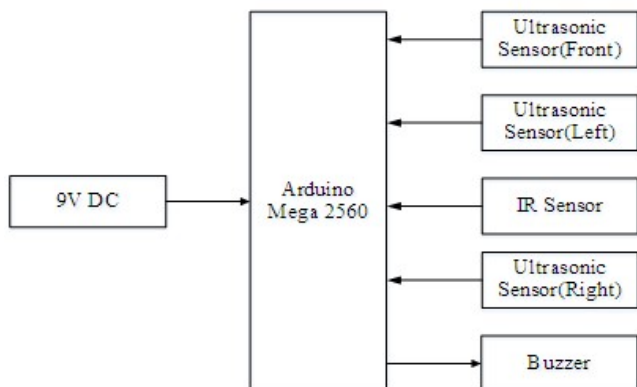


Figure1. Block Diagram of Smart Blind Walking Stick

ABSTRACT

This system is based on sensors and microcontroller. The features are to detect the obstacle for collision avoidance and it detects the object in directions left, right, down and front. The system is composed of the ultrasonic sensor, IR sensor and Arduino Mega 2560. It has a low cost and lightweight system design. By using these three items, it senses the distance with sensors and the blind stick frame is designed. And then send distance data to Arduino mega2560 controller. In emergency situations, the blind walker knows the distance or safe area for themselves.

KEYWORDS: Arduino Mega, Sensors, Motor

I. INTRODUCTION

Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. The traditional and oldest mobility aids for persons with visual impairments are the walking cane and guide dogs. The most important drawbacks of these aids are necessary skills and training phase, range of motion and very little information conveyed. With the rapid advances of modern technology, both in hardware and software front have brought potential to provide intelligent navigation capabilities. Recently there has been a lot of Electronic Travel Aids, ETA designed and devised to help the blind navigate independently and safely. Also high-end technological solutions have been introduced recently to help a blind person navigate independently.

III. Hardware Implementation

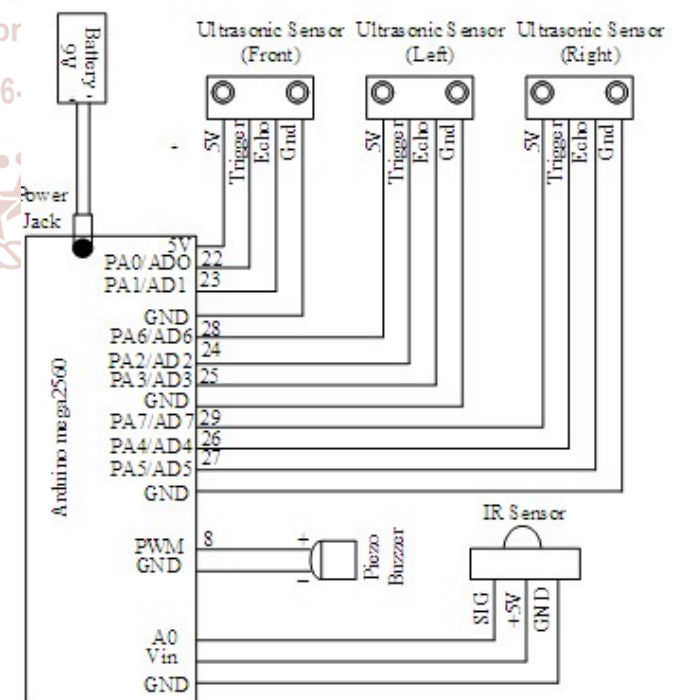


Figure2. Circuit Diagram for Smart Blind Walking Stick

A smart blind walking stick is made up with Arduino mega 2560, ultrasonic sensors and IR sensor. The core part of the system is microcontroller Arduino mega 2560. Most of the coding system is designed in the Arduino. Arduino IDE software and C programming language is used to run the whole system of the walking stick.HC-SR04 ultrasonic sensor

is used because it is not affected by color or transparency objects. The transmitter emits 8 bursts of a directional 40kHz ultrasonic wave when triggered and starts a timer. Ultrasonic pulses travel outward until they encounter an object, it causes the wave to be reflected back the unit. The ultrasonic receiver would detect the reflected wave and stop the stop timer. After calculating the distance, the information will send to the Arduino and then, the buzzer produces the voice. IR sensor is used to sense small obstacles, pits, staircase and gloves. GP2Y0A710K0F is a distance measuring sensor unit, its maximum measuring range is within 4cm and 30cm. It is composed of an integrated combination of PSD position-sensitive detector, IR-LED infrared emitting diode and signal processing circuit. In this system, the distance is greater than 20 cm between the object and the stick, the information is sent from the sensor to the Arduino board. The operation of the smart blind stick system is composed of three ultrasonic sensors, one IR range sensor and Arduino mega 2560. The three ultrasonic sensors sense the three directional distance and send distance data to Arduino mega. The IR range sensor sense the distance of the high of the blind stick and send data to Arduino mega. The Arduino Mega is calculated the receive distance for the safe zone of the blind walker. If the emergency situation, the out of safe zone area, the Arduino mega set the buzzer for an alarm system for the blind walker to safe.

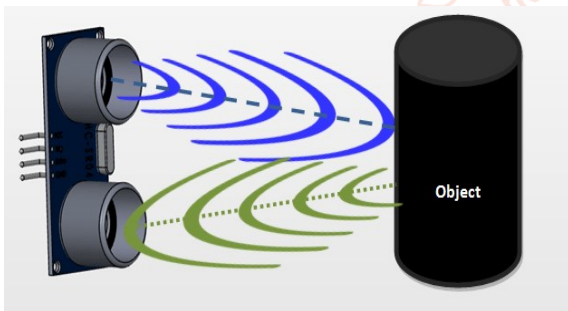


Figure3. Working Principle of Ultrasonic Sensor

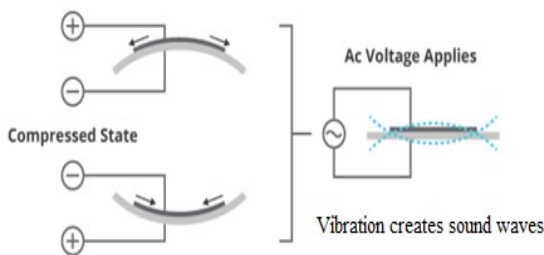


Figure4. Working Principle of Piezo Buzzers

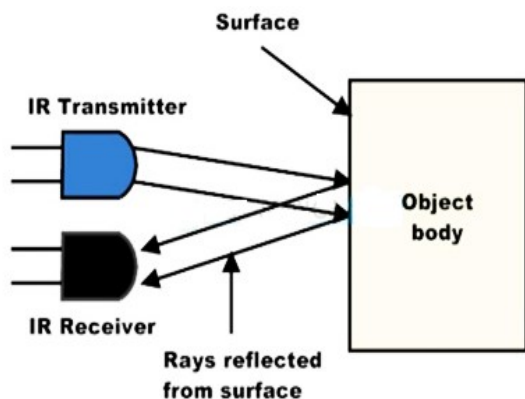


Figure5. Working Principle of the IR Sensor

IV. The System Operation

First, power is supplied to Arduino Mega2560 by 9V battery. And ports are initialized. And then ultrasonic sensor (front) is sensed the object between 2cm and 30cm. If the object is discovered less than 30 cm, the buzzer will start alarm with delay 1 second. If the object is not discovered, the left ultrasonic sensor is sensed. If the object is discovered less than 30 cm, the buzzer will start alarm with delay 1.5 seconds. If the object is not discovered, the right ultrasonic sensor is sensed. If the object is discovered less than 30 cm, the buzzer will start alarm with delay 1.9 seconds. If the object is not discovered, the IR sensor is sensed. If the object is discovered greater than 20 cm, the buzzer will start alarm. If the object is not discovered by the IR sensor, the system will start automatically. Figure.6 is the flow chart of Smart Blind Walking Stick System.

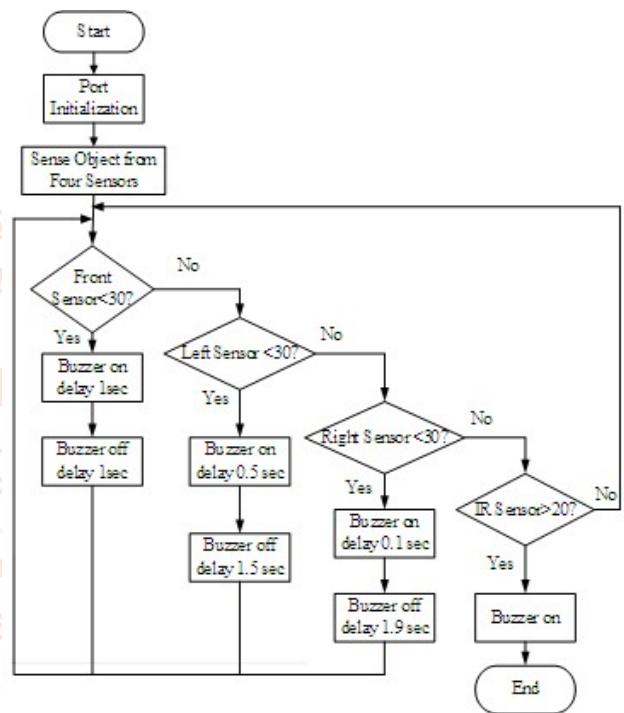


Figure6. Flow Chart of Smart Blind Walking Stick

V. System Design

A smart blind walking stick is made up with Arduino Mega2560, ultrasonic sensor, IR sensor, buzzer and 9V battery. The core part of the control system is the Arduino Mega2560. Most of the coding system is designed in the Arduino based on the ATMEGA 2560. C programming language and Arduino IDE software are used to run the whole system of a smart blind walking stick.



Figure7. Frame of the Stick

In this system, ultrasonic sensors and IR sensor are used to read the distance information. Here, the user has used the HC-SR04 ultrasonic sensor because it is not affected by color or transparency objects. The transmitter emits 8 bursts of a directional 40kHz ultrasonic wave when triggered and starts a timer. IR sensor is used to sense small obstacles, pits, staircase and gloves. GP2Y0A710K0F is a distance measuring sensor unit, its maximum measuring range is within 4cm and 30cm. It is composed of an integrated combination of PSD position-sensitive detector, IR-LED infrared emitting diode and signal processing circuit.

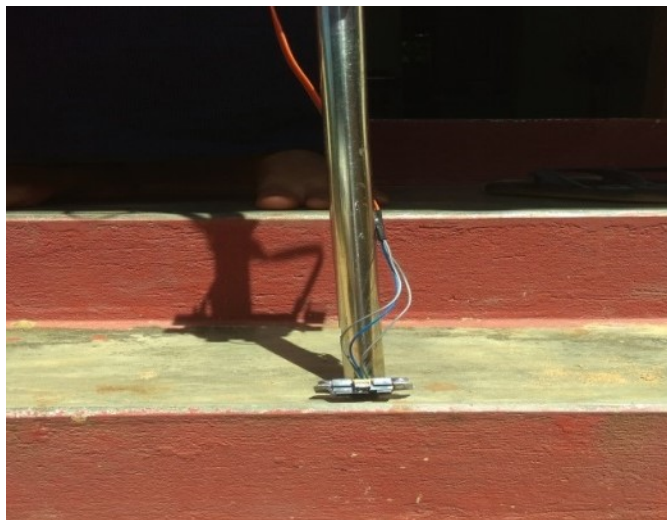


Figure 8. Working Principle of IR Sensor

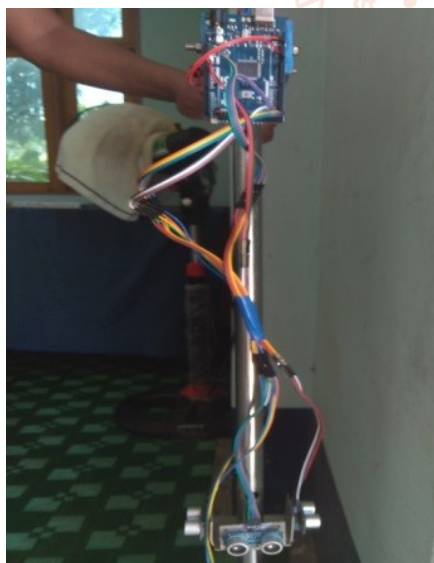


Figure 9. Working Principle of Left Ultrasonic Sensor

The variety of the reflectivity of the object, the environmental temperature and the operation duration are not influenced easily to distance detection because of adopting the triangulation method. In this system, the distance is less than 20 cm between the object and the stick, the information is sent from the sensor to the Arduino board and then, the buzzer produces the voice. When the object is discovered in front of the ultrasonic sensor (left), the buzzer alarm will start with delay 0.5s. When the object is discovered in front of the ultrasonic sensor (front), the buzzer alarm will start with delay 1s. When the object is discovered in front of the ultrasonic sensor (right), the buzzer alarm will start with delay 0.1s. When the staircase is discovered in front of the IR sensor, the buzzer alarm will start.

Discussions

The user gets the benefits for this system. This system is an automatic system that uses ultrasonic sensors to be detecting obstacles in front, left and right by an Arduino Mega2560. Adding security features for the disabled. Facilitate people with disabilities to move freely. This system will operate to help all of the blind people in the world to make them easier to walk everywhere they want. This system was done to help the blind to move in front very well. This smart blind walking stick by using technology system is successfully achieving the objective. That can detect objects or obstacles in front of users and feeds warning back, in the forms of voice messages and buzzer to users. This system is to people with disabilities that are blind to facilitate the movement and increase safety. If this system is used in the real-time condition, there are many benefits. The following benefits are some of this system:

- Time-saving
- Gained personal independence
- Save fuel
- Reduced number of accidents
- Environmental Aspects
- Can be used both indoor and outdoor navigation
- Detects obstacles and alerts the blind person through the buzzer

VI. Conclusion

The system is a new concept of a smart blind walking stick for blind people. The advantage of the system lies in the fact that it can prove to be a very low-cost solution to millions of blind person worldwide. The main purpose of this study is to produce a prototype that can detect objects or obstacles in front of users and feeds warning back, in the forms of voice messages to users. Combination of ultrasonic sensors and IR sensor and Arduino function for detection and distance stick and obstacles in front of. The smart blind walking stick is successfully designed consistent with all the objectives achieved. One of the most important difficulties faced by the visually challenged person is constraints in independent mobility and navigation. They primarily the white stick as mobility aid allowing them to detect close by obstacles on the ground. The detection of objects above knee height is almost impossible and is a major hindrance for them. Developments in embedded systems have opened up a vast area of research and development for affordable and portable assistive devices for the physically challenged. This system aimed at the design and implementation of a detachable unit which acts augment the functionality of the existing cane, to allow knee-above obstacle detection. This unit consists of an ultrasonic sensor and IR sensor controlled by Arduino Mega2560. The distance information is conveyed to the user through non-interfering multi-frequency vibratory stimuli, the frequency of vibration indicating the proximity of obstacles. This unit is also capable of detecting fast-moving obstacles. A lot of effort has been put in the electromechanical design of this unit conveying the voice effectively and ensuring that it is easily attachable on the existing stick without sighted assistance. A crucial design optimization goal has cost the unit has been developed as a low-cost device which is affordable by the poor in developing countries.

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