Arduino Uno Hand Gesture Control

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Objective

Gesture based interaction systems are becoming very popular both at workplace and home. This work intends to develop a system which can recognize hand gestures which can be used as an input command to interact with the PC or laptop such as switching to next tab in a web browser, scroll up/down in a web page to name a few.

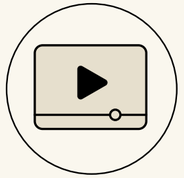
Motivation

We were really fascinated by the upcoming new wireless tv where people can just change channels using their hands so we wanted to do something with just our hands to change the browsers in our laptop/PC and hence this. Also, this type of hand gesture control of computers can be used for VR (Virtual Reality), AR (Augmented Reality), 3D Design, Reading Sign Language, etc.

Abstract

This work intends to develop a system that can recognize hand gestures that can be used as an input command to interact with the PC or laptop. The input is given with the help of a pair of ultrasonic sensors. The sensors are used to calculate the changes in the distance of our hand movements while giving the gesture. The Arduino will calculate the changes in distance and recognize the action done by the user. The Arduino will request the system processor to perform the requested action by the user. The time taken to perform basic operations like open, minimize, maximize, play, save, etc., operations are reduced because of this proposed model.

Literature Survey



The First Source

Godwin Ponraj et al. worked on sensor fusion of leap motion controller and flex sensors using kalman filter for human finger tracking. It contains a wearable glove which can be worn over hands to provide gestures. It needs to be charged on every time interval and requires High maintenance

The Second Source

Patsakorn Rittitum et al. developed digital scrum board using leap motion. It is a very costly system. It consists of a leap motion sensor and a wearable device.

The Third Source

Leigh Ellen Potter and others also worked on the leap motion sensor. It was named as “The Leap Motion controller: A view on sign language.” It is mainly designed to understand Australian signs. It is very costly and contains less accuracy.

The Fourth Source

Lucy Dodakian designed free-hand interaction with leap motion controller for stroke rehabilitation. The system ranges to very high cost. It consists of a leap motion sensor and a wearable device.

The Fifth Source

Meenakshi Panwar had designed hand gesture recognition based on shape parameters. It uses infrared sensors to detect gestures. The recognition was very slow and less accurate.

Summary of Literature Survey

The previous existing systems are hand gesture control system [1, 2] using leap motion devices. Hand gesture recognition based on shape parameters detects sharp gestures only. It follows all the basic principles for gesture detection. Motion acknowledgment decides the client expectation through the acknowledgment of the signal or movemessnt of the body or body parts.

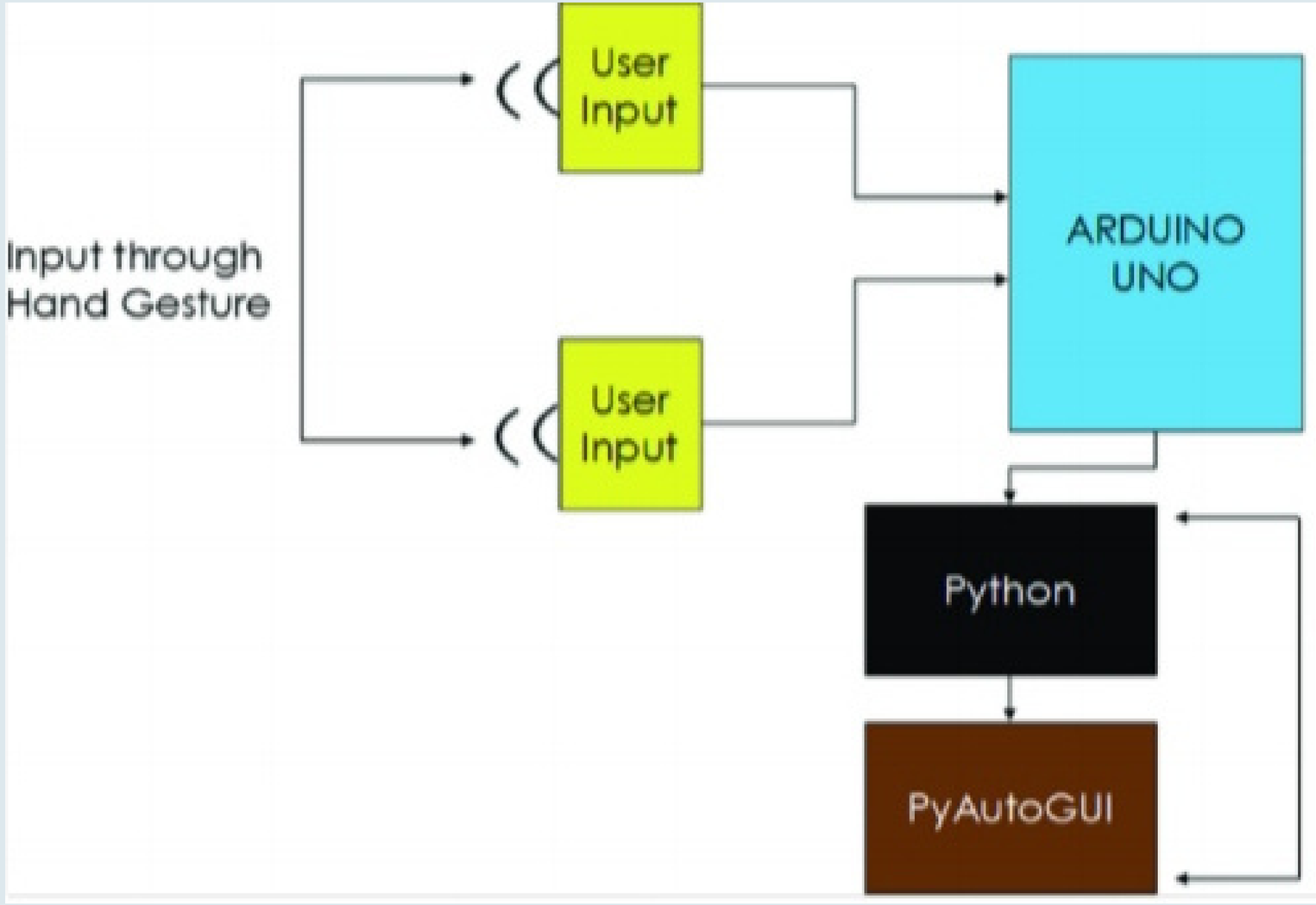
Drawbacks of Existing System

These systems are very costly and use various other sensors. These systems are not affordable by common people. It was basically designed for Australian people’s. It uses an infrared sensor to detect the movement and detection is not accurate

Proposed Work

We are proposing 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.

Architecture Diagram



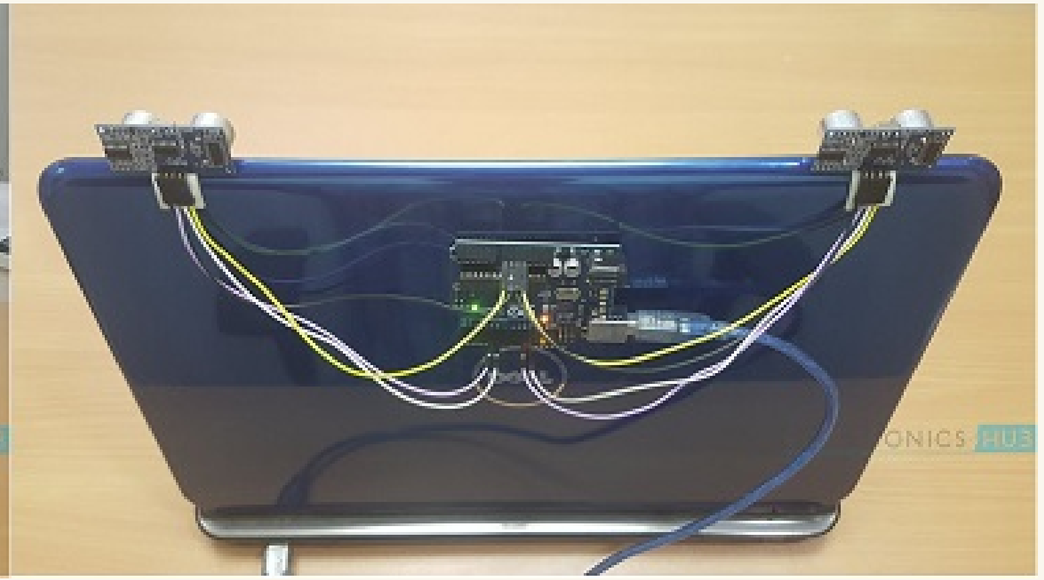
Concept

The principle behind the Arduino based Hand Gesture Control of Computer is actually very simple. All you have to do is use two Ultrasonic Sensors with Arduino, place your hand in front of the Ultrasonic Sensor and calculate the distance between the hand and the sensor. Using this information, relevant actions in the computer can be performed.
The position of the Ultrasonic Sensors is very important. Place the two Ultrasonic Sensors on the top of a laptop screen at either end. The distance information from Arduino is collected by a Python Program and a special library called PyAutoGUI will convert the data into keyboard click actions.

Design of the Project

The design of the circuit is very simple, but the setup of the components is very important. The Trigger and Echo Pins of the first Ultrasonic Sensor (that is placed on the left of the screen) 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. Now, coming to the placement of the Sensors, place both the Ultrasonic Sensors on top of the Laptop screen, one at the left end and the other at right. You can use double sided tape to hold the sensors onto the screen. Coming to Arduino, place it on the back of the laptop screen. Connect the wires from Arduino to Trigger and Echo Pins of the individual sensors. Now, we are ready for programming the Arduino.


DELL



Explanation

. Two ultrasonic sensors with the Arduino Uno are used as the main components to implement the project and to get the desired output. In this paper, a technique is being introduced, which is based on determining distances by the ultrasonic sensors. According to the specific distances, particular functions are performed. Some gestures are proposed in this new technique and then the actions are recognized by the sensors and then functions are performed according to the instructions given by the user. Here, a few mainstream methods are used, based on hand action recognition by ultrasonic sensors.

The respective distance information is collected by the Arduino UNO, using Python programming and a library called PyAutoGUI which converts the data into click action. Hand gesture recognition system can be used for many different functionalities, such as video control, music player control, Microsoft application control, and chrome handling. All these interactions are real-time gesture recognition. By using the ultrasonic sensor, the distance of hand acts as an input. Depending on the respective distances of hand, particular functions are performed in the system

The hand gestures in front of the Ultrasonic sensors can be calibrated so that they can perform five different tasks on your computer. Before taking a look at the gestures, let us first see the tasks that we can accomplish.

- Switch to Next Tab in a Web Browser
- Switch to Next Tab in a Web Browser
- Scroll Down in a Web Page
- Scroll Up in a Web Page
- Switch between two Tasks (Chrome and VLC Player)
- Play/Pause Video in VLC Player
- Increase Volume
- Decrease Volume

Code

Arduino Code:

```
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 )
////////////////////////////////// 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);// 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)
// it helps this project to use the gesture control in the defined space.
// so that, it will return zero if distance greater then 60m. (it helps usually if we remove our hands infront of the sensors).

r = 3.4 * duration / 2; // calculation to get the measurement in cm using the time returned by the pulsein function.
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); // initialize the trigger and echo pins of both the sensor as input and output:

pinMode(echoPin1, INPUT);
pinMode(trigPin2, OUTPUT);
pinMode(echoPin2, INPUT);
delay (1000);
}
void loop()
{
find_distance();
if(distance2<=35 && distance2>=15) // once if we placed our hands in front of the right sensor in the range between 15 to 35cm this condition becomes true.
{
temp=millis(); // store the current time in the variable temp. (" millis " Returns the number of milliseconds since the Arduino board began running the current program)

}
}

else if(distance1<=35 && distance1>=15) // once if we placed our hands in front of the left sensor in the range between 15 to 35cm this condition becomes true.
{

temp=millis();

while(millis()<=(temp+300))
{
find_distance();
if(distance2<=35 && distance2>=15) // if our hand detects in the right sensor before 300 milli seconds this condition becomes true. (usually it happens if we swipe our hand from left to right sensor)
{
Serial.println("change"); // send "change" serially.
l=1; // store 1 in variable l. (it avoids the program to enter into the upcoming if condition)
break; // break the loop.
}
}

```
if(l==0) // this condition will become true, only if we swipe our hand in front of left sensor.
{
Serial.println("previous"); // send "previous" serially.
while(distance1<=35 && distance1>=15) // this loop will rotate untill we removes our hand infront of the left sensor. this will avoid not to enter this if condition again.
find_distance();
}
l=0; // make l=0 for the next round.
}

}
```

The Python Code for Arduino based Hand Gesture Control of Computer is given below:

```
import serial # add Serial library for serial communication
import pyautogui # add pyautogui library for programmatically controlling the mouse and keyboard.

Arduino_Serial = serial.Serial('com12',9600) # Initialize serial and Create Serial port object called Arduino_Serial

while 1:
incoming_data = str (Arduino_Serial.readline()) # read the serial data and print it as line
print incoming_data # print the incoming Serial data
```

if 'next' in incoming_data: # if incoming data is 'next'
pyautogui.hotkey('ctrl', 'pgdn') # perform "ctrl+pgdn" operation which moves to the next tab

if 'previous' in incoming_data: # if incoming data is 'previous'
pyautogui.hotkey('ctrl', 'pgup') # perform "ctrl+pgup" operation which moves to the previous tab

if 'down' in incoming_data: # if incoming data is 'down'
#pyautogui.press('down') # performs "down arrow" operation which scrolls down the page
pyautogui.scroll(-100)

if 'up' in incoming_data: # if incoming data is 'up'
#pyautogui.press('up') # performs "up arrow" operation which scrolls up the page
pyautogui.scroll(100)

```
if 'change' in incoming_data: # if incoming data is 'change'
pyautogui.keyDown('alt') # performs "alt+tab" operation which switches the tab
pyautogui.press('tab')
pyautogui.keyUp('alt')

incoming_data = ""; # clears the data
```

NOTE:

- Keypress = Up Arrow – – > Action = Increase Volume
- Keypress = Down Arrow – – > Action = Decrease Volume
- Keypress = Ctrl+PgUp – – > Action = Play/Pause

Video

Comparision

Classification of the text provides the table with automation and simplification. It is amazing to see how marketers, product managers, designers, academics, and engineers will all be able to make use of this technology. Technology's entire idea is to make life easier. Classification of broad textual information helps standardize the system, simplifies and improves user experience. Text mining will be of increasing use in the future as a lot of everyday data in the form of text is generated. These type of gestures can be used to perform basic operations on computer applications. It is an open-source project where the gestures can be changed according to the user's comfort. Hand gesture control can be used in virtual reality applications. Augmented reality is the boom nowadays and hand gesture can play an important role. Reading sign language can be an application of hand gestures which wasnt available previously.

References

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05	]. Gergely Sziládi, Tibor Ujbányi and JózsefKatona, “Cost effective hand gesture computer control interface”,in: proc. of the IEEEInt. Conference on Cognitive Info communications, Oct. 2016.

THANK YOU