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Smart Obstacle Detector for Blind Person

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ABSTRACT

Smart obstacle detector helps blind people in moving and allowing them to perform their work easily and comfortably. In normal cane/stick, detection is done by the sensor. However, it is not much efficient because the blind person does not know what type of things or objects come in front of him, what is the size of that object and how far is he from the object? So it is difficult for blind person to move here and there. But SOD's output comes in two forms i.e. sound and vibration. In SOD, we detect the object by video processing method with the help of camera. For this we have used MATLAB software and then converted the video processing output into sound. Here we have used video processing for efficient and fast detection of objects, Stick measure distance between objects and SOD stick by Ultrasonic sensor. Moreover we have connected the vibrating motor with Ultrasonic sensor. When objects come in range of ultrasonic sensor then handle of the stick will vibrates. The vibration increases if the object comes toward the stick and vibration decreases when object goes far from the stick. We can also use solar chip for operating the stick which is definitely included in the future enhancement of our research based project.

KEYWORDS-: SOD (Smart Obstacle Detector), Video processing by MATLAB, Camera, Ultrasonic sensor, Arduino Board, vibration alarm.

1 INTRODUCTION

Goal of our research paper is to help the blind person. [1]More than 180 million people are visually disabled throughout the World. Of this group, 45 million people are completely blind. And of this group of 45 million blind people, 90% of them live in the developing world.[2] "In Pakistan, around two million people are blind, out of which 340,000 are in Sindh province, while cataract and diabetes are the major causes of blindness", said community

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ophthalmologist and patron-in-Chief of the Disabled Welfare Association Karachi, Dr. M Shahnawaz Munami.

Figure 1: The condition of blind person, structural design, working principle of stick

When someone becomes blind in the developing world: Firstly; 90% of these individuals can no longer work. Secondly; Life expectancy drops down to 1/3 that of a matched peer, in age and health. Thirdly; 50% of the blind report a loss of social standing and decision-making authority. Furthermore; 80% of all women note a loss of authority within their families. (Report by Javitt, Int. Congr. Opthalmol., 1983).

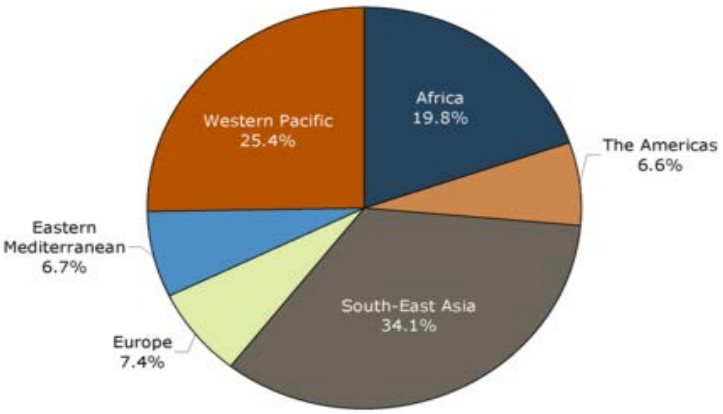

Figure: 2 Geographical Distribution of Global Blindness

2 WORKING PRINCIPLE

Working principle of Smart Obstacle Detector for blind person consist of

- Video processing by Matlab Software
- Conversion of video processing into sound

- Ultrasonic sensor
- Ear phone
- Solar cell

Figure 3: Block Diagram of Smart Obstacle Detector for Blind Person

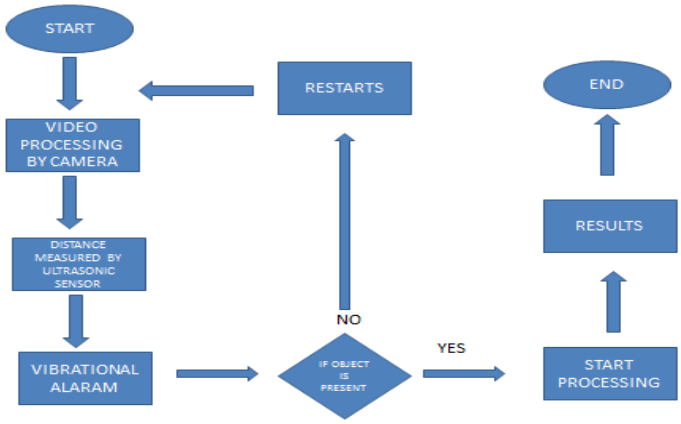

Figure 4: Flow Chart of Smart Obstacle Detector for Blind Person

2.1 Video processing by Matlab Software

2.1.1 Video Processing

Video processing systems [3] require a stream processing architecture, in which video frames from a continuous stream are processed one (or more) at a time. We use video processing for detection of objects because it gives fast and efficient response in which we use camera for detection purpose.

2.1.2 Procedure of Object Detection by Video ProcessingOpen this Example

Detection of moving objects and motion-based tracking are important components of many computer vision applications, including activity recognition, traffic monitoring, and automotive safety. The motion-based object tracking can be divided into two parts:

1. Detecting moving objects in each frame

2. Associating the detections corresponding to the same object over time

2.1.3 Create System Objects:

Create System objects used for reading the video frames, detecting foreground objects, and displaying results.

2.1.4 Initialize Tracks

The initialize Tracks function creates an array of tracks, where each track is a structure representing a moving object in the video. The purpose of the structure is to maintain the state of a tracked object. The state consists of information used for detection to track assignment, track termination, and display.

2.1.5 Detect Objects

The detect Objects function returns the centroids and the bounding boxes of the detected objects. It also returns the binary mask, which has the same size as the input frame. Pixels with a value of 1 correspond to the foreground, and pixels with a value of 0 correspond to the background. The function performs motion segmentation using the foreground detector. It then performs morphological operations on the resulting binary mask to remove noisy pixels and to fill the holes in the remaining blobs.

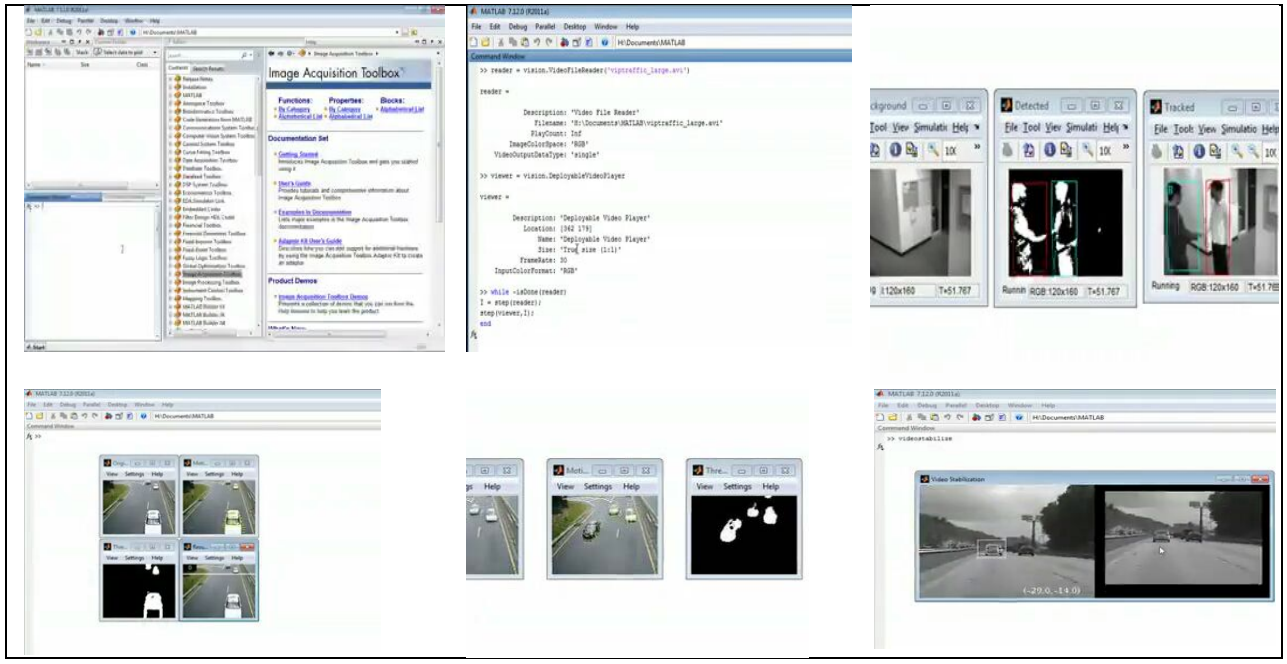

Figure 5: The video processing method

2.1.6 Predict New Locations of Existing Tracks

Use the Kalman filter to predict the centroid of each track in the current frame, and update its bounding box accordingly.

2.1.7 Assign Detections to Tracks

Assigning object detections in the current frame to existing tracks is done by minimizing cost. The cost is defined as the negative log-likelihood of a detection corresponding to a track.

2.1.8 Create New Tracks

Create new tracks from unassigned detections. Assume that any unassigned detection is a start of a new track. In practice, you can use other cues to eliminate noisy detections, such as size, location, or appearance.

2.1.9 Display Tracking Results

The display Tracking Results function draws a bounding box and label ID for each track on the video frame and the foreground mask. It then displays the frame and the mask in their respective video players.

2.2 Ultrasonic Sensor

2.2.1 Ultrasonic principle

In SOD the working principle of Ultrasonic sensor is similar to sonar which evaluate qualities of a target by interpreting the echoes from sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. The time interval between the sent signal and received signal is determined to measure the distance from an object. [7] Ultrasonic sensors emit short, high-frequency sound pulses at regular intervals. These propagate in the air at the velocity of sound. If they strike an object, then they are reflected back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo. [8] Independent to target materials, surface and color. Detect small objects over long operating distance. Work very well by dust, dirt or high moisture environments. Resistant to external disturbances such as vibration, light, noises…**[9]An ultrasonic sensor** consists of a transmitter and receiver which are available as separate units or inserted together as single unit.

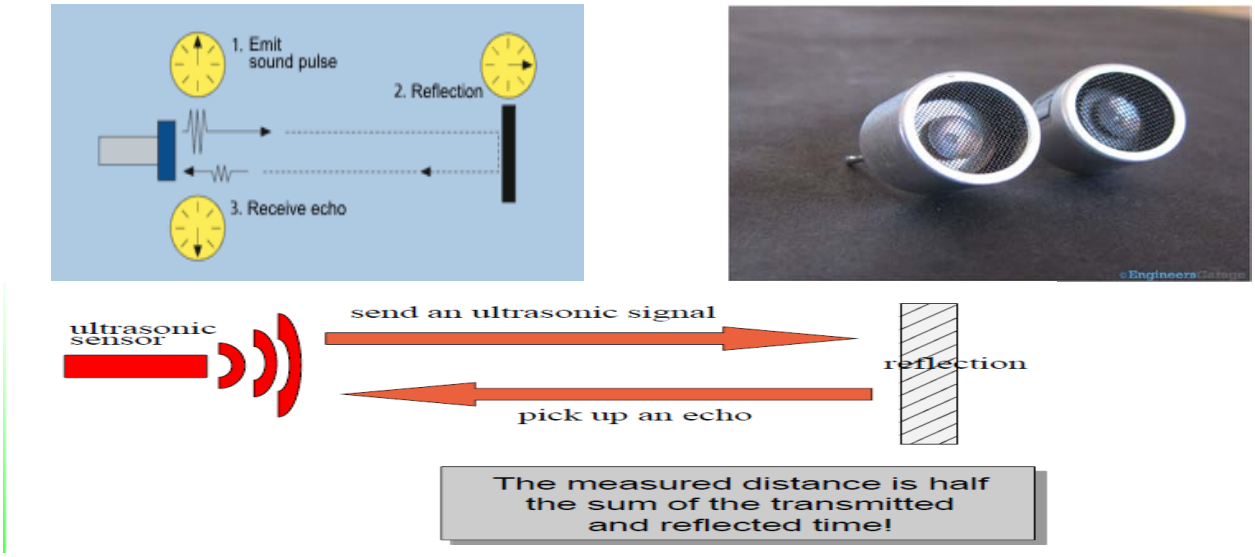

Figure 6: Working principle of ultrasonic sensor in which the sound signals are generated from the Ultrasonic Sensor which strike to the object and bounce back and receiver receives these signals.

The Timing diagram is shown below. You only need to supply a short 10uS pulse to the trigger input to start the ranging, and then the module will send out an 8 cycle burst of ultrasound at 40 kHz and raise its echo. The Echo is a distance object that is pulse width and the range in proportion .You can calculate the range through the time interval between sending trigger signal and receiving echo signal.

Formula: uS / 58 = centimeters or uS / 148 =inch;

or: range = high level time * velocity (340M/S) / 2;

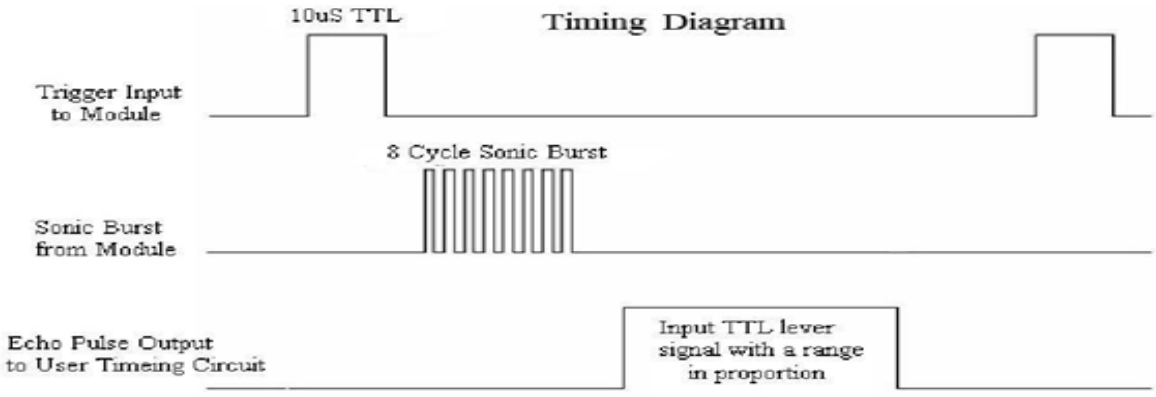

Figure 7 : The above figure shows the timing diagram of sound signals.

2.2.2 Arduino Board

We use Arduino board for operating Ultrasonic Sensor as it detects the presence of object in easy way and for this we do the programming in Arduino Board. It also reduces the size of Smart Obstacle Detector.

Schematic Diagram

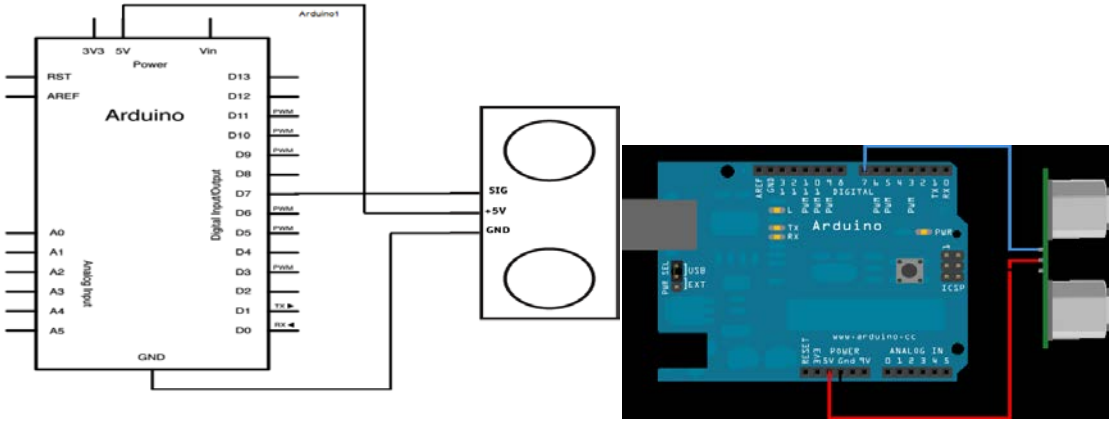

Figure 8: Schematic and layout diagram of Arduino connected with Ultrasonic sensor.

2.3 Vibration Alarm

Device currently uses Arduino Micro [29], Ping Ultrasonic sensor and vibrating motor. Micro-controller is used to measure the distance of the forth coming object by measuring time of flight of Ultrasonic waves emitted by Ping sensor. Depending on the distance, controller changes the vibration of the vibrating motors. Hence, Vibrating motor is attached with the sensor which vibrates faster if the distance between the obstacle and device decreases and vibration dampens as distance increases.

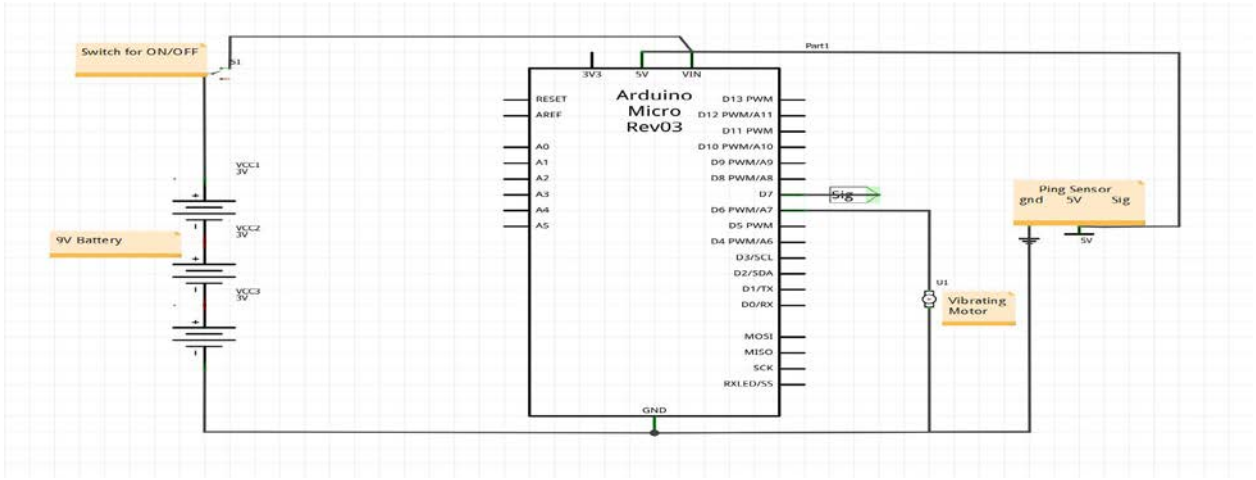

Figure 9:Schematic Diagram

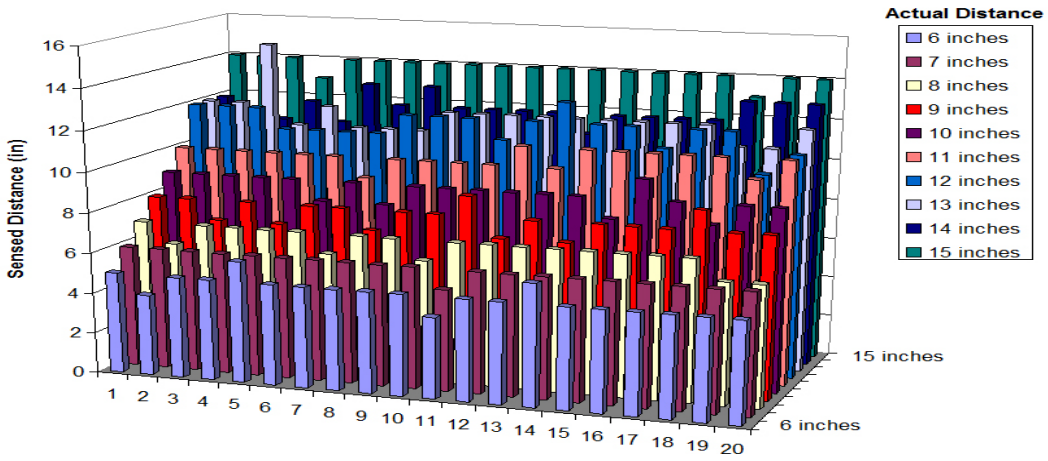

Figure 10: Sensed distance for 20 data points at a range of actual distances

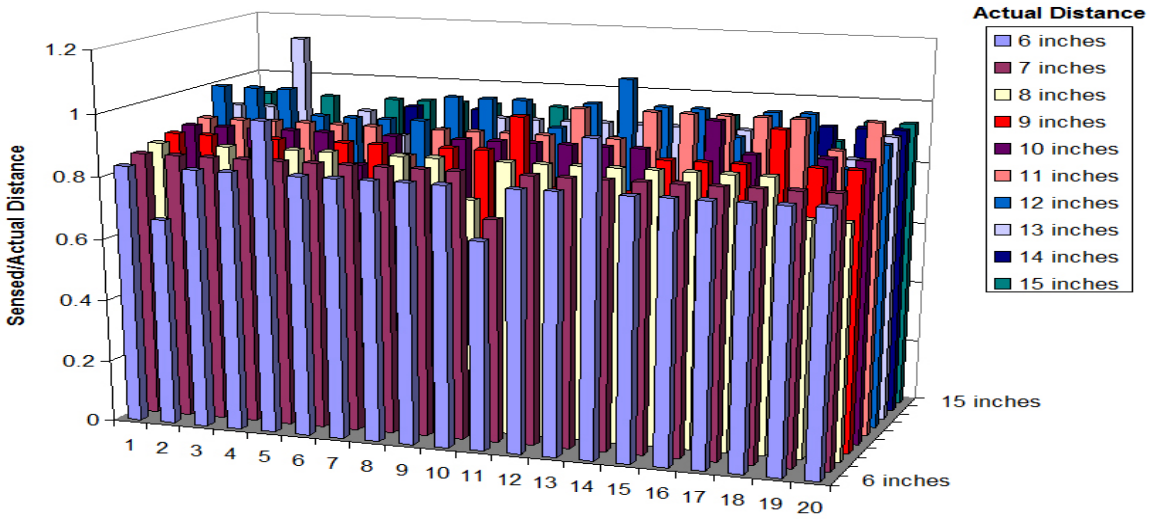

Figure 11: Sensed distance normalized b actual distance for 20 data points at a range of actual distances

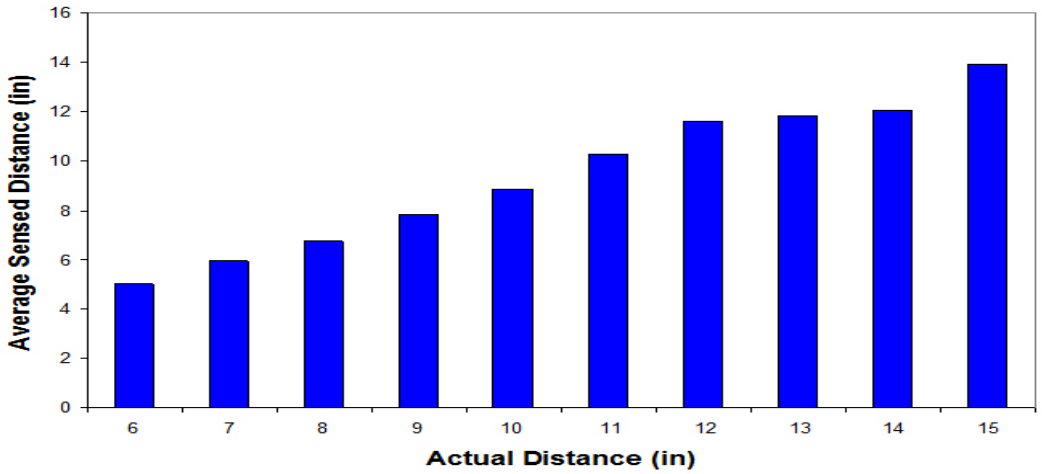

Figure 12: Average sensed distance of a large number of data points compared to actual distance

3 CONCLUSION

This paper has described the system and research mechanism which provides an immense help and support to blind persons.It is true that every organ of the body is very important and has its own and specific objectives.Similarly; eye is also a very important organ of the body. Unfortunetely, blind persons life is really colourless and is void of many happiest moments of life. The project will help the blind persons to detect the obstacles through the video processing mechanisnm by carrying just this small piece of stick (Smart obstacle detector). Ultimately;this research based project will result in serving the humanity which is indeed a greatest act.

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