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A Mini Project Report
On

"COMPUTER HUMAN INTERACTION BY GESTURES"

Submitted in partial fulfillment of the requirement for the award of the degree of

BACHELOR OF ENGINEERING
In
ELECTRONICS AND COMMUNICATION ENGINEERING

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MANGALORE INSTITUTE OF TECHNOLOGY AND ENGINEERING
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CERTIFICATE

Certified that the mini project work entitled **Computer Human Interaction by Gesture** carried out by **Mr. Ankith Shetty(USN: 4MT18EC017), Mr. Brayan Saldanha(USN: 4MT18EC025), Mr. Rohan S Shetty (USN: 4MT18EC065) and Mr. Shreeganesha K V (USN: 4MT18EC080), the bonafide students of Mangalore Institute of Technology and Engineering** in partial fulfillment for the award of **Bachelor of Engineering** in **Electronics and Communication Engineering** of the **Visvesvaraya Technological University, Belagavi**, during the year **2020-21**. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library. The Mini Project report has been approved as it satisfies the academic requirements in respect of Mini Project Work prescribed for the said Degree.

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1.	
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DECLARATION

We, **Ankith Shetty**(4MT18EC017), **Brayan Saldanha**(4MT18EC025), **Rohan S Shetty**(4MT18EC065) and **Shreeganesha K V**(4MT13EC0080) students of 6th semester BE in Electronics and Communication Engineering, **Mangalore Institute of Technology and Engineering, Moodabidri,** hereby declare that the Mini project work entitled **Title ,** submitted to the **Visvesvaraya Technological University, Belagavi** during the academic year **2020-21**, is a record of an original work done by us under the guidance of **Dr.Vinayambika S Bhat,** Assistant Professor, Department of Electronics & Communication Engineering, Mangalore Institute of Technology and Engineering Moodabidri. This mini project work is submitted in partial fulfillment of the requirements for the award of the degree of Bachelor of Engineering in Electronics & Communication Engineering. The results embodied in this report have not been submitted to any other University or Institute for the award of any degree.

Date:

Place:

ACKNOWLEDGMENT

The successful completion of any task would be incomplete without mentioning the people who made it possible. It would not have been possible for us to succeed in this project without the help of those who shaped and encouraged our idea of making this project and guide us to success. We express our gratitude to our Mini project mentor and guide Dr. Vinayambika S Bhat, Head of the Department of Electronics & Communication Engineering, who always stood behind us and supported in each and every step of this project. We are indebted to our respected Principal Dr. G.L. Easwara Prasad, beloved Chairman Mr. Rajesh Chowta and the management of Mangalore Institute of Technology and Engineering, for having provided all the facilities that helped us in timely completion of this Mini project report. We would like to thank our parents and all the teaching and non-teaching staff of Department of Electronics & Communication Engineering for their encouragement and cordial support during the preparation of the Mini project report. Last but not least, we would like to thank our friends and classmates.

SHREEGANESHA KV

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ABSTRACT

By keeping in mind, the difficulties faced by physically challenged people we have tried to build an Arduino based hand gesture control system to perform certain actions. Humans use their main five physical senses to react with the outside world but this project will emphasize on hand gestures specifically, which have been an important mode of communication in the ancient world in the form of sign language, even before any formal language was invented. Hands-free operation of electronic items is new to this world. We live in an era where almost everything around us can be automated thus increasing the need of forming effective ways to communicate with machines more than ever. Undoubtedly, automating certain operations of machines or even everything about it will be more intuitive if they are communicated using physical gestures. A gesture is a form of non-verbal communication which involves movement of part of the body, especially the hand or the head to express an idea or command. In the present world, the operations of the computer or laptop's desktop functionalities can be controlled through various hand gestures of human. In this system, a Human Machine Interface (HMI) system plays key role in exchanging the data between computer and human. The current design mainly involved with HMI system that is able to control the system applications such as volume offsetting, scroll vertical and horizontal, tab shifting, switching between tasks (Chrome and VLC Player), play/pause a video, etc without using any mouse, keyboard, or joystick. This would be a great help for paralyzed people if they able to control the system without any electronic gadget specified above. The paralyzed people can easily operate their laptops with simple hand gestures using current design. The system control with simple unique gestures of hands reduces the space between user and machine. In this project, basic Arduino Uno is used to support the hand gesture-based system control.

CONTENTS

LIST OF FIGURES AND TABLES

LIST OF ACRONYMS

HCI: Human Computer Interaction

HMI: Human Machine Interaction

GUI: Graphical User Interface

ICSP: In Circuital Serial Programming

IDE: Integrated Development Environment

USB: Univeral Serial Bus

PWM: Pulse Width Modulation

VLC: Video Lan Client

GPIO: General Purpose Input/Output

COM: Communication Port

UNO: One (in Italian)

Chapter 1

INTRODUCTION

The main objective of our project is in recent days the automation in the domain of robotics motivates the researchers to develop more flexible and simple operable machines. In the present work, the operations of the computer or laptop's desktop functionalities controlled through various hand gestures of human.[1] In this system, a Human Machine Interface (HMI) system plays key role in exchanging the data between computer and human. The current design mainly involved with HMI system that is able to control the system applications such as volume offsetting, scroll vertical and horizontal, tab shifting etc., without using any mouse, keyboard, or joystick. This would be a great help for paralyzed people if they able to control the system without any electronic gadget specified above. The paralyzed people can easily operate their laptops with simple hand gestures using current design. The system control with simple unique gestures of hands reduces the space between user and machine. In the present paper basic Arduino Uno is used to support the hand gesture-based system control. [1]

1.1 Trends in Embedded Systems

An embedded system is the microprocessor-based computer hardware system with the software that is designed to perform a dedicated functions, either as an independent system or as a part of a large system. At the core it is an integrated circuit designed to carry out computation for real-time operations.

Complexities range from a single microcontroller to a suite of processors with connected peripherals and networks from no user interface to the complex graphical user interfaces. The complexity of an embedded system varies significantly depending on the task for which it is designed.[2]

Embedded system applications range from digital watches and microwaves to the hybrid vehicles and avionics. As much as 98 percent of all the microprocessors manufactured are used in embedded systems.

1.2 Human Machine Interaction

By keeping in mind, the difficulties faced by physically challenged people we have tried to build an Arduino based hand gesture control system to perform certain actions. Humans use their main five physical senses to react with the outside world but this project will emphasize on hand gestures specifically, which have been an important mode of communication in the ancient world in the form of sign language, even before any formal language was invented. Hands-free operation of electronic items is new to this world. We live in an era where almost everything around us can be automated thus increasing the need of

forming effective ways to communicate with machines more than ever. Undoubtedly, automating certain operations of machines or even everything about it will be more intuitive if they are communicated using physical gestures.[5] A gesture is a form of non-verbal communication which involves movement of part of the body, especially the hand or the head to express an idea or command. In the present world, the operations of the computer or laptop's desktop functionalities can be controlled through various hand gestures of human. In this system, a Human Machine Interface (HMI) system plays key role in exchanging the data between computer and human. The current design mainly involved with HMI system that is able to control the system applications such as volume offsetting, scroll vertical and horizontal, tab shifting, switching between tasks (Chrome and VLC Player), play/pause a video, etc. without using any mouse, keyboard, or joystick. This would be a great help for paralyzed people if they able to control the system without any electronic gadget specified above. The paralyzed people can easily operate their laptops with simple hand gestures using current design. The system control with simple unique gestures of hands reduces the space between user and machine. In this project, basic Arduino Uno is used to support the hand gesture-based system control.

1.3 Structure of Report

Chapter 1: This chapter gives brief introduction on the Embedded Systems.

Chapter 2: This chapter describes the literature survey done on Computer Human Interaction.

Chapter 3: It describes the domain chosen i.e., Embedded Systems

Chapter 4: This chapter explains the design methodology followed.

Chapter 5: System implementation is explained using flowcharts in this chapter.

Chapter 6: The software requirements and its brief explanation is included in this chapter.

Chapter 7: The experimental results and discussions are explained in this chapter.

Chapter 8: The chapter concludes and describes the future enhancement of the proposed work.

Chapter 2

LITERATURE SURVEY

A literature survey is that section which shows various analysis and research made in the field of our interest and results already published, taking into account of the various parameters and the extent of the project. It is the most important part of the report as it gives a direction in the area of research. It helps to set a goal for the analysis, thus giving the problem statement.

2.1 Literature Review

[1] IJSRD - International Journal for Scientific Research & Development - Vol. 8, Issue 2, 2020 ,ISSN (online): 2321-0613 : Hand Gesture Recognition:

This journal deals with the detection and recognition of hand gestures. Images of the hand gestures are taken using a camera input device or webcam and matched with the images in the database and the best match is returned. Gesture recognition is one of the essential techniques to build user-friendly interfaces. For example, a robot that can recognize hand gestures can take commands from humans, and for those who are unable to speak or hear, having a robot that can recognize sign language would allow them to communicate with it.

[2] International Journal of Engineering Research & Technology (IJERT): Dynamic hand gesture recognition:

This journal deals with the building of hand gesture recognition system, to that can be used to control a robot or to convey meaningful information. The aim of this technique is the proposal of a real time vision system for its application within visual interaction environments through hand gesture recognition, using general purpose hardware and low cost sensors, like a simple personal computer and an USB Webcam, so any user could make use of it in his/her office or home.

[3]Fakhreddine Karray, Milad Alemzadeh,Jamil Abou Saleh,Mo Nours Arab, (2008).“Human Computer Interaction: Overview on State of the Art”:

This paper provided an overview of basic definitions, existing terminology and methods of HCI, applicational areas of HCI, also overview of system which has unimodal and multimodal configurations. The basic methodology behind sensor

based HCI is also been explained. This paper attempted to give an overview on the issues in existing system and provide a survey of existing research through a comprehensive reference list.

[4] Department of Information Technology, "Hand Gesture Recognition Control for Computers Using Arduino" , Sathyabama Institute of Science and Technology, Chennai, India:

Paper provides brief idea of how to provide hand gesture as input to the computer, how to implement a better system in reducing cost affairs, drawbacks of existing system and also hindrances in implementation of gesture-controlled systems. Paper also focused on using ultrasonic sensor to recognize hand movements and to recognize the actions done by the end user, time elapsed in implementing functions specified etc.

2.2 Motivation

We had chosen this project with an interest of learning the direct interaction of humans with the consumer electronic devices. This takes the user experience to a whole new level. The gesture control technology would reduce our dependence on the age old peripheral devices hence it would reduce the overall complexity of the system. Initially this technology was considered in the field of gaming (like Xbox Kinect), but the application of motion/gesture control technology would be more diverse if we apply it to our other electronics like computers ,televisions, etc., for our day to day purposes like scrolling, selecting, clicking etc.

Our primary objective in doing this project was to build a device inspired from Leapmotion. It is a device which recognizes hand gestures and can be used to virtually control a computer. In short, it provides a virtual screen with which we can interact with the computer. But the required hardware for making a device on these lines was not feasible, in terms of budget and time frame provided. So, we decided to build an introductory software implementation of the device which would eventually act as a virtual mouse.

2.3 Need (Scope) of project

Human-computer interaction (HCI) is a field based in the design and the use of computer technology, which focuses on the interfaces between people (users) and computers. HCI researchers observe the ways humans interact with computers, and they design technologies that let humans interact with computers in novel ways.

2.4 Problem statement

Specially abled people face problems in operating the computer.

The paralyzed people face difficulties to control the system with electronic gadgets.
The infections also spread to others from the infected person if they are using the same PC.
So in order to overcome all these problems we are trying to implement a way to manipulate the operations of laptop or PC without coming in physical contact with it.

2.5 Proposed System

This article proposes a simple hand motion control based on Arduino. This system helps us to control various functions of a computer using hand signals. As a replacement of using a keyboard, mouse or joystick, our hand motion can be used to direct few computer tasks such as playing/pausing a clip, moving left/right in a picture slide show, scrolling up/down on a Web page, and more. It is cheaper than the existing system as it contains two Ultrasonic sensors and an ARDUINO board which are available at very low cost.

Chapter 3

Area of Domain: EMBEDDED SYSTEMS

An embedded system is a combination of computer hardware and software designed for a specific function. Embedded system can also function as a part of a larger system. These systems can be programmable or have a fixed functionality. Embedded systems are computing systems that can have a complex graphical user interface such as in mobile phones or a simple interface like this project.

In this project, the hardware consists of the ultra-sensors, the laptop and the software part consist of the logic implemented by c-language to collect the data and convert it to distance and serially communicate it to the python script embedded with pyautogui module to execute the operations. Therefore, the embedded system used here is the Arduino uno which forms the part of a larger system if we include the other hardware and software components that have been integrated with it which finally executes a specific function that is to respond to human gestures with useful computer operations.

The application of the embedded system here is that it plays an important role of forming the bridge between the hardware (Ultra sensor) and the software, I.e., connecting the distance values with the python script, and also performs the mapping operations for each range of distance. Since the embedded system is a general-purpose system, its behavior can be customized according to the type of result required. This is why Arduino is a commonly used embedded system and it easy to use and cost effective, so we have gone with it.

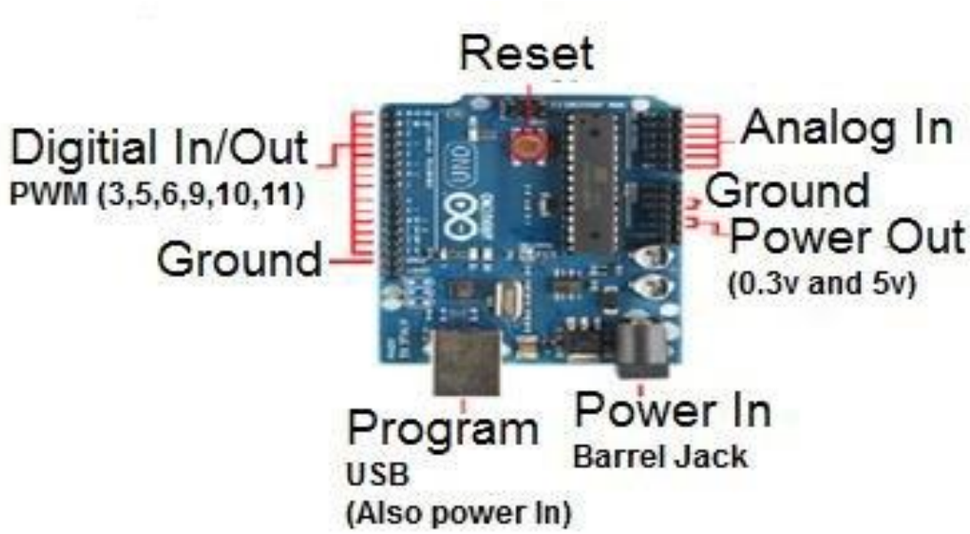

Fig 3.1: Pin – Configuration of the microcontroller

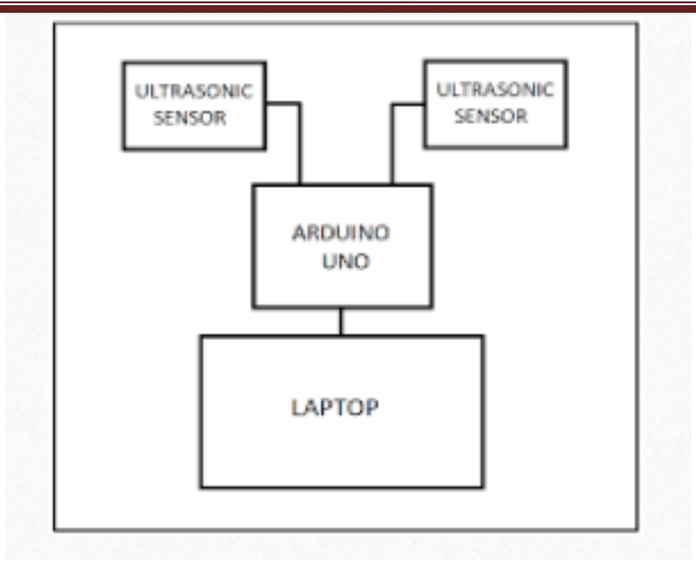

Fig 3.2: Overview of the system

Equations: Here the equation is implemented inside the code dumped in the Arduino to convert the time difference between the emission and detection of ultrasonic waves, to the distance in milliseconds (ms)

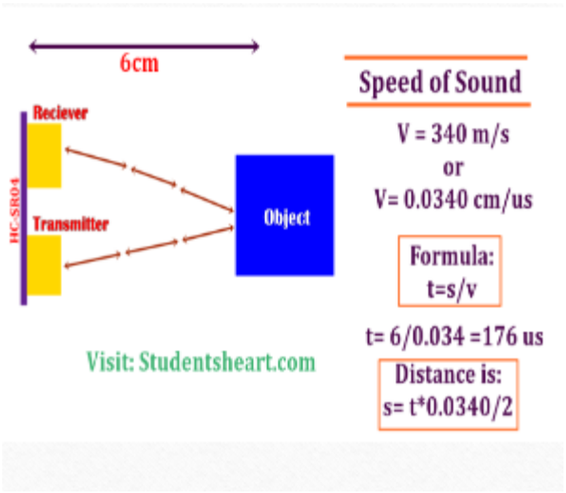

Fig 3.3: Calculations

Chapter 4
4.1 Human-Computer Interaction: Definition,Terminology

Sometimes called as Man-Machine Interaction or Interfacing, concept of Human-Computer Interaction/Interfacing (HCI) was automatically represented with the emerging of computer, or more generally machine, itself.[1] The reason, in fact, is clear: most sophisticated machines are worthless unless they can be used properly by men. This basic argument simply presents the main terms that should be considered in the design of HCI: functionality and usability . Why a system is actually designed can ultimately be defined by what the system can do i.e. how the functions of a system can help towards the achievement of the purpose of the system. Functionality of a system is defined by the set of actions or services that it provides to its users. However, the value of functionality is visible only when it becomes possible to be efficiently utilized by the user.[2] Usability of a system with a certain functionality is the range and degree by which the system can be used efficiently and adequately to accomplish certain goals for certain users. The actual effectiveness of a system is achieved when there is a proper balance between the functionality and usability of a system .

Having these concepts in mind and considering that the terms computer, machine and system are often used interchangeably in this context, HCI is a design that should produce a fit between the user, the machine and the required services in order to achieve a certain performance both in quality and optimality of the services. Determining what makes a certain HCI design good is mostly subjective and context dependent. For example, an aircraft part designing tool should provide high precisions in view and design of the parts while a graphics editing software may not need such a precision. The available technology could also affect how different types of HCI are designed for the same purpose. One example is using commands, menus, graphical user interfaces (GUI), or virtual reality to access functionalities of any given computer. In the next section, a more detailed overview of existing methods and devices used to interact with computers and the recent advances in the field is presented.[5]

Chapter 5

HARDWARE/SOFTWARE DESCRIPTION

5.1 Hardware implementation:

The 3 hardware components used in our project are

1. Arduino (microcontroller)

2. Ultrasonic sensor

3. Laptop

1. Arduino:

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.[6]

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards

The Trigger and Echo Pins of the first Ultrasonic Sensor (left sensor) are connected to Pins 11 and 10 of the Arduino. For the second Ultrasonic Sensor, the Trigger and Echo Pins are connected to Pins 6 and 5 of the Arduino.

The given circuit shows the exact circuit connection of arduino Uno R3 that is one of the most commonly used Arduino boards.

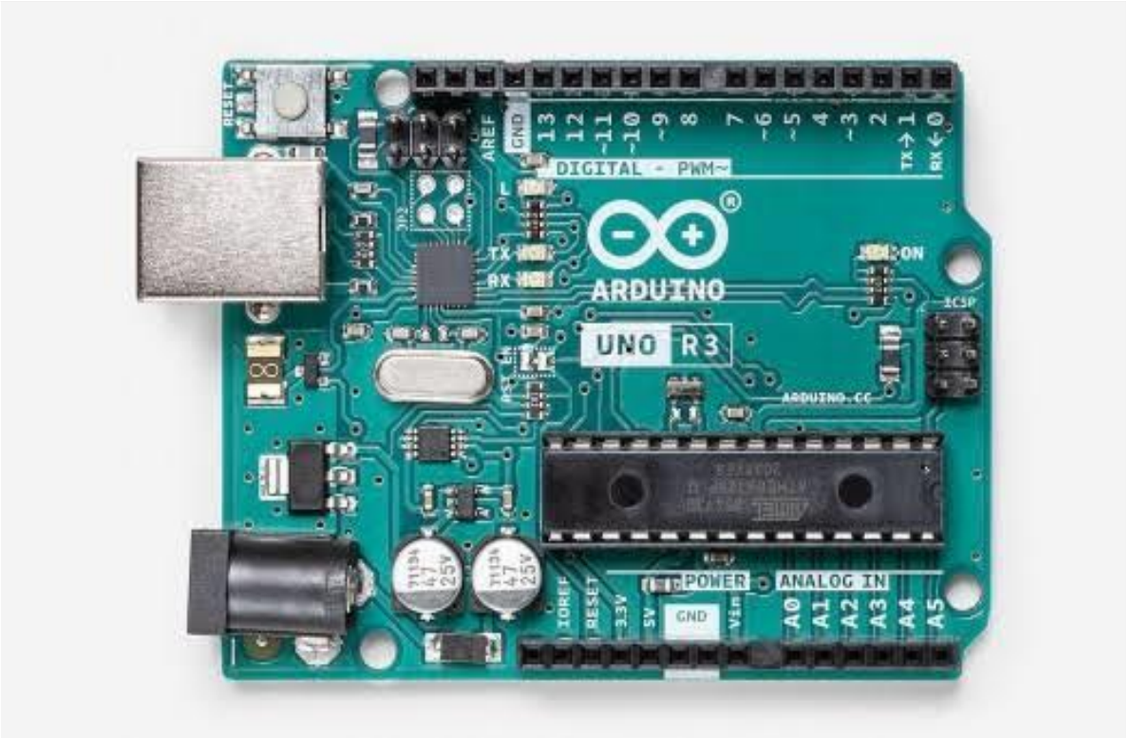

Fig 5.1: Arduino Uno

2. Ultrasonic sensor:

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. Ultrasonic sensors work by sending out a sound wave at a frequency above the range of human hearing. The transducer of the sensor acts as a microphone to receive and send the ultrasonic sound. Our ultrasonic sensors, like many others, use a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse. [6]

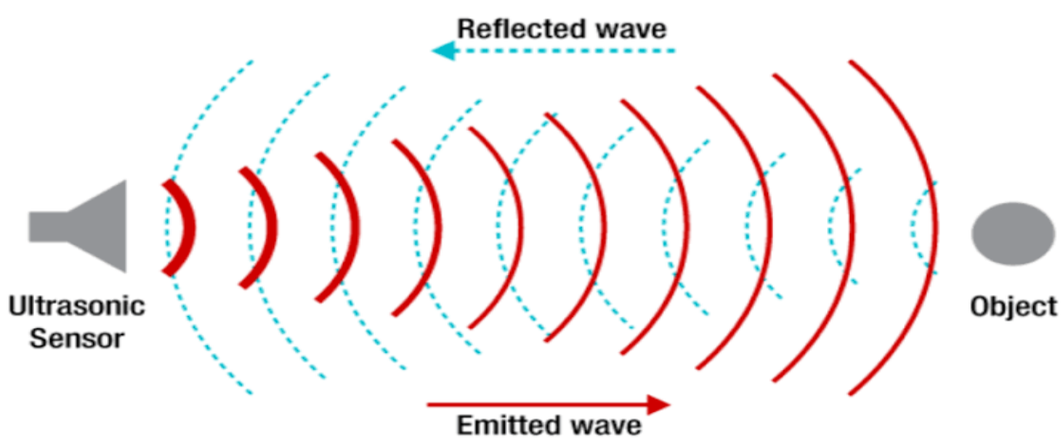

Fig 5.2: Ultrasonic sensor working

3. Laptop:

The last hardware component that we have used is a laptop. Rather than using a new laptop, we chose to use the one we use on a regular basis Both the Arduino and ultrasonic sensors are connected to the laptop.

5.2 Software implementation:

The software components used are

1. Arduino IDE
2. Python 3.7.1
3. PyAutoGUI module is used to control the data communication.

1. Arduino IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.[7]

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right-hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

2. Python 3.7.1

Python is an interpreted high-level general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant indentation. Its language constructs as well as its object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects

You'll cover the basics of Arduino with Python and learn how to:

1. Set up electronic circuits

2. Set up the Firmata protocol on Arduino

3. Write basic applications for Arduino in Python

4. Control analog and digital inputs and outputs

5. Integrate Arduino sensors and switches with higher-level apps

6. Trigger notifications on your PC and send emails using Arduino

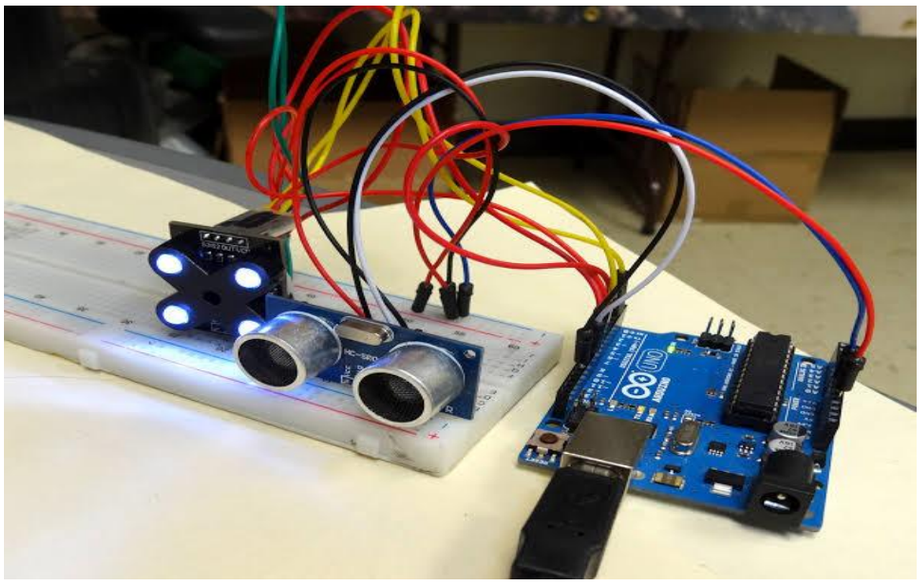

Fig 5.3: Connections on breadboard

3. PyAutoGUI module is used to control the data communication

PyAutoGUI lets your Python scripts control the mouse and keyboard to automate interactions with other applications. The API is designed to be as simple. PyAutoGUI works on Windows, macOS, and Linux, and runs on Python 2 and 3.[8]

PyAutoGUI has several features:

1. Moving the mouse and clicking or typing in the windows of other applications.

2. Sending keystrokes to applications (for example, to fill out forms).

3. Take screenshots, and given an image (for example, of a button or checkbox), find it on the screen.

4. Locate an application's window, and move, resize, maximize, minimize, or close it (Windows-only, currently)

5. Display message boxes for user interaction while your GUI automation script runs.

Chapter 6

DESIGN AND IMPLEMENTATION

This chapter deals with the overall methodology of the project and the flow chart associated with the workflow. Also the applications that are related to it are discussed in this section.

6.1 Working principle:

The hand gestures are sensed by the ultrasonic sensor to execute the computer applications such as volume change, scroll up/down during a website and tab change, window change, switching between tasks (Chrome and VLC Player), play/pause a video, etc. The main advantage of ultrasonic sensor is there will be no sound noise interference present in voice based controlled systems. No external hardware is required to read and control some external peripherals. In this system, ultrasonic sensor is directly interfaced with the computer. This methodology provides more flexibility and easy operation; even a nonprofessional can operate the HMI system. We will place two ultrasonic sensor on top of our laptop screen and it will be used to read the distance values from the ultrasonic sensor. The laptop can easily be operated from small distances and up to the range of pre-programmed distances. We will be using two ultrasonic sensor to measure the gesture as varying distance from the hand.[8]

The arduino will be programmed to read the distance of hand from ultrasonic senor. By reading the value of distance we can send certain actions to be controlled serially. The python program for this project is programmed in such a way that first we will be creating a serial port to establish the serial communication and with python would be to install the Pyautogui module also install Pyserial module. Inside while loop we repeatedly listen to the COM port and will compare with the keyword with any predefined work and will make the keyboard press accordingly.

6.2 Block Diagram:

The below diagram shows how the software and hardware parts are integrated to work together as a unit.

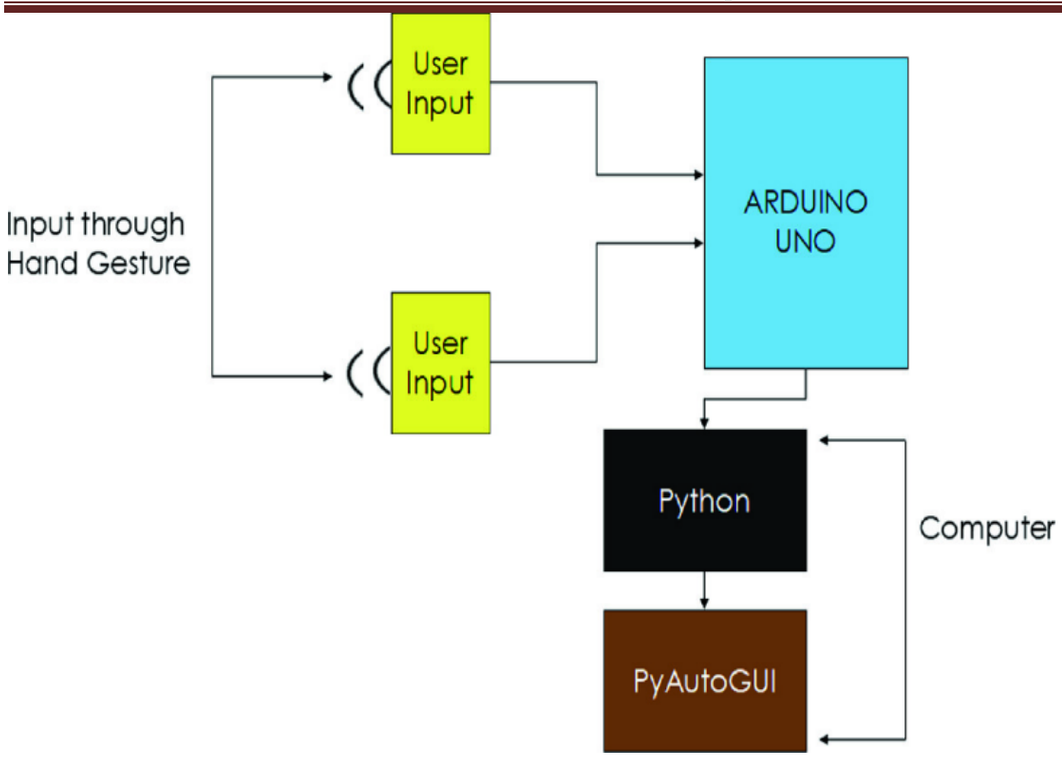

Fig 6.1: Block diagram of gesture controlled system.

The hardware section contains a Laptop, Arduino Uno Microcontroller, and an Ultrasonic senor. Similarly, in the software section, Arduino and Python IDEs (Integrated Development Environment) are used along with 'PyAutoGUI' - a python module that helps the Python scripts to directly control the mouse and keyboard to automate interactions with other applications. Coming to the hardware connections, in the below Figure, it is observed that two ultrasonic sensors are interfaced with the Arduino Uno board GPIO pins. The Arduino board is connected with the Laptop through USB port. The ultrasonic sensors comprise of two sensors; one acts as a transmitter and the second one is a receiver. The transmitter emits ultrasonic waves and travels until it bombards with the user hands. When the ultrasonic waves hit a surface of user hand and the reflected waves travelled back and received by the receiver part of the sensor. The time gap between transmission and reception is calculated to measure the distance of hand in front of the laptop. The operating system of the computer is not able to recognize the commands produced by the Arduino. Therefore, a background program is written in Python to detect the Arduino codes and produces the respective virtual hotkeys to run the applications. Python programming decodes the virtual keystrokes and respective hotkeys pre-programmed to execute the computer applications.

6.3 Flow chart of methodology:

The process flow of giving input as gesture to implementing the desired function is shown below briefly

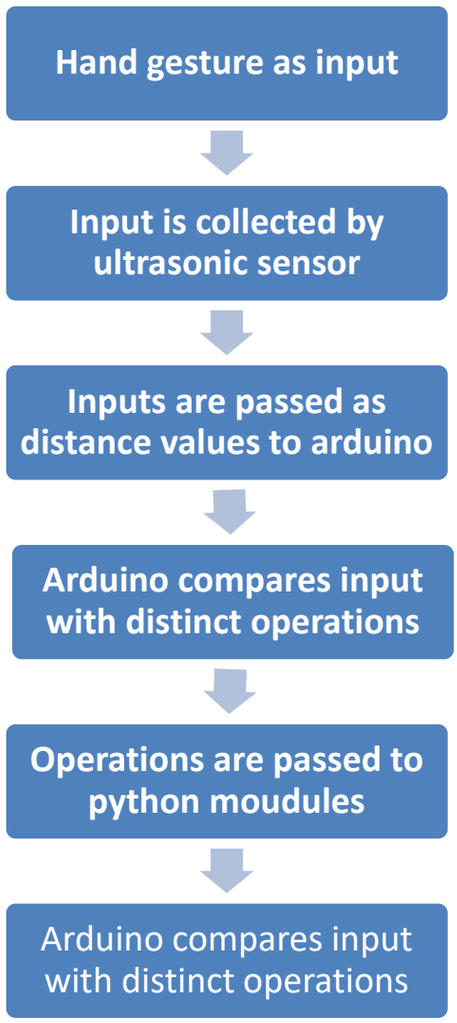

Fig 6.2 : Flowchart of process flow.

Ultrasonic sensor gets the distance value between hand and it as gesture. Gesture is nothing but the varying distance measured over period of time. These distance values measured are passed to arduino Uno via output pin (echo pin), the distance measured by sensor are stored in variables which are programmed in UNO board previously. Now based on pattern of varying distance certain command are passed via serial communication. The laptop is connected to computer via USB port .The operating system in the computer cannot recognize these values henceforth we will program the hotkey operation to be implemented by python programming. Firstly a serial port object is created to establish a serial communication with arduino board, the commands obtained based on gesture are received by serial port object. The command is converted as string variable and the string is passed to an infinite while loop where the python code decodes the keystrokes received and then implements the function accordingly.[3]

6.4 Circuit Diagram:

The circuit diagram of Arduino part of the project is shown in the following image.

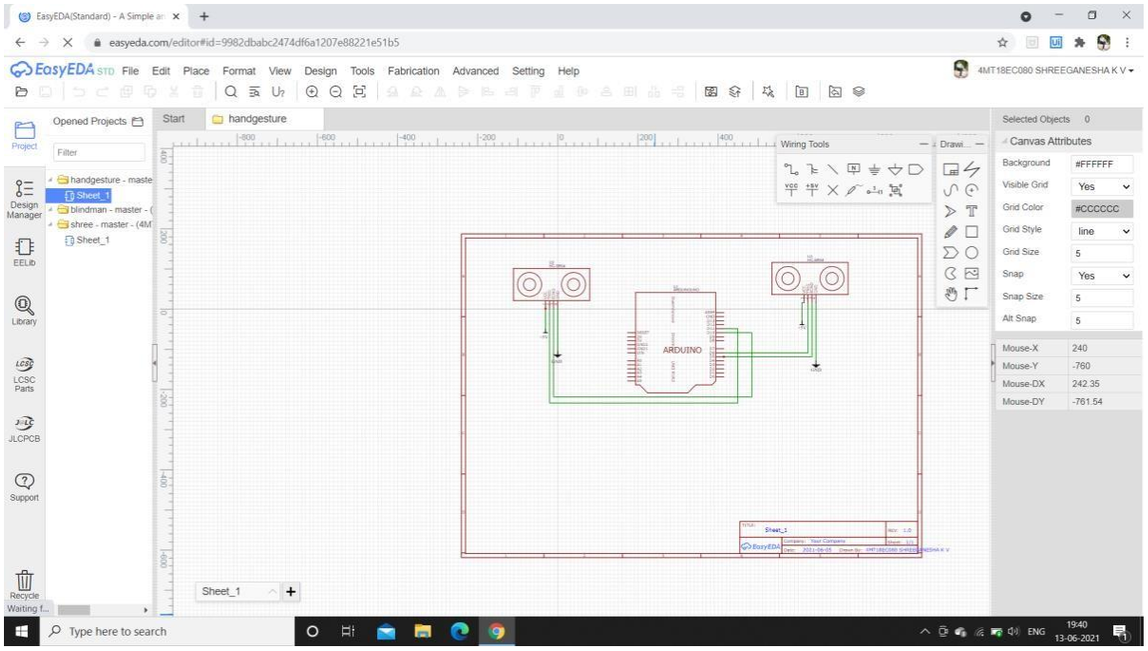

Fig 6.3: Online simulation

It consists of an Arduino UNO board and two Ultrasonic Sensors and you can power up all these components from the laptop's USB Port. The Trigger and Echo Pins of the first Ultrasonic Sensor (left sensor) are connected to Pins 11 and 10 of the Arduino. For the second Ultrasonic Sensor, the Trigger and Echo Pins are connected to Pins 6 and 5 of the Arduino.

Here the pin connected to trigger of sensor 1 (pin 11) is declared as variable named trigPin1 and pin10 connected to echo of sensor1 is named as echoPIn1. Similarly trigger and echo connections to sensor2 are named as trigPin2 and echoPin2 respectively.

Appendix:

```
const int trigPin1 = 11; // the number of the trigger output pin ( sensor 1 )
const int echoPin1 = 10; // the number of the echo input pin ( sensor 1 )
const int trigPin2 = 6;   // the number of the trigger output pin ( sensor 2 )
const int echoPin2 = 5;   // the number of the echo input pin ( sensor 2 )
long duration;
int distance1, distance2;
float r;
unsigned long temp=0;
int temp1=0;
int l=0;

void find_distance (void);



void find_distance (void)
{
  digitalWrite(trigPin1, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin1, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin1, LOW);

  duration = pulseIn(echoPin1, HIGH, 5000);// here this pulsein function wont wait more then
5000us for the ultrasonic sound to came back. (due to this it wont measure more than 60cm)

  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;
   }

}
```

Chapter 7

EXPERIMENTAL RESULTS & DISCUSSION

7.1 Simulation results:

The results of simulating and verifying the hardware functionality in Tinker card is shown below

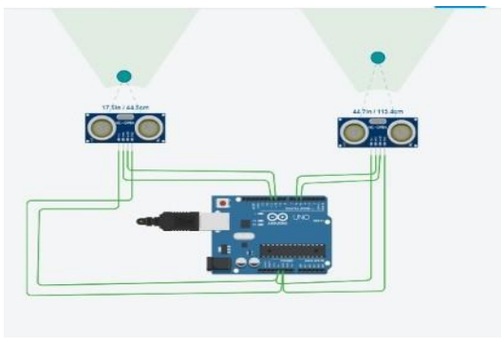

Fig 7.1: Simulation results using Tinker card.

The circuit diagram of Arduino part of the project is shown in the following image.

It consists of an Arduino UNO board and two Ultrasonic Sensors and you can power up all these components from the laptop's USB Port.

The Trigger and Echo Pins of the first Ultrasonic Sensor (left sensor) are connected to Pins 11 and 10 of the Arduino. For the second Ultrasonic Sensor, the Trigger and Echo Pins are connected to Pins 6 and 5 of the Arduino.

The dot there represents our hand when an obstracle is detected the sensor measures the distance from it and send the distance data to arduino. This is the function of hardware part.

7.2 Input specifications:

Model takes hand gesture as the input, gesture is nothing but the pattern of changing distance between our hand and ultrasonic sensor.

Gesture1: When we place our hand in front of left sensor (between 15 to 35cm) and move our hand away this will scroll down the webpage.

Gesture2: When we place our hand in front of left sensor (between 15 to 35cm) and move our hand towards it, this will scroll up the webpage.

Gesture3: When we place our hand in front of right sensor (between 15 to 35cm) and move our hand away this will decrease.

Gesture4: When we place our hand in front of right sensor (between 15 to 35cm) and move our hand towards it, this will increase the volume.

Gesture5: Swipe our hand in front of left sensor. This gesture will move to the next tab of browser.

Gesture6: Swipe our hand in front of right sensor. This gesture will move to the previous tab of browser.

Gesture7: Swipe our hand in front of both. This gesture will switch between task .

The prototype of Hand gesture controlled computer is shown in below figure

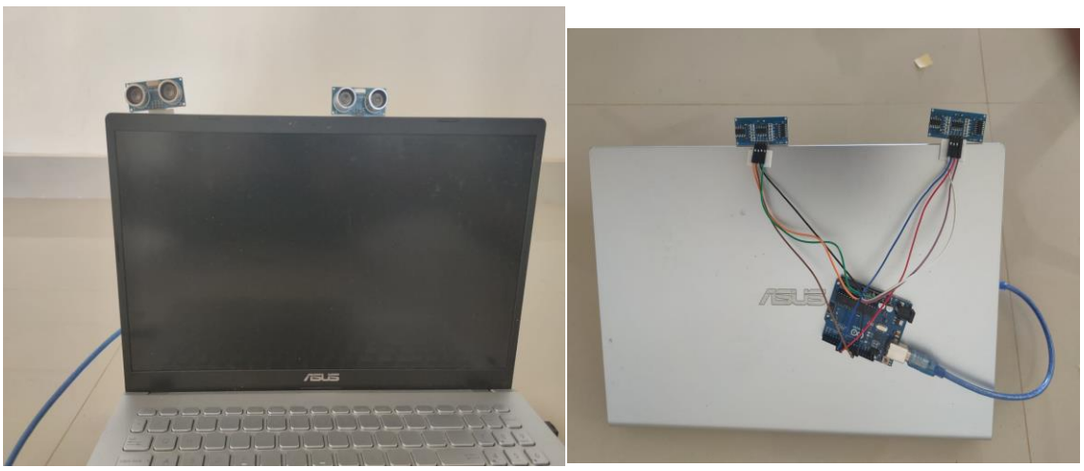

Fig 7.2: Prototype of Hand gesture controlled computer.

We placed both the ultrasonic sensor on top of the Laptop screen, one at the left end and the other at the right end. The double sided tape is used to hold these firm in laptop. Arduino is placed on the back of the laptop screen through double sided tape. Arduino and sensor gets power from laptop itself.

The serial message or command obtained as result of gesture is shown in the figure.

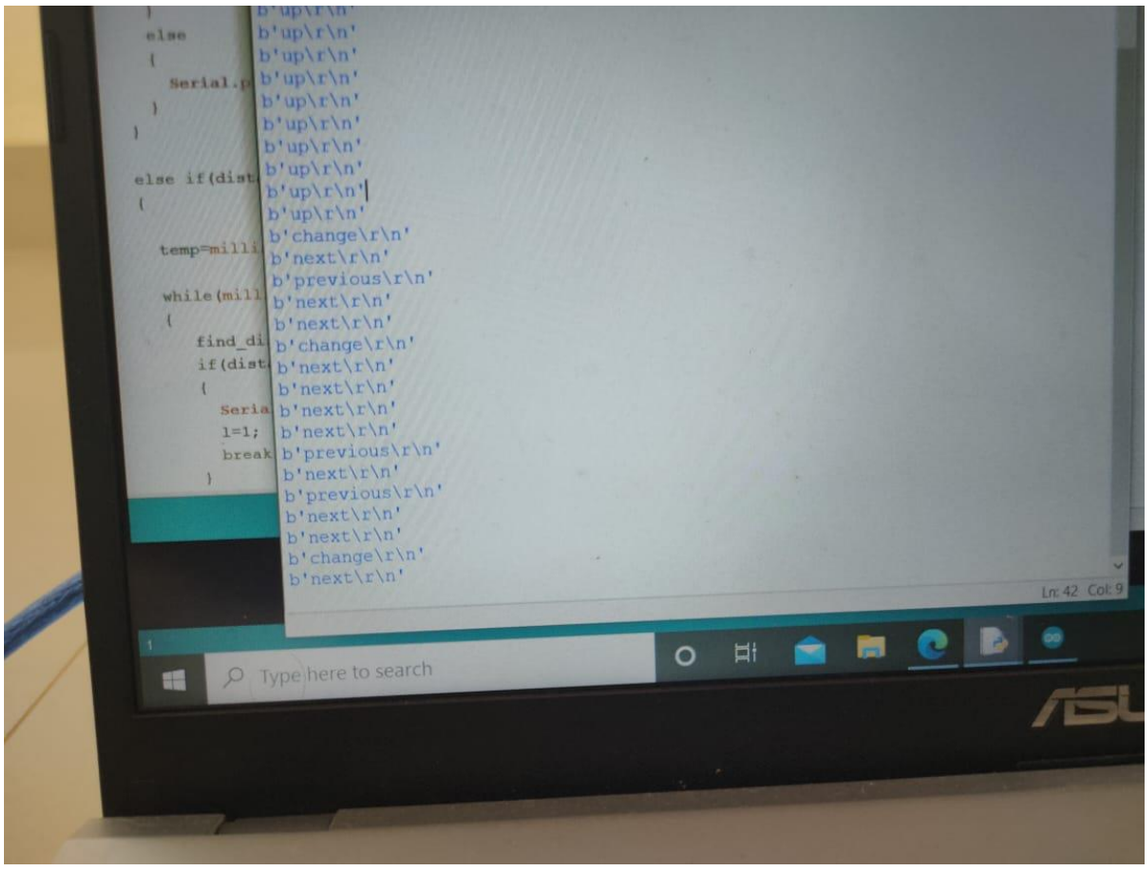

Fig 7.3:Output obtained in python command prompt.

The input to Python program is always collected through the pyserial and the corresponding operations are performed. These operations are controlling basic keyboard and mouse functions etc.., with help of PyautoGUI module. According to specified operation given as input by the Arduino pyserial, particular hotkeys combination of a keyboard can also be automated. The output can be obtained on a real-time basis on computer screen

The task implemented are: switch to next tab, switch to previous tab, web page scroll up, web page scroll down, volume up, volume down, switching between task, play/pause.

Chapter 8

CONCLUSION

The project mainly aimed in automating and implementing the certain hotkey function so as to be implemented universally. It is very fascinating to look at how the marketers, designers, academics and engineers will all be able to make use of this technology. The technology's entire agenda is to make one's life easier, to assist the physically challenged people in operating a system and also to avoid unnecessary physical to do certain basic computer task. This enhances user experience and also helps to standardize thee system. Text mining will be of greater scope in future as a lot of everyday data in form of text is generated. These type of gestures can be used to perform basic operation on a computer application. It's an open source project since the gesture can be changed and also the functions can be changed according to user's comfort. Hand gesture control can be used in virtual reality applications. Augmented reality is the boon nowadays and hand gestures can play a vital role. Reading sign language can be a future scope or can be an application of hand gesture.

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