WALKING STICK FOR VISUALLY IMPAIRED

An Aid For Visually Impaired People

Abhishek Matlotia, Student, EED, BVCOE, Delhi, India abhi.matlotia@gmail.com
Ajay Kumar, Student, EED, BVCOE, Delhi, India ajaysahney007@gmail.com

Abstract

Walking stick is an innovative and helpful stick designed especially for visually disabled people, helping them becomes self sustained and connecting them to technology. The prime purpose is to alarm the visually disabled person, as and when any problem comes in the way. The indicators used are such that the blind person can easily get notified. The main features of the stick are obstacle detection, darkness and water detection and if the stick gets lost blind person can easily trace it too. The highlighting points of the walking sticks are its compactness, weight and cost. All the features of the stick are assembled and put together in such a way that the stick is very compact, rigid and easy to carry. The weight of the stick is fairly small and the overall stick is very economical. The stick has been tested in normal day-to-day environment and has shown good results.

1. INTRODUCTION

Cloud compThe walking stick would address the 15 million completely blind people in India and the 35 million completely blind people in the world. Blind people face a lot of difficulties in day to day life, especially if they are in a new and not so familiar environment. To make life less complicated for them, walking stick is an aid that would serve blind people by alarming them whenever there is any harmful environment around them. The stick will protect and alarm the blind person from any obstacle and water spills that comes in the way. Whenever the blind person enters a dark place, an indication would be given to other people in the affinity. This will allow the other person to help the blind person. In case, the blind person leaves is stick somewhere and is unable to find it, simple button pressing will allow the person to know the location of the stick. The stick has reflective tapes on it, this allows the drivers, driving at night to easily locate the blind person and accordingly take action. The height of the stick is such that it also protects the person from any potholes in the way. The stick is compact and light in weight allowing easy mobility. The rigidity of the stick will make the stick last long.

I. BASIC DESIGN

The stick is made from Polyvinylchloride (PVC) pipe. PVC has better tensile strength and tensile modulus than other general purpose plastics. Its tensile strength can range from 34 to 62 MPs, tensile modulus can range from 2.5 to 4.1 Giga N/m2 and its strength is such that it will not break even after applying repeated stress for 10 million times. PVC is also very robust and durable. Hence it has been used for making the basic structure of the stick.

The main parts of the stick can be broadly classified into 3 parts sensors, microcontroller and indicators. The sensor will detect any change in input values and give a signal to microcontroller. The microcontroller will than send a signal to indicator. This is the interlink between sensors, microcontroller and indicators. Block diagram to explain this is shown in fig. 1.
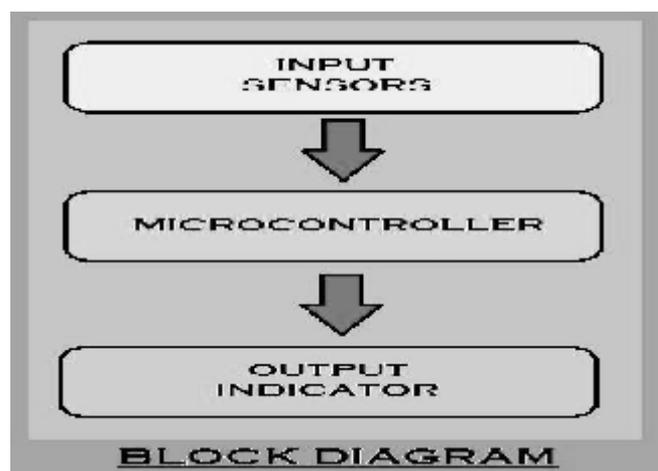

Fig.1 Basic Block Diagram

The battery used in this is 9volts D.C. battery, both alkaline (6LR61) and lithium ion batteries can be used. These D.C. batteries have long shelf life, up to 10 years. These batteries have rating between 400 to 600mAH. Rechargeable Nickel-Cadmium and Nickel-Metal Hydride batteries of 9V rating can be used too. For using rechargeable batteries, wires would be coming out of the stick. So in the case of discharge, only a few connections would make the stick function. Thus, battery need not be removed regularly. Hence this makes the design more compact.Other components, obstacle detection sensor, dark and water sensor, microcontroller and indicators are fit inside in such a way that the stick is very compact and easy to carry.

II.   OBSTACLE DETECTION

The prime objective in obstacle detection is to detect any obstacle in a desired range and alarm the blind person through the sound of buzzer and vibrations of the vibration motor.

The sensor used for this purpose is ultrasonic sensor, HC-SR04. This sensor has range from 0.02 m to 3 m. Ultrasonic sensor sends high frequency ultrasonic waves having frequency between 18 kHz to 40 kHz. The indicators used are buzzer and vibration motor. The microcontroller used is Arduino Nano. This is used due to its small size which helps in making the stick compact in size.

The microcontroller continuously sends electrical signals to ultrasonic sensor. The transducer of ultrasonic sensor converts electrical signals into sound signals. The sensor continuously transmits high frequency waves through transmitter. Whenever any obstacle comes in the path, the high frequency waves are reflected back and received by the receiver. The transducer again converts, sound signals into electrical signal and sends it to the microcontroller. The microcontroller then sends electrical signals to buzzer and vibration motor. At buzzer and vibration motor, the transducers convert electrical signals into sound signals and mechanical output respectively.

The distance till which object will be detected as an obstacle can be set easily by programming in microcontroller. Programming is done on the Atmega 328P microcontroller chip, which is there on the Arduino Nano board. The software used for programming the microcontroller is Arduino-1.5.4. The frequency of the sound generated by buzzer can also be set with the help of programming. The code of programming is shown in fig. 3 and fig.4.

III. DARKNESS DETECTOR

Darkness detector is used, so that the blind person can be easily helped by other person who is not blind. Thus for the other person to know that there is a blind person in the affinity and needs help, an indicator is used which works in darkness.

The main requirements for making the darkness sensor are, light resistance detector (l.d.r.), 555 timer, capacitor and light emitting diode. The amount of light intensity range within which it will consider as dark, can be controlled by the value of resistance.

The circuit diagram in fig. 2 is used for making the darkness detector. The circuit was made on Proteus Software. When light falls on the light resistance detector, a low resistance path is formed and whole of the current flows from supply to ground through light resistance detector. When light is not falling on the light resistance detector that is there is darkness, a high resistance path is formed along the circuitry of light resistance detector. Hence current will flow through the 555 timer and light emitting diode. So, the basic functionality of dark sensor is fulfilled using this circuit.
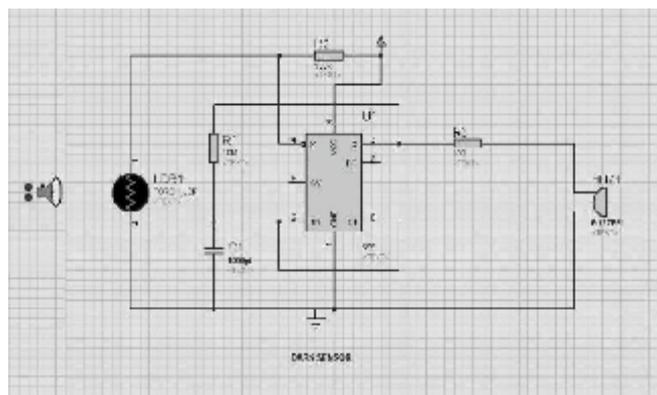

Fig.2 Darkness Detector

```
#define trigPin 12
#define echoPin 11
int Buzzer = 13;
int MOTOR = 9;

void setup() {
Serial.begin (9600);
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
pinMode(Buzzer, OUTPUT);
pinMode(MOTOR, OUTPUT);
}

void loop() {
int duration, distance;
digitalWrite(trigPin, HIGH);
delayMicroseconds(1000);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance = (duration/2) / 29.1;
if (distance >= 80 || distance <= 0){
Serial.println("no object detected");
digitalWrite(Buzzer, LOW);
digitalWrite(MOTOR, LOW);
}
```

Fig. 3 Code 1

IV. WATER DETECTOR

Water detection is used to protect the blind person from any water spills in the way. The water spills in the path of a blind person can really be fatal. Hence, some mechanism is to be made to protect the blind person from water spills.

The main components used for this is a transistor and a buzzer. Fundamental principle of transistor is that it allows electricity to flow through it only when current goes on its base terminal. So, this principle is used to make the water detector.

```
else {
Serial.println("object detected");
digitalWrite(MOTOR, HIGH);
tone(Buzzer, 400); // play 400 Hz tone for
500 ms
delay(500);
tone(Buzzer, 800); // play 800Hz tone for
500ms
delay(500);
tone(Buzzer, 400); // play 400 Hz tone for
500 ms
delay(500);
tone(Buzzer, 800); // play 800Hz tone for
500ms
delay(500);
tone(Buzzer, 400); // play 400 Hz tone for
500 ms
delay(500);
tone(Buzzer, 800); // play 800Hz tone for
500ms
delay(500);
noTone(Buzzer);
}
delay(300);
}
```

Fig. 4 Code 2

V. STICK FINDING DEVICE

We humans have a tendency to misplace the things we have. So, there needs to be a device which can trace the walking stick when it gets lost by the blind person.

For this purpose, a transmitter and a receiver are to be used. Transmitter is always there with the blind person and the receiver is placed on the stick. When the stick gets misplaced, the blind person just needs to press a button on the transmitter and a signal will go to the receiver and the buzzer will ring. Thus notifying the blind person where the stick is placed.

VI. OTHER PROPERTIES

The stick has reflective material tapes on it. So, travelling at night becomes safer and easier. The stick is very light in weight and compact. The stick also gives an additional protection from any potholes in the way of the blind person.

The cost of the stick is very less compared to all the features the stick is enabled with. The breakdown of the cost is shown in the table 1.

FEATURE IN STICK	COST
1. Obstacle Detector	Rs. 500
2. Darkness Detector	Rs. 20
3. Water Detector	Rs. 10
4. Rf-Tf	Rs. 100
5. Other Features	Rs. 300

Table 1