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Smart Ultra-Sonic Blind Stick

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Abstract: In the Blind Worldwide, still the visually challenged persons are facing lots of problem when they are walking in their daily life. They require proper indication to detect any obstacles in front of their walking path. The followed project is designed to guide a visually challenged person to walk and avoid bumping into obstacles. Low cost ultrasonic rangefinders along with a microcontroller is used to measure the distance of any obstacles and if they are close enough provide a feedback to the user in form of beeps or vibrations. The "Ultrasonic Blind Stick" device is the best solution. The main component used for this device is the ultrasonic sensor.

Keywords: Ultra-Sonic blind stick, smart blind stick, Intelligent Navigation Device.

Introduction

There are several numbers of people around us which are visually impaired, and among them millions of people are blind and there are thousands of people those who are irreversibly blind. For visually impaired people, performing daily activities is a difficult task since vision plays a central role in almost every activity of ours. The visually impaired person has to rely on their memory to find their belongings and may become irritated if someone replaced the object or it falls down occasionally. It is not possible to search an object in an unknown place or surroundings without having the eye sight. Many blind people face the real scenario when they injure in different way due to not getting any indication of the obstacles in front of them. So, by this project try to improve the better mobility of the blind persons. The main objective of this project is to design a walking stick which is very much useful for those people who are visually impaired and are often need help from others. It allows the user to walk freely and independently by detecting the obstacles. The obstacles can be detected by using various techniques. Low cost ultrasonic rangefinders along with a microcontroller is used to measure the distance to obstacles and if they are close enough provide a feedback to the user in form of beeps or vibrations. The blind stick is integrated with ultrasonic sensor. Basic working principle of ultrasonic sensor is to detect any kind of obstacles in front of the sensor. After detecting the obstacles the sensor communicate with the microcontroller. Then the microcontroller responses and analyze the data whether the obstacles close or not. If any obstacle comes to close to a blind person the he will analyze it by hearing the sound. The smart ultrasonic Blind stick is very simple and user friendly device to resolve the problem of blind person to detect any obstacles in front of him. It is low cost and smaller weight device as well as it is very helpful as a traveling aids. The blind can move from one place to another independently without the others help. The main aim of the system is to provide an efficient navigation aids for the blind persons who give a sense of vision by providing the information about their surroundings and objects around them

Components Required

To make this project we used different components among which the following components are the major part of this project. In this paper we discussed about the basics of the major parts following:

(A) Atmega 328 P-Pu Microcontroller

The ATMEGA328-PU is a low power CMOS 8 bit microcontroller based on the AVR enhanced RISC archi-

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tecture. By executing powerful instructions in a single clock cycle, the ATMEGA328-PU achieves throughputs approaching 1MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

Features:

- 28-pin AVR Microcontroller
- Flash Program Memory: 32 KB
- EEPROM Data Memory: 1 KB
- SRAM Data Memory: 2 KB

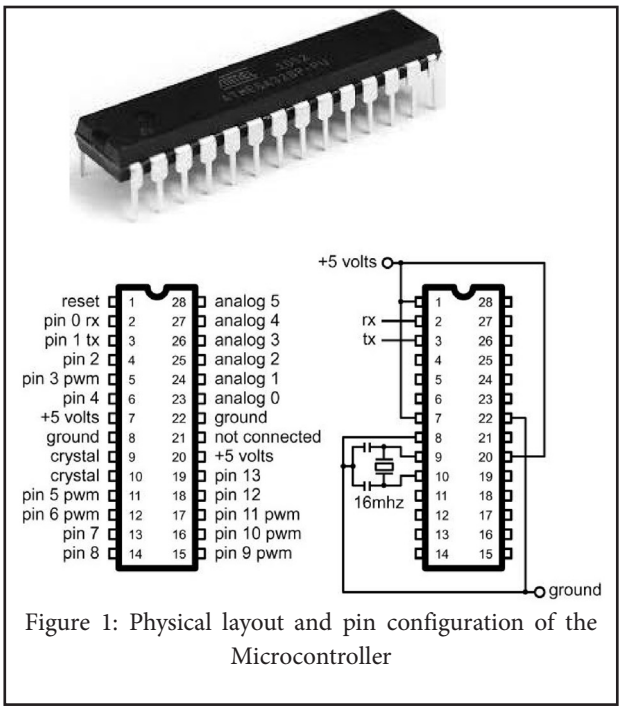

Figure 1: Physical layout and pin configuration of the Microcontroller

- I/O Pins: 23
- Timers: Two 8-bit / One 16-bit
- A/D Converter: 10-bit Six Channel
- PWM: Six Channels
- RTC: Yes with Separate Oscillator
- MSSP: SPI and I^2C Master and Slave Support
- External Oscillator: up to 16 MHz

(B) Hc-Sr 04 Ultrasonic Sensour

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non- contact range detection with high accuracy and stable readings in an easy-to-use package from 2cm to 400 cm. Its operation is not affected by sunlight or black material like Sharp rangefinders are (although acoustically soft materials like cloth can be difficult to detect). It comes complete with ultrasonic transmitter and receiver module. This Ultrasonic Module has 4 pins, Ground, VCC, Trigger and Echo.

Features:

- Power Supply :+5V DC
- Quiescent Current : <2mA
- Working Current: 15mA
- Effectual Angle: <15°
- Ranging Distance : 2cm – 400 cm
- Resolution : 0.3 cm
- Measuring Angle: 30 degree
- Trigger Input Pulse width: 10uS
- Dimension: 45mm x 20mm x 15mm

Figure 2: Pin diagram (Physical layout) of an ultrasonic

Sensor

The sensor is a kind of transducer. It emits the sound wave in the environment and after striking of an object the wave reflects back to the receiver. After getting the sound wave it converts the sound wave into the electrical signal. By analyzing the electrical pulse the microcontroller can calculate the distance of the obstacle by using the following technique.

Time = Width of Echo pulse, in μS (micro second) Distance = (Speed * Time) / 2

Where, Speed of sound = 340m/s

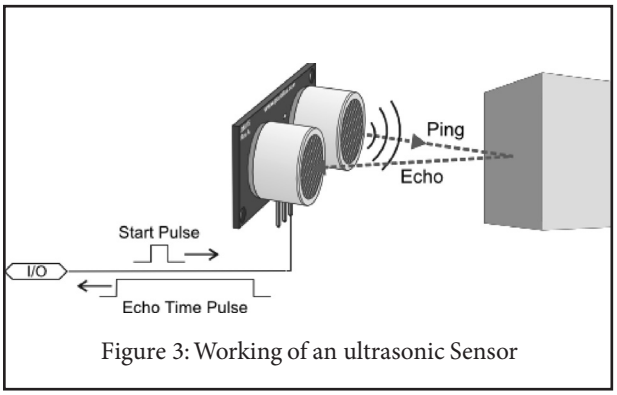

Figure 3: Working of an ultrasonic Sensor

(C) PCB Board

PCB Stands for "Printed Circuit Board". A PCB is a thin board made of fiberglass, composite epoxy, or other laminate material. Conductive pathways are etched or "printed" onto board, connecting different components on the PCB, such as transistors, resistors, and integrated circuits.

Figure 4: Physical layout of PCB

(D) ZZER

A buzzer is an electrical device that is used to make a buzzing sound for example, to attract someone's attention. A buzzer may be a mechanical, electromechanical, magnetic, electromagnetic, electro-acoustic or piezoelectric audio signaling device. A piezo electric buzzer can be driven by an oscillating electronic circuit or other audio signal source. A beep or ring can indicate that a button has been pressed.

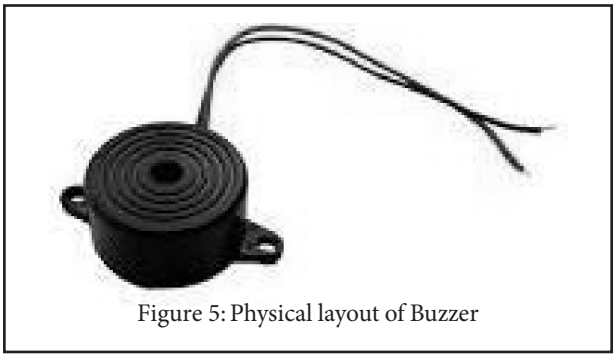

Figure 5: Physical layout of Buzzer

Circuit Design and Operation

To design the circuit basic power supply path and its oscillator circuit are used to perform the microcontroller. For this pin 7 & 20 are connected to +VCC and pin 8 & 22 are connected to GND. The microcontroller need an operating frequency to perform a program which is 16MHz and it is provided by the crystal oscillator. The crystal oscillator is connected with two ceramic capacitor for resonance. And both are connected to pin 9 &10. Another ends of the capacitors are to be grounded (GND). The Pin no 01(reset pin) is connected with a SPST push button switch and it will be connected with +VCC. I/O interface is the main part of this circuit schematic. In this project ultra-sonic sensor works as an input peripheral device. It has 4 pins which are pin 1 as +VCC, pin 2 as ECHO, pin 3 as TRIGGER, and pin4 asGND.

The pin 1 of the u-sonic is connected to the +VCC, the pin 2 is connected to the IC pin14 (which is Digital pin 8) of the microcontroller. The pin 3 of the U-sonic sensor is connected to the IC pin 15(which is the Digital pin 9) of the microcontroller. (Both pins are to be declared according to the software program of this system). And the pin-4 of the sensor is connected to the GND.

In this circuit we are using "Buzzer" as an output device of the system. The buzzer has two pin (one is +VCC & GND). The +VCC is connected to the pin 12 of the IC (which is the Digital pin PWM 6) of the microcontroller.

This ultrasonic blind stick has a technology which is using ultrasonic echo wave. The ultrasonic sensor has one transmitter and one receiver, the transmitter is transmitted a sound wave and the transmitted wave is tricked and reflected back to the receiver. After receiving the reflecting wave the inbuilt circuit is generates a pulse, which is send to a microcontroller. After that the microcontroller receiving the pulse, it process the pulse signal and calculate the distance of the object. And when the distance of the object cross the target level then the controller send a signal to a buzzer then the buzzer will sound.

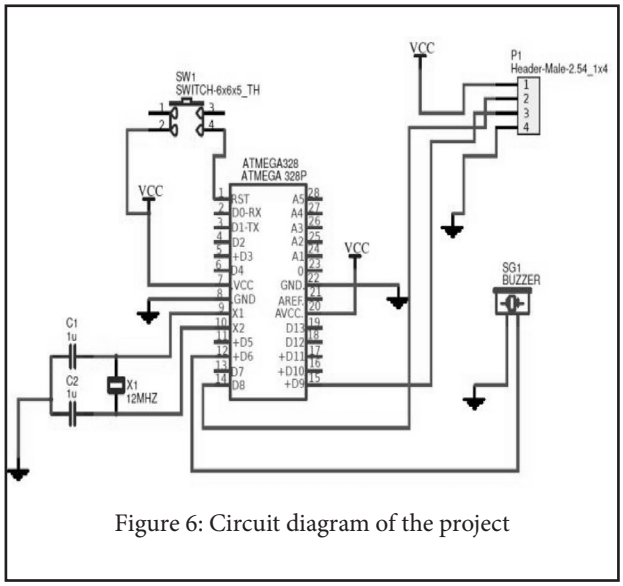

Figure 6: Circuit diagram of the project

Flowdiagram (As Per Coding)

In this program flow diagram we wanted to show, how this system software is build and how its work. So in this flow chat at first "START" it means the beginning of the program. "PORT SELLECT" this mean in this case we need to select some port address/ pins of microcontroller to initializing the peripheral components which would be attached during operation. "CALIBRETING SENSOUR" in this step we have to calibrating the sensor as per our requirement.

"IF <75 OR IF >75" this is the condition which is used to measure the distance between object and sensor.

In that case if the distance <75 then the buzzer will ring, and other case if the distance is >75 then the buzzer will not ring.

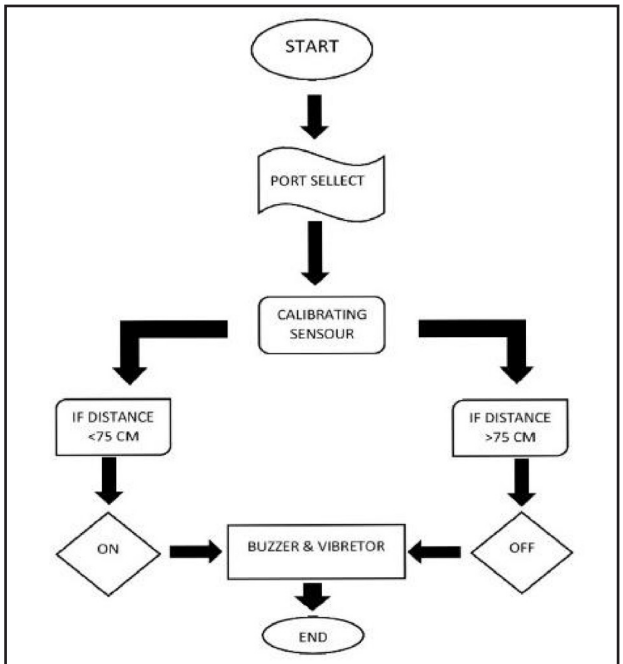

Figure 7: Flow chart diagram of the project

PCB Design

In this project we build up the PCB. After designing the PCB it is basically the error free of the connection and it is more sophisticated.

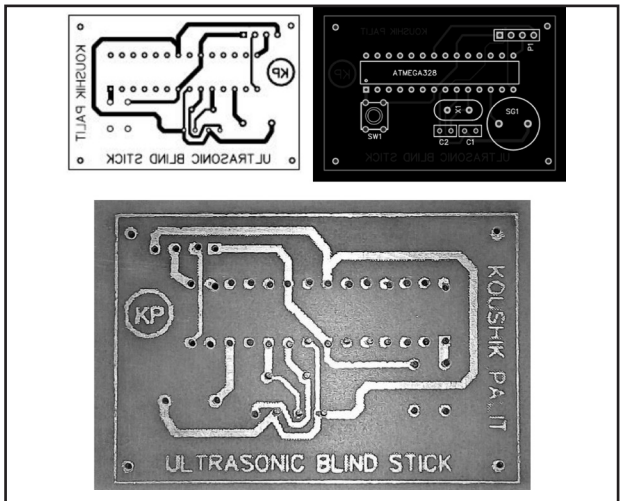

Figure 8: Main Printed circuit board of the project

Hardware Setup

After implementing the project few physical snap-shots are shown below:-

Figure 9: Physical snapshot of the system

Plication

The system aims to solve the problems faced by the blind people in their daily life. The system also takes measures to ensure their safety. The system can be used both indoor and outdoor navigation.

It detects the obstacles and alerts the blind person through sound as well as vibration alert.

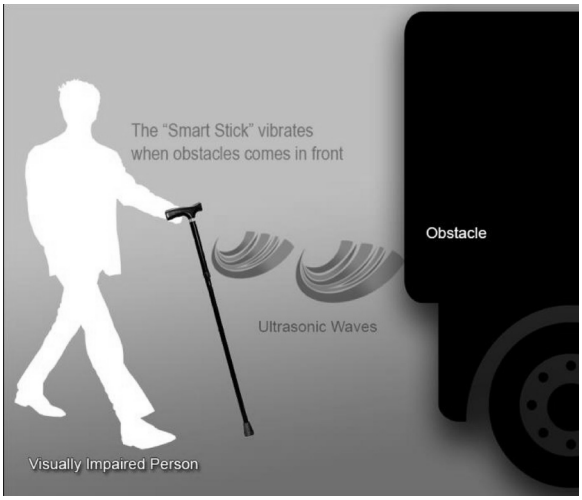

Figure 10: Real life scenario of the project

Conclusion

Now a day it is very challenging works to give a proper navigation to the blind persons. The Smart Ultrasonic Blind Stick is the exact replica for that. Basically it is an innovative idea & user-friendly device. With the help of an ultrasonic sensor by using this modern device one can achieve the goal in the real scenario of the blind World.

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