Low Vision Aiding Device

[1.] Mansi Agarwal
School of Computer Science and Engineering
Vellore Institute of Technology
Vellore, Tamil Nadu, India

***Abstract*—Haptic or kinesthetic correspondence reproduces the feeling of touch by applying strengths, vibrations, or movements to the user. This mechanical incitement can be utilized to aid the formation of virtual protests in a PC reproduction, to control such virtual questions, and to improve the remote control of machines and gadgets. Our aim is to design portable device to help blind or low visioned people. The basic principle behind haptic interaction is simple. When the human user manipulates the generic probe of the haptic device, the position sensors of the device convey its tip position to the computer.**

At every time interval – say every 1 ms – the computer that controls the device checks for collisions between the sensor and the virtual objects populating the virtual environment. If a collision has occurred, the haptic rendering system calculates the reaction distance between them ,leading to a tactual perception of the virtual objects. In the case that no collision is detected, no distance will be computed/applied, and the user is free to move as if exploring empty space.

***Keywords*—Haptic, Vision, Aiding device**

INTRODUCTION

The Haptic Proximity Module (HPM) seeks to enable people with low vision, or other vision impairments, to engage with their direct surroundings through vibration feedback from a range detector, and do so cheaply with readily available components.

The idea behind this project was to construct a sixth sensory system that interacts with the body in an intuitive and user friendly fashion and enables the user to navigate without vision. We believe this can serve very useful for the visually impaired to have the freedom to possibly move about hands-free without the assistance of a cane or Seeing Eye dog. Technology has undoubtedly made our daily lives better. By using a few inexpensive components and sensors, we will make a device that will allow the blind to navigate their surroundings and avoid collisions.

MOTIVATION

Our aim is to develop portable device to help Blind or Low vision Peoples. It will assist blind people with the sound and vibration. The Low Vision Aiding device will enable people with low vision, or other vision impairments, to engage with their direct surroundings through vibration feedback from a range detector. This device will be a better option than the service assistance dogs which might not be foolproof way of helping the visually impaired. This is not only for the blind but also at smog or smoke or dim-lit circumstances that pose as a difficulty to see or sense the objects already present and which might be approaching hence can avoid accidents. This is possible if the device sensor is efficient enough to sense far off objects too.

Haptic or kinesthetic correspondence reproduces the feeling of touch by applying strengths, vibrations, or movements to the user. The basic principle behind haptic interaction is simple. When the human user manipulates the generic probe of the haptic device, the position sensors of the device convey its tip position to the computer. In our project we try to generate this haptic sensing or recreate i.e the intensity of the output devices (buzzers, led and/or vibrator) increases with decrease in distance (proximity).

METHODOLOGY

THE PROPOSED LOW VISION HAPTIC MODULE

Vision:

- The module will detect the obstacle and warn the user.
- Different Type of sound for Different Distance.
- Depth and Height of any Obstacle can be detected.

Components:

- Arduino UNO Board
- Buzzer
- Breadboard
- Connecting Wires
- HC-sr 04 Ultrasonic Sensor
- Wires

Regardless of the visually impaired populace proceed to develop and henceforth cause genuine worries in social advancement, specialized answers for help their day by day life undertakings is as yet an issue.

This theory extend means to assemble a natural and minimal effort gadget that help the visually impaired stay away from hindrances around the head tallness region. The device is called Low Vision Haptic Module(LVHM). LVHM utilizes ultrasonic sensor to measure the distance between the user and the obstacle inside 3m territory. The estimation is then changed over to vibrations in various amplitudes and frequencies, which nearer separate compares to more grounded and quicker vibrations. LVHM can function admirably in low light condition. In experiments LVHM demonstrated to identify dependably

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complex surface items and level surface objects including glasses. Estimation exactness shifts with the separation to the obstacle, question geometry and intricacy. The outcomes recommend that LVHM is a doable and promising idea to help the visually impaired evade hindrances.

ULTRASONIC SENSORS

Ultrasonic sensor works by emitting ultrasonic sound to the environment. If there is obstacles, the sound will be reflected. By measuring the time elapsed between emitting and receiving together with known speed of sound (around 340 m/s), distance can be calculated. Ultrasonic sensors used for distance measuring are also referred to ultrasonic range finders, or sonar range finders.
Ultrasonic sensor inherits sound characteristics. It does not depend on light condition or color of the obstacles. It can also distinguish transparent objects, such as glass, which is invisible to most light- based devices. Also the rather low speed of sound and simple principle let ultrasonic sensor be able to yield good accuracy without complex calculations. On the other hand, this causes a relatively large response time, 35 ms for objects at 6 m away. On the commercial market, ultrasonic range finders are inexpensive.

The device we have prepared consists of three ultrasonic sensors of the following features:

- Power Supply :+5V DC
- Quiescent Current : <2mA
- Working Current: 15mA
- Effectual Angle: <15°
- Ranging Distance : 2cm – 400 cm/13 – 13ft
- Resolution : 0.3 cm
- Measuring Angle: 30 degree
- Trigger Input Pulse width: 10uS
- Dimension: 45mm x 20mm x 15mm.

It consists:

- VCC: +5VDC
- Trig : Trigger (INPUT)
- Echo: Echo (OUTPUT)
- GND: GND

The HC-SR04 Ultrasonic Module has four pins, Ground, VCC, Trig and Echo. The Ground and the VCC pins of the module must to be connected to the Ground and the five volts pins on the Arduino Board respectively and the trig and echo pins to any Digital I/O pin on the Arduino Board.
First of all, we need to trigger the ultrasonic sensor module to transmit signal by using arduino and then wait for receiving ECHO. Arduino reads the time between triggering and Receiving ECHO.
The ultrasonic sensor can measure distances in centimeters and inches also. It can measure from 0 to 2.5 meters, with a precision of 3 cm. It provides good readings in sensing large-sized objects with hard surfaces, but has more difficulties reading reflections from soft, curved, thin or small objects.

OUTPUT:
This device functions at the 0 to 40 cm ranges (with minimal error) ranges producing different sounds at varying distance ranges to enable the user of the proximity of the approaching obstacle or person.

When the object is in range of 0 to 5 cm then the buzzer produces sound of 1000 Hz for about 200 milliseconds.
When the object is in range of 6 to 10 cm then the buzzer produces sound of 5000 Hz for about 200 milliseconds.
When the object is in range of 11 to 20 cm then the buzzer produces sound of 200000 Hz for about 200 milliseconds.
When the object is in range of 21 to 40 cm then the buzzer produces sound of 250000 Hz for about 200 milliseconds.
The Distances is measured by the code by noting the duration of the ultrasonic sound transmitted and applying the following formula:

Distance= (Time x Speed of Sound in Air (340 m/s))/2

We 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 ultra- sound at 40 kHz and raise its echo. The Echo is a distance object that is pulse width and the range in proportion. We can calculate the range through the time interval between sending trigger signal and receiving echo signal.
Formula:
μS/58 = centimeters or μS/148 = inch; or:

Explanation:
The speed of the Ping is 340m/s. Therefore, to cover 1 meter, the signal takes = 1/340 seconds

=0.002941/100 s/cm
=0.00002941 s/cm
=29.41 μS/cm
≈ 29 uS/cm.
Thus the code measures the distance by the above formula.

Code used is as follows:

```
int buzzerPin = 2; //buzzer
int pingPin = 3; //Trig
int inPin = 4; //Echo
int duration;
int distance;
void setup()
{
pinMode(inPin, INPUT);
pinMode(pingPin, OUTPUT);
pinMode(buzzerPin, OUTPUT);
Serial.begin(9600);
}
void loop()
{
digitalWrite(pingPin, HIGH);
```

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```
delayMicroseconds(500);
digitalWrite(pingPin, LOW);
duration = pulseIn(inPin, HIGH);
distance = (duration/2) / 29.41;
Serial.print(distance,2);
if (distance > 0 && distance <= 50)
{
tone(buzzerPin,40, 200);
}
else if (distance > 50 && distance <= 100){
tone(buzzerPin,300, 200);

}
else if (distance > 100 && distance <= 150){
tone(buzzerPin,2500, 200);

;
}
delay(3000);
noTone(buzzerPin);
}
```

COMPARISON BETWEEN PROPOSED AND EXISTING MODELS

We have used a sensor in our model that will detect an approaching obstacle from different directions. This feature is missing most of the previous proposed models. The components used by are light, cheap and easily available in the market. This model can be made at home provided that some little knowledge of coding is there.

CONCLUSION

Ultimately, the project aims to create an assistive device for the blind to avoiding obstacles reliably and inexpensively. In the proof-of-concept prototype, ultrasonic sensors have been used to detect objects and distance information is inferred via a haptic experience.
In a nutshell, a ultrasonic range finder can identify a wide range of protest material aside from sound retentive ones .They are ease, simple to utilize, reduced, light weight and offer great range for the undertaking (from many centimeters to meters) and has low power utilization. These components are essential for a wearable outline. In addition, haptic effect of buzzer sound has been chosen to give distinctly different sound frequencies for each distance range. The warning amplitude and frequency is higher at closer distance.

DRAWBACKS

• Even though the sensor resolution can go up to inches users often do not want to be overloaded with detailed information. Instead, they prefer a familiar unit related to daily life, for instance a hand (20 cm) or a step (50-60 cm). Notice that blind people walk with smaller steps than the sighted people steps (70-90 cm). The warning system therefore is programmed to vibrate due to which distance zone it is, each zone width is represented by a familiar unit. The sensor high resolution is used by MCU to enhance calculation precision. Not all distances are equally important. The closer the object is, the higher risk that user could collide and the more important it is to warn. The user might not care whether an object is at 2.5 m or 3 m away (0.5 m resolution) but when it comes closer he wants higher accuracy message, for example 1.1 m or 1.3m. In other words the distance resolution needs to adapt to different ranges.
• HOD does not intend to measure high speed moving objects. Most moving objects faster than normal walking generate noises sufficient for the blind to recognize. Hence the tests focus on moving objects with speeds equal or slower than walking.

REFERENCES

[1] http://www.academia.edu/2099897/Haptic_Proximity_Module_for_Low_Vision_Users
[2] http://www.diva-portal.org/smash/get/diva2:818827/FULLTEXT01.pdf
[3] http://dl.acm.org/citation.cfm?id=1671018
[4] http://duino4projects.com/haptic-proximity-module-hpm-low-vision-users/