A Project Report on

"HAND GESTURE CONTROL OF COMPUTER"

Submitted in partial fulfilment of the requirement for
Degree in Bachelor of Engineering (Information Technology)

By

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CERTIFICATE

This is to certify that the project entitled
HAND GESTURE CONTROL OF COMPUTER
Submitted By

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In partial fulfilment of degree of T.E in Information Technology for term work of the project is approved.

External Examiner

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Internal Examiner

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Internal Guide

Date: -

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Head of Department

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Chapter 1

INTRODUCTION

1. INTRODUCTION

Humans interact in the physical world by the means of the five senses. However, gestures have been an important means of communication in the physical world from ancient times, even before the invention of any language. In this era of machines taking control of every complex works, interactions with machines have become more important than ever. Since this paper deals with gesture-controlled laptop, the primary focus will be on the use of hand gestures for specific applications only. There are several ways to capture a human gesture that a computer would be able to recognize. The gesture can be captured using distance measurement, camera, or a data glove. Gestures can also be captured via Bluetooth or infrared waves, Acoustic, Tactile, optical or motion technological means. The embedded systems designed for specific control functions can be optimized to reduce the size and cost of the device and increase the reliability and performance. This project consists of mainly three components – Arduino Uno, Ultrasonic sensors, and a laptop. The ultrasonic sensors hooked to the Arduino are used to determine the gestures and the distance of the hand from the ultrasonic sensors. The code loaded in Arduino finds the respective keyword for the distance found and sends it to Windows OS. Python code that runs in the background recognizes the keywords and generates the corresponding virtual keystrokes for Windows. The hotkeys then control particular function of the application of intend to run, that is VLC Media Player. The Arduino coding is done in "Arduino IDE" and uploaded to Arduino Uno. To run the required python code, we need to complete a few more steps.

(1) Python 2.7.14 is downloaded and installed.

(2) "pip" function is upgraded, a tool to easily update python modules.

(3) PyAutoGUI module is downloaded using the pip function and downloaded through internet in the Python command screen itself.

(4) Then we open "IDLE (Python GUI)".

(5) We create a new file and type in the code.

(6) The file is then saved and run

With the above steps done, python will be able to receive feedback from the Arduino board and hence generate virtual keystrokes in Windows OS. The keystrokes then control the hotkeys of the VLC media player.

1.1 Background

Gesture based navigation has become alternative to Normal navigation. Instead of using a keyboard, mouse or joystick, we can use our hand gestures to control certain functions of a computer like to play/pause a video, move left/right in a photo slideshow, scroll up/down in a web page and many more.

1.2 Purpose

The sensor which is used in this system consumes very less power. The module is developed in low cost. In this system ultrasonic sensor is used to detect hand gesture or distance of hand and according to condition operation is perform on computer. The solution shown in article is implementable and very useful for the user.

1.3 Problem Definition

Gestures have been used as an alternative form to communicate with computers in an easy way. Vision based automatic hand gesture recognition has been a very active research topic in recent years with motivating applications such as human computer interaction (HCI), robot control, and sign language interpretation. This kind of human-machine interfaces would allow a user to control a wide variety of devices through hand gestures.

1.4 Scope

Hand gesture technique is not only limited to gaming, using basic function of computer it can be useful for medical applications. Hand gesture technique can work as input method between medical instruments and human body as proposed. It can be used for operating each and every functions of computer.

1.5 Objectives

- For this system there is no need of sound to be created so no interruption of background noise
- A number of functions of computer can be operated by using ultrasonic sensor.
- This technique may be very useful for those who does not know functionally of computer. This technique decreases the learning time required.
- Using this technique, it is easy to interact with the computer and there is no language barrier.
- By using this system, we can control our laptop from a small distance and it can help to control laptop in conference room presentation.

1.6 Limitations

- Variation of illumination conditions; where any change in the lighting condition affects badly on the extracted hand skin region.
- Range is limited hence sometimes recognition is not possible.
- Some unconscious movement of hands can be considering as gesture input by computer.

Chapter 2

LITERATURE SURVEY

2.1

Data Glove*:*

A Data Glove which is also called as Wired Glove or Cyber Glove was developed first in 1977. This input device could be worn like a glove and used for human-computer interaction. Different gestures were used for the interaction such as finger movement, signs using fingers waving etc. The movement was tracked by using hand movement detector sensor and using computer vision.

An Efficient Framework for Indian Sign Language Recognition Using Wavelet Transform*:*

The proposed ISLR system is considered as a pattern recognition technique that has two important modules: feature extraction and classification. The joint use of Discrete Wavelet Transform (DWT) based feature extraction and nearest neighbor classifier is used to recognize the sign language. The experimental results show that the proposed hand gesture recognition system achieves maximum 99.23% classification accuracy while using cosine distance classifier.

Hand Gesture Recognition Using PCA:

In this paper authors presented a scheme using a database driven hand gesture recognition based upon skin color model approach and thresholding approach along with an effective template matching with can be effectively used for human robotics applications and similar other applications. Initially, hand region is segmented by applying skin color model in YCbCr color space. In the next stage thresholding is applied to separate foreground and background. Finally, template based matching technique is developed using Principal Component Analysis (PCA) for recognition.

Hand Gesture Recognition System for Dumb People:

Authors presented the static hand gesture recognition system using digital image processing. For hand gesture feature vector SIFT algorithm is used. The SIFT features have been computed at the edges which are invariant to scaling, rotation, addition of noise.

Leap Motion Controller:

Leap Motion Controller system was a finger, hand and position detection system which was developed by the Leap Motion Inc. in 2010. The beauty of the system was that it could detect the slightest movement of the fingertips also. Thus, the system has number of gestures. It was a mixture of LEDs, high speed monochrome infrared cameras and the Leap Motion Control software which worked as the gesture control system.

Real Time Detection and Recognition of Indian and American Sign Language Using Sift:

Author proposed a real time vision-based system for hand gesture recognition for human computer interaction in many applications. The system can recognize 35 different hand gestures given by Indian and American Sign Language or ISL and ASL at faster rate with virtuous accuracy. RGB-to-GRAY segmentation technique was used to minimize the chances of false detection. Authors proposed a method of improvised Scale Invariant Feature Transform (SIFT) and same was used to extract features. The system is model using MATLAB. To design and efficient user-friendly hand gesture recognition system, a GUI model has been implemented.

Kinect Devices:

Kinect is a line of motion sensing input devices produced by Microsoft. Initially, the Kinect was developed as a gaming accessory for Xbox 360 and Xbox video consoles and Windows PCs. Based around a webcam-style add-on peripheral, it enabled users to control and interact with their console/computer without the need for a game controller, through a natural user interface using gestures and spoken command.

Camera and Marker Based Controller:

These systems used camera to capture the hand movement of the marker which was mounted on the user's hand. The patterns given by the user or signs as viewed in front of the camera were recorded and certain algorithms were used for interpretation purposes. This device, however took time to interpret and hence was not reliable.

Chapter 3

SYSTEM DESIGN

3.1 Basic Layout

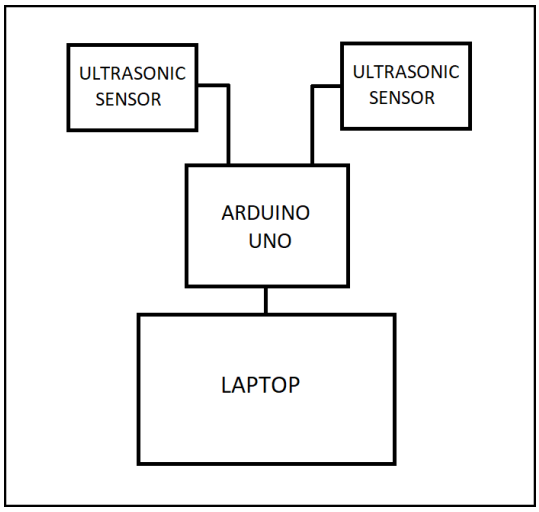

Fig. 3.1 Block Diagram

From the above figure 3.1, we see that two ultrasonic sensors are connected to Arduino Uno board and the board is connected to Laptop through USB. The ultrasonic sensors have a transmitter and a receiver where the transmitter emits ultrasonic waves. The waves hit a surface in front of the sensor and any reflected waves are picked up by the transmitter and based on the intensity the distance of the object is determined. This data is received by the Arduino and looks for specific keywords within the code according to the distance that is to be sent to the Python code

running in the background of Windows. Python picks up the keywords and generates virtual keystrokes of hot keys for the VLC media player. This process is kept on a continuous loop to control media playback, either video or audio files.

The ultrasonic sensors are the components that read the hand gesture and he distance of the hand from the sensor. For the left sensor, bringing our hand closer to it will rewind the video and moving away from it will fast forward the video. In the right sensor, the same actions would result in controlling the volume of the player.

3.2 Circuit Layout

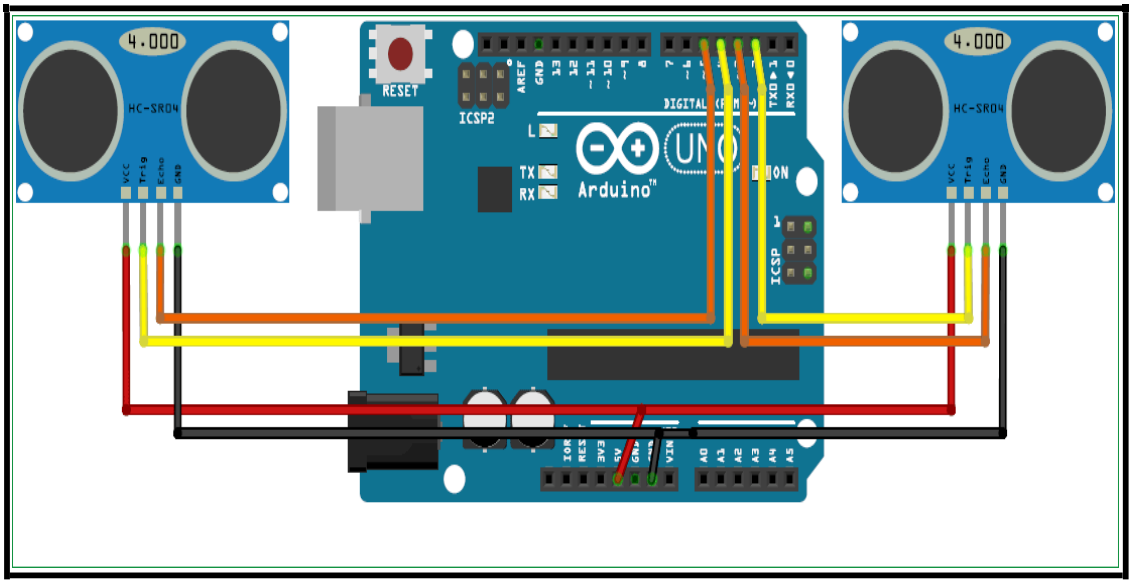

Fig.3.2

As we see in Fig 2.2 here, two ultrasonic sensors are connected to Arduino Uno board and the board is connected to Laptop through USB. The Vcc pin of each sensor is provided by Arduino using the 5V output port. Grounding of both sensors is attached to GND0. The Trigger and Echo pins are connected as per the code written.

The ultrasonic sensors are equipped with a transmitter and a receiver where the transmitter emits ultrasonic waves. The waves hit a surface in front of the sensor and any reflected waves are picked up by the transmitter and based on the intensity the distance of the object is determined. This data is received by the Arduino and looks for specific keywords within the code according to the distance that is to be sent to the Python code running in the background of Windows. Python picks up the keywords and generates virtual keystrokes of hot keys for the VLC media player. This process is kept on a continuous loop to control media playback, either video or audio files.

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Chapter 4

SYSTEM REQUIREMENTS

4.1 HARDWARE REQUIRENTS:

1. **HC-SR04 Ultrasonic Sensor**
2. **Arduino Uno**
3. **Laptop (Windows 7/8/10 OS)**

4.2 SOFTWARE REQUIREMENTS:

1. **Arduino IDE**
2. **Python 2.7.14**
3. **VLC Media Player**

Chapter 5

IMPLEMENTATION DETAILS

5.1 USER INTERFACE FRONTEND

Here, we have created hand gesture, which provides a way to control computer with hands.

We had used ultrasonic sensor and Arduino Uno for this purpose.

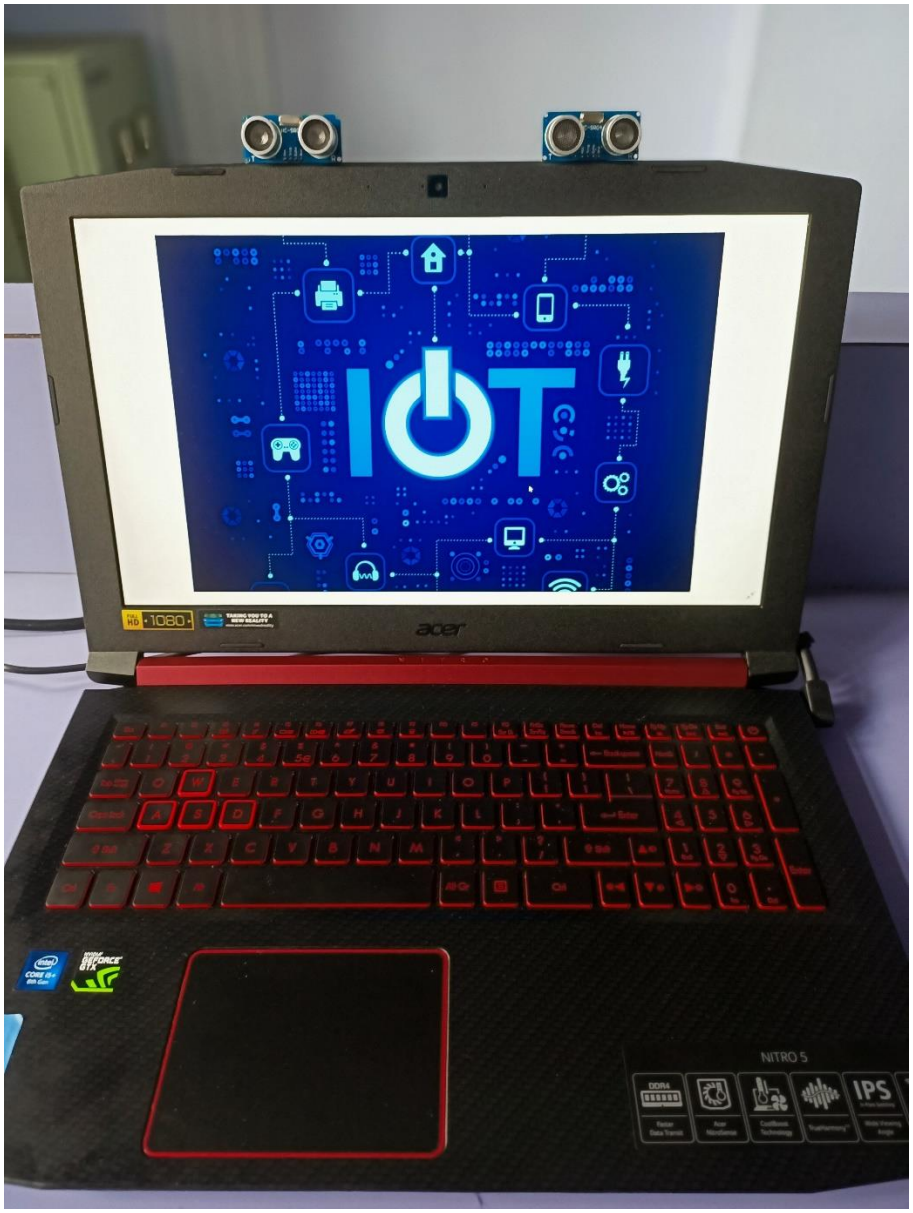

Figure 5.1 (a) Frontend

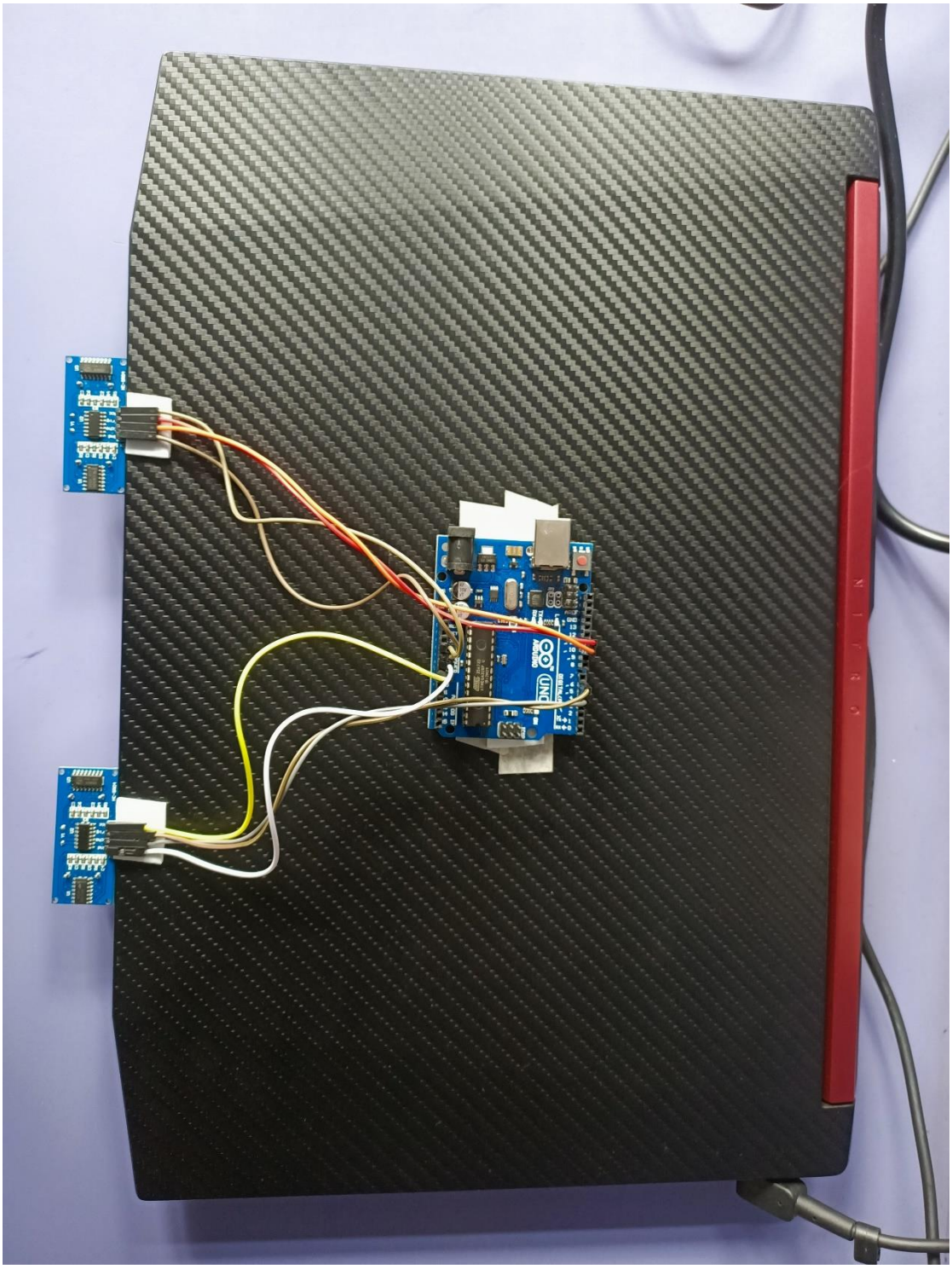

Figure 5.1 (b) Arduino connected to laptop

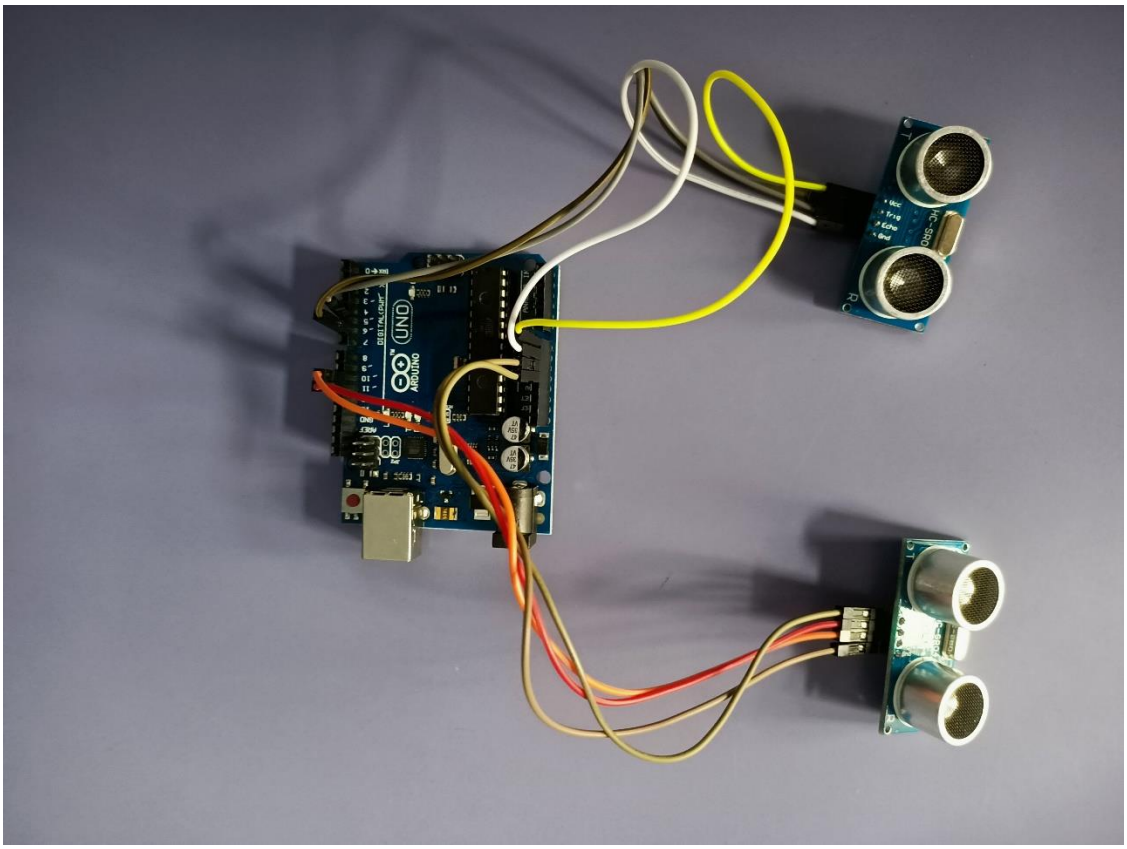

Figure 5.1 (c) Connection of ultrasonic sensor

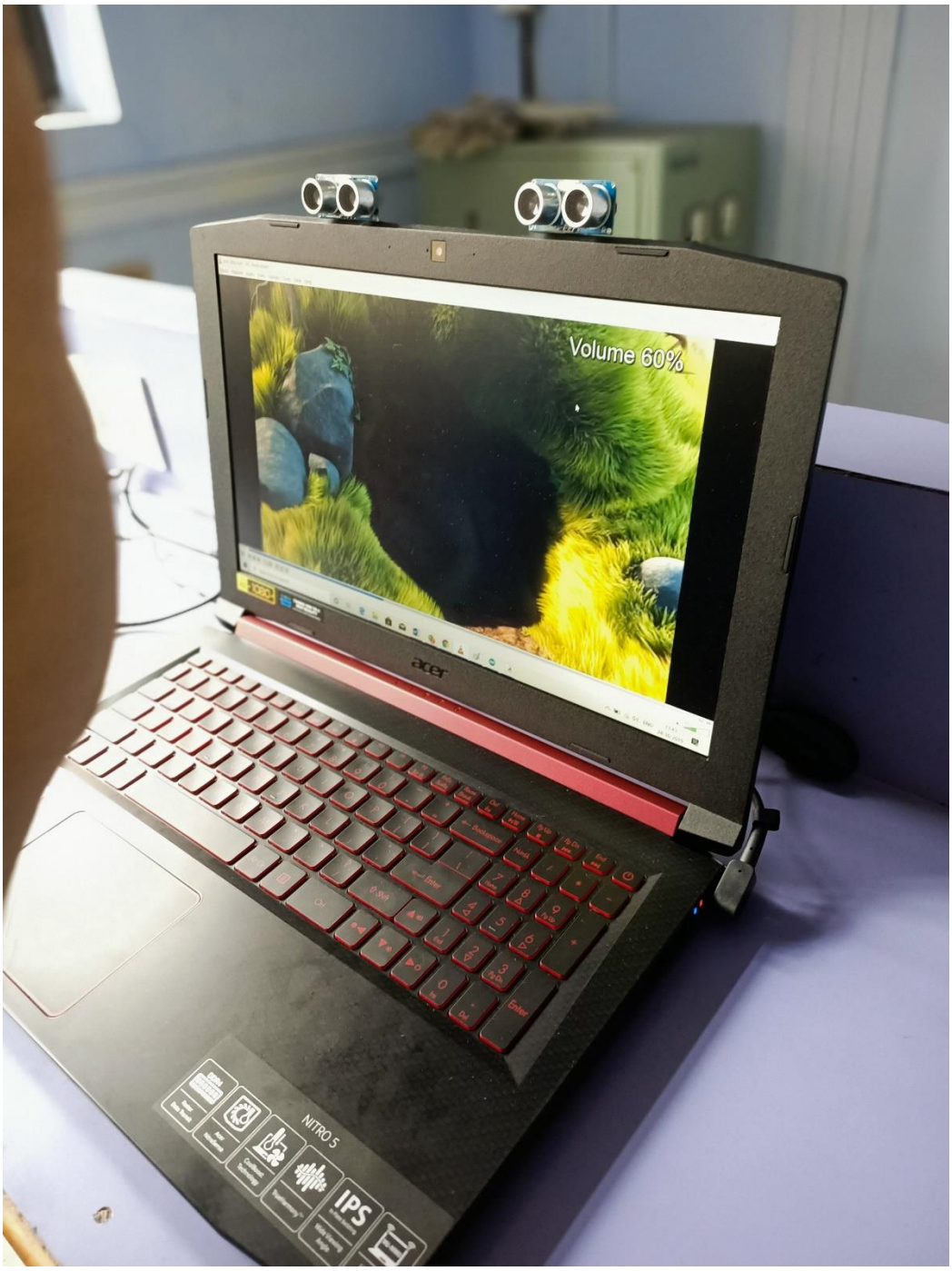

Figure 5.1 (c) VLC Media Player

Chapter 6

EXPERIMENTAL RESULTS

6. EXPERIMENTAL RESULTS

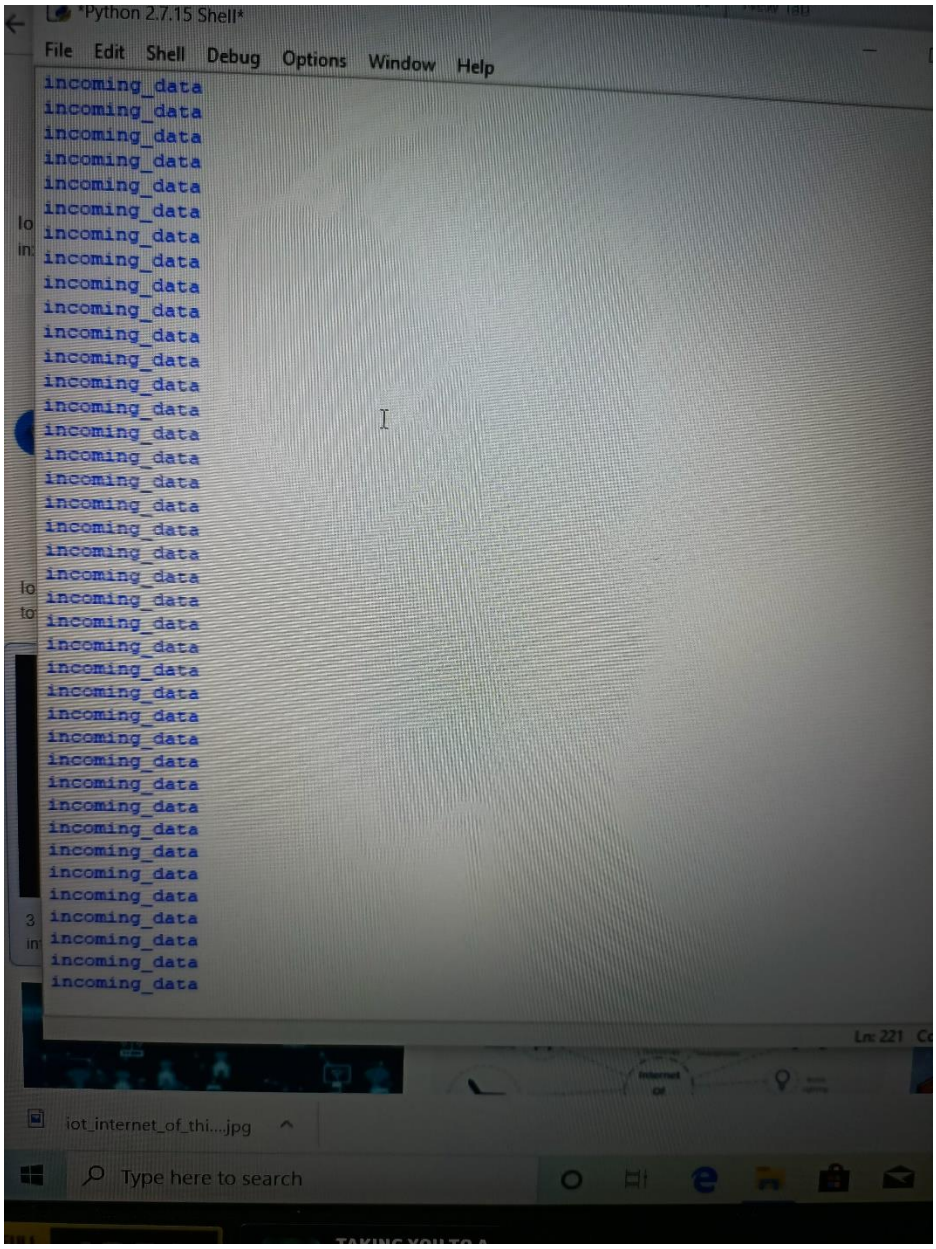

Figure 6.1(a) Output on python Shell

Figure 6.1(b) Output on tab changing

Figure 6.1(c) Output on Volume increase and decrease

Chapter 7

CONCLUSION

This article presents one of the solutions among various others, for operating a computer using hand gestures. It is one of the easiest ways of interaction between human and computer. It is a cost-effective model which is only based on Arduino UNO and ultrasonic sensor. The python IDE allows a seamless integration with

Arduino UNO in order to achieve different processing and controlling methods for creating new gesture control solutions.

Hand gesture laptop uses an Arduino Uno, Ultrasonic sensors and a laptop to carry out the operation of controlling media playback and volume. It is mainly aimed at reducing the effort of interaction with computers through input devices using simple gestures. It is also done to increase the interactivity with computers. This type of technology can be used in classroom for easier and interactive learning, immersive gaming, interacting with virtual objects on screen. It will become more effective if merged with completely developed hologram technology. We will be able to interact with virtual 3D objects in the physical world in real time.

Chapter 8

APPENDIX - CODE SAMPLE

Arduino Code

```
const int trigPin1 = 11;
const int echoPin1 = 10;
const int trigPin2 = 6;
const int echoPin2 = 5;

////////////////////////////////// variables used for distance calculation
long duration;
int distance1, distance2;
float r;
unsigned long temp=0;
int temp1=0;
int l=0;
//////////////////////////////

void find_distance (void);

// this function returns the value in cm.
/*we should not trigger the both ultrasonic sensor at the same time.
it might cause error result due to the intraction of the both soundswaves.*/
void find_distance (void)
{
  digitalWrite(trigPin1, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin1, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin1, LOW);

  duration = pulseIn(echoPin1, HIGH, 5000);

  r = 3.4 * duration / 2;
  distance1 = r / 100.00;

  digitalWrite(trigPin2, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin2, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin2, LOW);

  duration = pulseIn(echoPin2, HIGH, 5000);
  r = 3.4 * duration / 2;
  distance2 = r / 100.00;
  delay(100);
}
```

```
void setup()
{
  Serial.begin(9600);
  pinMode(trigPin1, OUTPUT);
  pinMode(echoPin1, INPUT);
  pinMode(trigPin2, OUTPUT);
  pinMode(echoPin2, INPUT);
  delay (1000);

}

void loop()
{
  find_distance();
  if(distance2<=35 && distance2>=15)
    temp=millis();
    while(millis()<=(temp+300))
    find_distance();
    if(distance2<=35 && distance2>=15)
    {
     temp=distance2;
     while(distance2<=50 || distance2==0)
     {
       find_distance();
       if((temp+6)<distance2)
       {
       Serial.println("down");
       }
       else if((temp-6)>distance2)
       {
        Serial.println("up");
       }
     }
    }
    else
    {
      Serial.println("next");
    }
  }

  else if(distance1<=35 && distance1>=15)
  {

    temp=millis();

    while(millis()<=(temp+300))
    {
       find_distance();
```

```
        if(distance2<=35 && distance2>=15)

  {
        Serial.println("change");
        l=1;
        break;
       }
    }

)



            }
    if(l==0)
    {
    Serial.println("previous");
    while(distance1<=35 && distance1>=15
    find_distance();
    }
    l=0;
   }

}
```

Python Code

```
import serial
import pyautogui

Arduino_Serial = serial.Serial('com12',9600)

while 1:
    incoming_data = str (Arduino_Serial.readline())
    print incoming_data


    if 'next' in incoming_data:
        pyautogui.hotkey('ctrl', 'pgdn')

    if 'previous' in incoming_data:
        pyautogui.hotkey('ctrl', 'pgup')

    if 'down' in incoming_data:
        #pyautogui.press('down')
        pyautogui.scroll(-100)

    if 'up' in incoming_data:
        #pyautogui.press('up')
        pyautogui.scroll(100)

    if 'change' in incoming_data:
        pyautogui.keyDown('alt')
        pyautogui.press('tab')
        pyautogui.keyUp('alt')

    incoming_data = "";
```

Chapter 9

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