# Human Machine Interaction Using Gestures

## *BE FINAL YEAR PROJECT*

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*Abstract :* For the interface between the human and computer the communication is needed, as humans communicate with each other by the means of speech, voice or any other actions so same as in digital world communication is needed so justice can be an important and very useful function for new technology in this era to interact with computer by means of these without touching any of the equipment. So human machine interface which is abbreviated as HMI technology which includes hardware and software that helps in communication or exchange of any data or any information between human beings and electronic gadgets or computer. The Basic goal of HMI is to interact between the user and computer and improve the computer usability and more efficient to use the functions of computer a laptop. So in spite of using any of the input devices like mouse keyboard or joystick pointer or any of these we can use a hand for the means of justice to provide input for the electronic gadgets or computer which which will return the output on the laptop screen. in this project we have used to under Sonic sensors and PF mountain two sensors and laptop screen and provided the input to the laptop or computer / PC by the means of hand gestures and and then the sensor will calibrate a convert the distance and provide to Arduino and further data will proceed with relevant information by using certain libraries in Python and then the output is shown on the screen. There are many functions which can be form using this technology but the functions which we have included in a project is what three main sectors first is for scrolling for shifting the web pages in any of the web browsers and second would be VLC media player by by performing certain actions like increasing the volume and decreasing the volume or playing the video or pause the video and third part would be, to control the actions in any of the game like to swipe either sides of the game or up down jumping in any of the game. So for doing this we have performed the programming in two softwares first is arduino IDE and second would be Python IDLE by including two libraries pyserial and Piautogui. Pyserial library is used personal communication and Piautogui is used to perform actions. And hence we successfully meet a girls by controlling the laptop or computer / PC.

*Keywords – Arduino, Ultrasonic Sensor, python, Pyautogui, pyserial.*

## I. INTRODUCTION

As in 21st century the era of Knowledge has flooded as with various fascinating and commendable Gadgets smartphones new generation species and many more. There are many new inventions and skills in the Technology Sector which has just evolved and changed our basic human needs with improvement and upgrading our lifestyles. So the interaction between human and computer is being used by the means of input and output devices but now it can also be used by means of gesture without touching the equipment, free hand gestures that can be equipped and used to interact with PC laptop.

Human interact in the physical world by the means of five senses. Hence gesture has been an important means of communication from quite old times like before ancient times when any language was not produce these gestures were used to communicate between each other. And to interact with computer is very important in this era for many of the actions to be performed and has become very important than ever before.

So a project is on interaction between human and computer by the means of gesture. The Gesture can be seized by by means of distance measurement camera or a data glove. It can also be taken by a Bluetooth or any of the waves like infrared waves of caustic tangible ocular or motion technical resources the rooted system design for precise switch purposes can be enhanced to diminish the extent and rate on the of the device and increased consistency and presentation. You might have seen robot which has been used to interact with computers just by one touch or sometimes it is touchless, so in a project we are using our hand to provide the input to the sensors and the sensor which we are using is ultrasonic sensor which is widely used to detecting the object and calibration the distance with very high accuracy. This technique to control the equipment by using gestures or touch less is also known as leap motion which enables to control the equipment by just waving hand in front of it. It is very cool and fancy technique for communication. The concept behind this is very simple like just to place the both the sensors on the laptop screen like to Mount the sensors on top of the screen and then to provide the input by the means of hand gestures and then after that the sensor will detect the hand and then calibrate the distance or convert those measured distance and provide it to the Arduino and then further those relevant information or those relevant data is then further provided to Python and by using certain libraries in Python like pyserial library and pyAutogui library the actions are performed on the laptop screen.

## II. DESCRIPTION

### 2.1 AIM:

The aim of the project is to implement a Arduino based hand gesture control of a computer where we can control specific applications using hand gesture.

## 2.2 OBJECTIVES:

a. To build the circuit that should understand the gestures accurately through ultrasonic sensors.
b. To do programming in python that it changes the distances restrained by together into suitable instructions for regulating certain movements or activities.
c. To permit the user, to grip numerous points of contribution and even describe various constraints at once.

## 2.3 METHODOLOGY:

In project we are going to build the gesture control laptop or PC, which is based on the combination of Arduino and Python. Apart from using any of the input devices like keyboard mouse or joystick, here the inputs are provided to the laptop or PC by using hand gestures. The basic principle of our project is that the inputs are provided by the means of hand gesture and then both the ultrasonic sensors which are mounted on the laptop screen, it detects the object and calibrate the distance and sends the information to the Arduino, and by using these relevant information certain actions are performed on the Laptop Screen.

Design:
The Pins of both the ultrasonic sensor is connected to the Arduino UNO Board via USB Cable, i.e the Trigger and Echo pins. And then this circuit is mounted on the laptop, where one sensor is placed at the right side and the other sensor is placed at the left side of the laptop screen. So is the whole design of our Project.

Programming in Arduino:
The Arduino programming is used to measure the distance by both the sensors into appropriate commands and convert or calibrate it to perform the certain actions. The the input given which is the hand gesture in front of the sensor is detected and then further calibrated to perform actions

Programming in Python:
For Python Programming we have used two libraries first pyserial library for serial communication with arduino through the correct Baud rate and then perform some basic keyboard actions. And pyAutogui library to control functions of mouse and keyboard and perform certain actions.

Change the hot keys:
We need to modify the certain commands in the VLC Media Player, to perform gestures and control the videos.
Keypress = Up Arrow - Action = Increase Volume of the video.
Keypress = Down Arrow - Action = Decrease Volume of the video.
Keypress = Ctrl + PgUp - Action = Play/Pause the video.

## 2.4 REQUIREMENTS:

| Hardware | Software |
|---|---|
| 1. Arduino Uno board<br>2. Ultrasonic Sensors<br>3. Jumping wires<br>4. USB cable<br>5. Laptop | 1. Arduino IDE<br>2. Python IDLE<br>3. Pyserial Library<br>4. Pyautogui Library<br>5. Proteus<br>6. VLC media player<br>7. Web Browser<br>8. Any Game |

## III. SOFTWARE DESIGN & SIMULATION

### 3.1 CIRCUIT DIAGRAM:

The circuit diagram of Arduino part of the project is made known in the next image. It entails of an Arduino UNO board and two Ultrasonic Sensors and you can power up and about all these mechanisms from the laptop's USB Port.
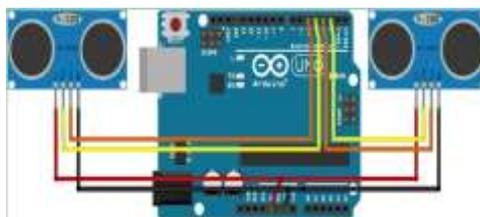


### 3.2 CIRCUIT DESCRIPTION:

Arduino UNO :-
➤ Atmega – 8 bit AVR family microcontroller.
➤ 5 V Output vol.
➤ Flash memory of 32KB ( of which 0.5 KB is used by bootloader)
➤ Digital Input/Output Pins: 14
➤ Analog Pins: 6
➤ SRAM: 2 KB

Ultrasonic Sensor (HC-SR04)
➤ VCC Pin –5 V power supply
➤ Trig- Trigger input pin
➤ Echo- Receiver output pin
➤ GND- Ground

- ➢ EEPROM :1 KB
- ➢ 1 UART
- ➢ 1 I2C
- ➢ 1 SPPI

### 3.3 SOFTWARE SIMULATION:

In software simulation we have used two Softwares, first is Arduino IDE, which is Arduino Integrated development environment which can be used in Windows, Mac OS, and Linux and the functions are written in C and C++ language. An Arduino IDE is used to write the arduino code and upload it to the arduino compatible boards. The features or characteristics are mentioned above. For Writing the code in arduino IDE there are two basic functions required first is for initial the sketch and second would be the main program loop they are compiled and related with the program stub main() into an executable program which includes the GNU toolchain and also includes the IDE Distribution.

As now 2nd software which we are using is python IDE which is python integrated development and learning environment which includes the default implementation of the language sons 1.5.2 B1. Python includes packaging with many Linux distribution. and in Linux we can able to download and find the Python ideal using your package manager and once you have installed the software there are many advantages and many features which includes in Python which are now used in each and every sector like, for basic Syntax highlighting, code completion auto indentation and there are many inbuilt functions which can directly be used in Python for application of our purpose. so we have written R code in Python ideal which includes two basic libraries which is pi serial and Pi autogui.

### 3.4 INSTALLING LIBRARIES:

PyAutoGUI:

PayAutoGUI is used to allow the python scripts to control the mouse and the keyboard. This is used to automate the communications with the other bids. PyAutoGUI works on windows, Mac OS and Linux. It runs on python 3 and python 2. PyAutoGUI is a GUI automation module and it is cross-platform. To control the mouse and keyboard in a programatical manner, Pip install pyautogui is used. To control the actions of mouse such as left-click, right-click scroll up, scroll down etc. we will write a python program using PiAutoGUI. We will also perform keyboard actions like enter, key press, multiple keypress without actually physically doing them with the help of python programming and with the assistance of Pyautogui.

Steps to install PyAutoGUI:

- By using the administrative privileges open command prompt and move to the directory where python is installed.
- If you have installed the newest python version in your laptop then "pip" which is a tool for installing packages in python should be already installed. So to check whether python is installed in the laptop or not the subsequent command should be typed, Pip-V
- Upgradation to the newest package of paper should be done using the subsequent command:

Python -m pip install -upgrade pip  OR

Python -m pip install -U pip

(This step can be ignored if pip is already in it's newest version.)

- The next step is to install PyAutoGUI. The subsequent command should be tied for the installation of PiAutoGUI

pip install pyautogui OR

Python -m pip install pyautogui
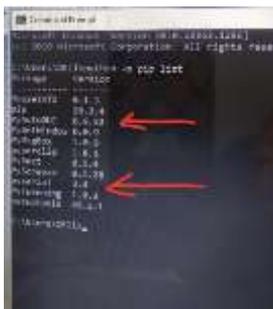


Figure : Installation of Libraries.
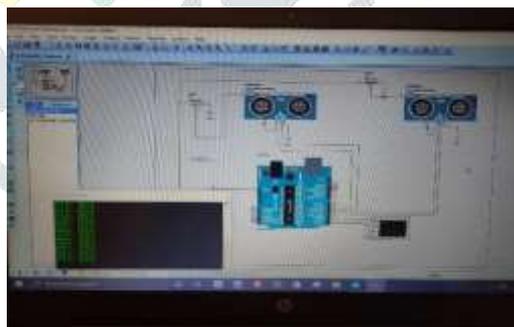


Figure: Simulation

### 3.5 SIMULATION

The Proteus design suite is used primarily for electronic design automation. This software is highly used in electronic design by various technicians for creating schematics and various electronic prints. The software is used for manufacturing of printed circuit boards which is called as PCB.

Protest software can be used for simulation, schematic capture and designing of PCB. This software was developed by Labcenter electronics. It can be cast-off for digital simulations such as microcontrollers and microprocessors. Popularity of proteus design software has increased in recent times due to its simplicity and user-friendly design. It can be used for simulation of LED, LDR, USB communication, etc.

**IV. OPERATING INSTRUCTION & HARWARE**



Figure: Hardware

The gestures that need to be performed for the operation of Web Browser are:

- Gesture 1: Keep your hand before the right ultrasonic sensor at a distance of around 15 to 35 cm for a short time and move your hand away from the sensor. It will scroll down the webpage or decrease volume.
- Gesture 2: Keep your hand before the right ultrasonic sensor at a distance of about 15 to 35 cm for short time and move it towards the sensor. This will scroll the webpage upwards or increase the volume.
- Gesture 3: Swiping your hand before the Right Ultrasonic Sensor will switch to the Next Tab.
- Gesture 4: Swiping your hand before the Left Ultrasonic Sensor will switch to the Previous Tab.
- Gesture 5: Keep your hand before the left Ultrasonic Sensor at a distance of 15cm to 35cm for a short time and move your hand away from the sensor. This gesture will change the tab.
- Gesture 6: Keep your both hands before the Ultrasonic Sensor at a distance of around 15cm to 35cm for a short time. This gesture will press the enter key.

The gestures that need to be performed for the operation of VLC media player are:

- Gesture 1: Keep your hand before the Right Ultrasonic Sensor at a distance of about 15cm to 35cm for a short time and move it away from the sensor. It will Decrease the Volume
- Gesture 2: Keep your hand before the Right Ultrasonic Sensor at a distance of about 15cm to 35cm for a short time and move it towards the sensor. This will Increase the Volume.
- Gesture 3: Keep both the hands before the Left Ultrasonic Sensor and it will Play or Pause the video.
- Gesture 4: Keep your hand before the Left Ultrasonic Sensor at a distance of about 15cm to 35cm for a short time and move it towards the sensor. This action will forward the video.
- Gesture 5: Keep your hand before the left Ultrasonic Sensor at a distance (between 15CM to 35CM) for a small duration and move your hand away the sensor. This gesture will rewind the video
- Gesture 6: Swipe your hand in front of both the sensors (Left Sensor first). And this gesture will Switch between Tasks.

The gestures that need to be performed for the operation of Gaming are:

- Gesture 1: Keep your hand ahead of the Right Ultrasonic Sensor at a distance of around 15cm to 35cm for a short time and swipe your hand. This action will take you towards the Right direction .
- Gesture 2: Keep your hand ahead of the Left Ultrasonic Sensor at a distance of about 15cm to 35cm for a short time and swipe your hand. This action will take you towards the left direction.
- Gesture 3: Keep your hand ahead of the Right Ultrasonic Sensor at a distance of around 15cm to 35cm for a short time and move it towards the sensor. This action will take you to an Upward direction.
- Gesture 4: Keep your hand ahead of the Left Ultrasonic Sensor at a distance of around 15cm to 35cm for a short time and move it towards the sensor. This action will take you to a downward direction .
- Gesture 5: Keep both your hands in front of the Left Ultrasonic Sensor and this action will Play or Pause the Game.

**V. RESULTS**

- The computer will recognize the hand gestures by the user and use it as an input function to perform a particular task in accordance to the given gesture.
- This method of gesture recognition by by means of ultrasonic waves is precise and consistent.
- Movement of a solo or many hands can be used for testing the circuit.
- Movement of a solo hand was detected precisely whereas when multiple hands were moved, the movement was not noticed properly and the operations in the laptop were not performed properly.
- The background area did not affect the working of the project and any movement in the background area was not detected.
- The detection was not affected by the noise in human audible range.

➢ For Web Browser
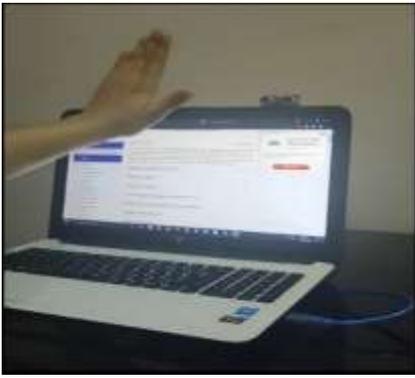
Figure: Output of Web Browser Controlling
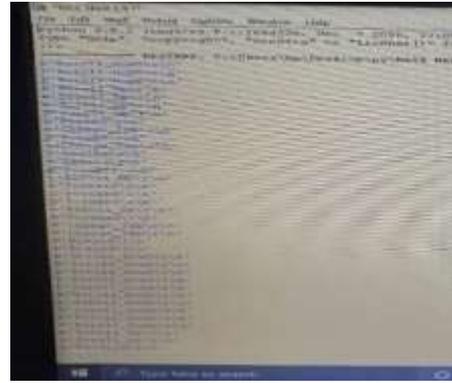


Figure: Python Output

➢   For VLC Media Player :



Figure: Output of Video Controlling
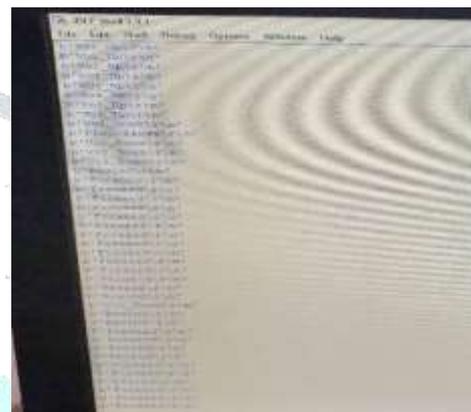


Figure: Python Output

➢   For Gaming :



Figure: Output of Game Controlling
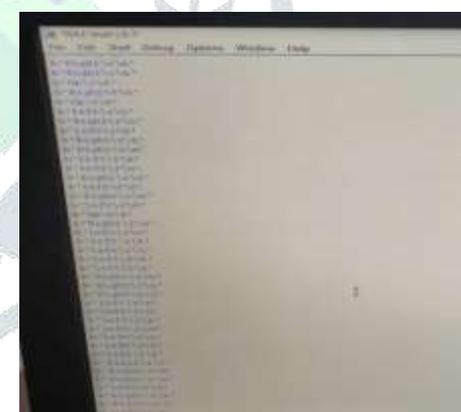


Figure: Python Output

## VI. CONCLUSION

This project of controlling the laptop using hand gestures can be used for decreasing the use of input devices for computer interaction and using simple gestures for input. This increases the interactivity with the machine. If it gets mixed with the hologram technology it will be more effective as it will result in interaction by computer-generated 3D objects in real time in the physical world.

➢   With slight modifications in the python programming many features can be added
➢   This module can be integrated for many other designing and editing applications.
➢   A company called leap motion has already been working on gesture based control of computer.
➢   This technology can be used in virtual reality, agumented reality, reading sign language, 3D design, etc

### 6.1   APPLICATIONS :

Gesture recognition technology is useful in following areas:

a.   Gaming : To provide a additional communicating and immersive practice to users gesture recognition technology can be used for interaction with gaming console
b.   Control using facial gestures: This knowledge can be used for facial gesture recognition. This technology can be used for ease is in the interaction with the machine and can also be further used for applications like mood sensing.
c.   Education: This kind of technology can be used in various areas like education for interactive learning.

d.　Remote control: This technology can also be used as a remote controller for numerous devices likeTV, laptop,etc.

e.　Controlling Home Appliances : We can use this technology to regulate the household appliances.

## VII. ACKNOWLEDGMENT

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