

Control of Devices by Hand Gestures

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Abstract — *Gesture control technology is gaining importance because of the rapid increase in automation. Laptop Control Using Hand Gestures is one such technique to detect gestures made by hand or body which act as an input to communicate with the PC or laptop. In this project we have made use of hardware components including Arduino UNO, Ultrasonic Sensors (Range Sensors) and connecting wires along with Arduino code and Python code for implementation of the project. The Ultrasonic sensor detects the hand gestures and this when integrated with Arduino and Python code performs actions accordingly on the laptop screen. This technology is rapidly in the field of VR, AR, 3D Design, medical, etc. It will be quite handy for paralyzed patients. Since they have great difficulty in controlling the mouse and typing on the keyboard, they can easily perform hand gestures which perform actions accordingly on the screen. One of the key areas which requires development is sensing gestures accurately. We feel that if we are successful in meeting our goals then we will consider ourselves as contributors to the future of natural gesture based interfaces.*

Keywords — *Hand gesture, Ultrasonic sensors, Arduino UNO, Python*

I. INTRODUCTION

This project is about controlling a laptop using hand gestures. This technique is called leap motion. Leap motion is a technology of controlling a PC device or Mac using hand movements. In this project we have used Arduino and Python to perform software applications. We have used python based PyautoGUI library and Embedded C. We have used this project as a simple demonstration for this technology. This technology can be used in a much wider application in various fields.

For a long time, the keyboard and mouse served as important devices for input of commands for the computers. But, with the increase in popularity of ever-present gadgets

like PlayStations, etc. and devices which permit the users to have hold of virtual objects, gesture control using the hand is very essential. Research on gesture control technology began in the early 1980s. Initially there was usage of voice control and specially designed hand gloves to communicate with things located on a big screen. Experimentation in this field began in the 1990s which was like an aid for the disabled people. This included a web interface by IBM which was mainly camera based and controlled home appliances by a wearable pendant. There were several developments in this field further. Experiments on mobile touch screen gesture models were published in 2011 which resulted in an industrial design view point on pointing devices accepted as an input.

Gesture control technology can bring major developments in the education sector. Currently use of technology in the teaching and learning sector is not adopted. This is primarily because of two reasons. Firstly because of drastic change in syllabus from one subject to other. To make this technology accessible in academics, there is a requirement of extensive customisation of software, which highlights the need of developers. Most of the universities do not have access to these resources to carry forward their work. Secondly because of inaccuracy of gesture control devices. Calibration and control of devices is time consuming as it requires training and practicing. For adopting gesture control technology in the education sector, we will require special purpose applications designed for educational purposes, which will be cheaper for individual development.

II. LITERATURE REVIEW

In today's field of science and technology, Automation is a big part of it. Gesture recognition is important in automation to translate human gestures using different computer visions techniques and algorithms. Most common gestures are of face and hands. Tracking and recognizing gestures and their representation and using them for commands is referred to as gesture recognition.

The starting approach of interaction with computers using hand gestures was first projected by Myron W. Krueger [1]. The mouse cursor control was performed with the help of an external webcam (Genius FaceCam 320), which is a software package that interprets hand gestures. It then turns the recognized gestures into OS commands that control the mouse actions on the display screen of the computer device [2]. The following research paper contains a method on calculating the length from the hand to the sensors and

correspondingly an action will be performed. Few actions have been coded in the device using Arduino and Python code, then accordingly a particular function is performed. The placement of Ultrasonic sensors is done on the device (computer or laptop) at the top of the screen to ensure quick operation. Previous works were done related to hand recognition, recognition of alphabet characters and real time finger recognition[3]. Inclusion of real time HCIs (Human Computer Interactions) ensure functions like video control, music player, gaming, etc.[4]. These types of systems always require a physical device to recognise body movements so that the computer identifies them[5]. For this purpose we have used Ultrasonic sensors which act as an input and thus distance of hand can be found. According to distance of hand, corresponding action will be executed on the computer.

III. METHODOLOGY/EXPERIMENTAL

A. *Materials/Components:* following components are used for implementation of proposed system.

Components: -

- Arduino UNO x 1 - Controls the hardware components
- Ultrasonic Sensors x 2 - Measures the distance to an object using ultrasonic sound waves.
- USB Cable (for Arduino)-For Software-Hardware Integration
- Few Connecting Wires - Divided into compensating cables and extension cables.
- A Laptop having internet connectivity- For implementing the project

B. *System design* - The Echo and Trigger Pins of Ultrasonic Sensor, which is located on the left of the screen, are connected to Pins 10 and 11 of the Arduino UNO Board. For another Ultrasonic Sensor, the Echo and Trigger Pins are connected to Pins 5 and 6 of the board[4].

We require two ultrasonic sensors (Left and Right) which are connected to the Arduino Uno board. We've mounted the two sensors on the head of the device screen using two-sided sellotape. Arduino is kept on the back of the screen using double-sided tape.

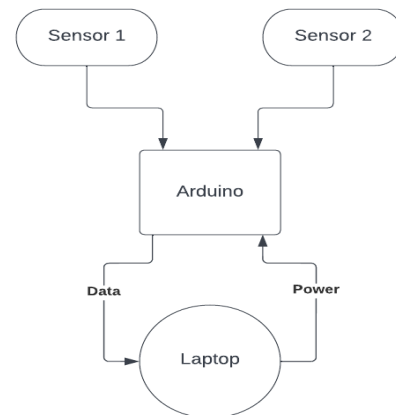


Fig 1: System Design

C. *System Flow chart:*

Firstly we run the Arduino code and then we run the python code. This completes our coding and designing part. Following are some hand gestures we defined for demonstration purpose:

1. Place your both hands in front of both sensors (in between 25cm to 50cm). It will Play/Pause the video.
2. Keep your hand before the Right sensor (Between 10cm to 20cm) and then push your hand ahead($x < 15\text{cm}$). It will rewind the video.
3. Keep your hand before the Right sensor (Between 10cm to 20cm) and then pull your hand back($40\text{cm} > x > 20\text{cm}$). It will forward the video.
4. Keep your hand before the Left sensor (Between 10cm to 20cm) and then push your hand ahead($x < 15\text{cm}$). It will raise the volume.
5. Keep your hand before the Left sensor (Between 10cm to 20cm) and then pull your hand back($40\text{cm} > x > 20\text{cm}$). It will decrease the volume.
6. Maintain your hand before the Right sensor (Between 0cm to 8cm). It will turn the video to Fullscreen.

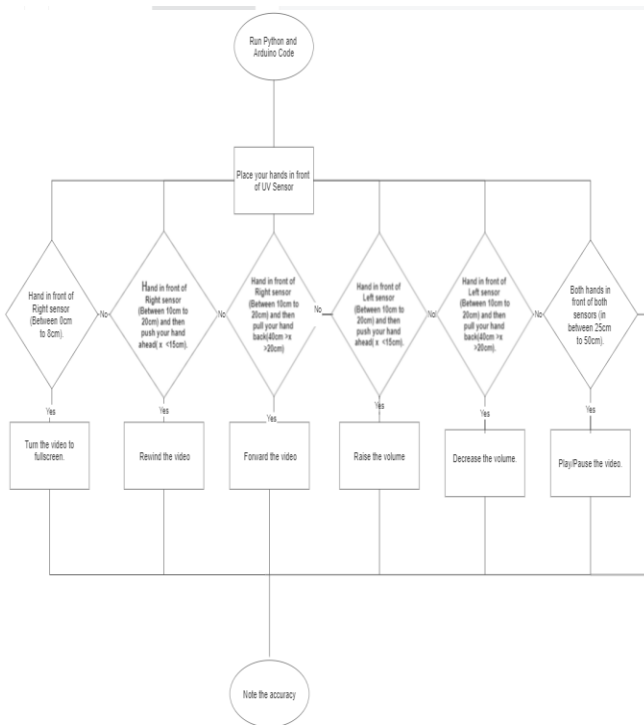


Fig 2: Project Flowchart

IV. RESULTS AND DISCUSSIONS

Hand gesture detection by making use of ultrasonic sensors is useful in many test cases as it is accurate and reliable. The functions involving the movement of the hand are less accurate as compared to others. Hand detection only occurs when hands are in the line and range of ultrasonic sensors. In our project, we defined some hand gestures that are used to do a certain task without using a mouse or a keyboard. Results obtained from experimentation stating the accuracy of operation are presented in Table 1.

Sr no	R Lock	L Lock	R (in cm)	L (in cm)	Result	No. of Tests	Positive outcomes	Success Rate(In %)	Accuracy
1	-	-	25 < x < 50	25 < x < 50	Play/ Pause	20	18	90	High
2	10 < x < 20	-	3 < x < 15	-	Rewind	20	13	65	Medium
3	10 < x < 20	-	20 < x < 40	-	Forward	20	15	75	Medium

4	-	10 < x < 20	-	3 < x < 15	Raise the volume	20	13	65	Medium
5	-	10 < x < 20	-	20 < x < 40	Lower the volume	20	14	70	Medium
6	-	-	-	3 < x < 8	Full screen mode	20	19	95	High

Table 1 Accuracy of operation

V. FUTURE SCOPE

Laptop control using hand gestures is futuristic technology which is evolving rapidly these days. We can use advanced technology to hand gesture technology in manufacturing industries to eliminate human labor. It can help dumb and deaf students to control laptop or any other electronic item without facing any technical problem or without any support. This gesture recognition technology can be also used in hospitals to recognize patients' needs with actions only or without saying a single word.

VI. CONCLUSION

Gesture control technology is simply a way to interact between Human and Computer. The system is cost-effective as it utilizes Arduino UNO and UV sensors only. The python IDE enables integration with Arduino UNO to help various controlling as well as processing ways for creating new gesture control solutions. It indeed helped in understanding the applications of modern and advanced technology. This technique also assisted in eliminating the use of mouse and keyboard for operating laptops. If we are successful in eliminating all the loopholes of this system, then truly it will be of great benefit to everybody.

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