
Computer Control with Hand Gestures Using Ultrasonic Sensor

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ABSTRACT

Hand gesture is an innovative technique of interaction between human and computer. As compared to existing techniques, hand gesture technique has the advantage of being easy to use. By using this technique the traditional way of using mouse and keyboard will be change because one can then interact with the computer with hand gestures. In this technique, ultrasonic sensor is used to classify the hand movement in real-time. Ultrasonic sensor measures the distance of hand by using sound waves. The main idea of our approach is to speed up the interaction with computer, using general purpose hardware like personal computer, Arduino UNO board and low cost sensor like ultrasonic sensor. In this way any user can easily interact with the computer using hand gestures.

KEYWORDS — *Hand Gesture, ultrasonic sensor, Arduino UNO, Python*

INTRODUCTION

Today's world is a high technological world; imagining life without computer is impossible. Now computer is an essential part of human's day-to-day life. Vision and gesture are the important approach for communication between human beings just in the same way as keyboard and mouse play a role for interacting with computer. Numbers of effective techniques are available for interaction with computer and one of them is hand gesture technique. In that technique hand gesture is used as an input which replaces functionality of mouse and keyboard shortcut keys. Hand gesture is an attractive and faster technique. For determining user hand distance ultrasonic sensors are used. By using hand gesture user can communicate with computer easily and there is no need of any physical connection between user and system.

PROPOSED WORK

This paper introduces a technique based on determining distance by the sensor and accordingly a particular function is performed. Some recognition method of the gestures are proposed and then actions are recognized using sensor. We set up few mainstream methods based on the action recognition by the sensors. The sensor device is attached on computer at head of the screen, for quick operation. In this field much research work has been done but that work is related to hand recognition, real time finger recognition and recognition of alphabet characters [9]. Real time human computer interaction using hand gesture, are also used for many functionalities [5] such as video control, music player, gaming [5], controlling the functions of PDF reader etc. All these interactions have real time gesture recognition techniques. A gesture controller resolution always requires a physical device which follows and recognizes the body language or movements, so that the computer can clarify them [1]. By using ultrasonic sensor, the distance of hand can be found which acts as an input. According to the distance of hand, particular function is performed.

METHODOLOGY (HARDWARE/SOFTWARE)

ARDUINO UNO

The Arduino Uno board is based on the ATmega328 [7]. Arduino UNO is an Open-Source Platform and easy to understand for beginners [7].

A vital role in Arduino is played by its standard connectors which lets the CPU board connect to various add-on modules known as shields. Motor controls, GPS, Ethernet, LCD, or breadboard are provided by shield. Arduino IDE (integrated development environment) is used to program Arduino boards in C and C++ programming languages over a serial connection.



Figure 1: Arduino UNO board[7]

Ultrasonic sensor

The ultrasonic sensor is used to determine distance to an object. [7] It emits an ultrasound and this sound travels in the air. When it gets to an object it is reflected back to the ultrasonic sensor. The ultrasonic sensor has four pins, these are: VCC, used to power the sensor, Trigger, to send the US waves, and Echo, the output pin. The US wave is returned back to sensor through echo pin and GND is connected to the ground pin of Arduino board. [7]

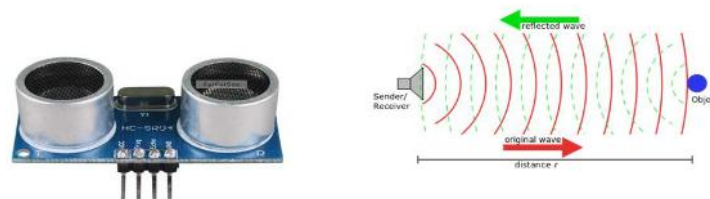


Figure 2: Ultrasonic sensor [7]

WORKING

Gesture controlling is based on specifying hand position from the ultrasonic sensor. For processing the raw data, a micro-controller is essential; for that we use Arduino UNO board. Via USB connection the micro-controller transfers the processed and calculated distance value which is provided by the sensor. The data which is sent by the sensor is processed in the software in PC where all the calculations are performed and the data is matched with the predefined conditions (gesture resolution). In this model two ultrasonic sensors are used to detect hand position and are connected to the Arduino board. As we know ultrasonic sensor continuously emits sound and it gets reflected back from user's hand. The distance between the sounds is sent and detection of reflect back sound wave is calculated by the micro-controller.

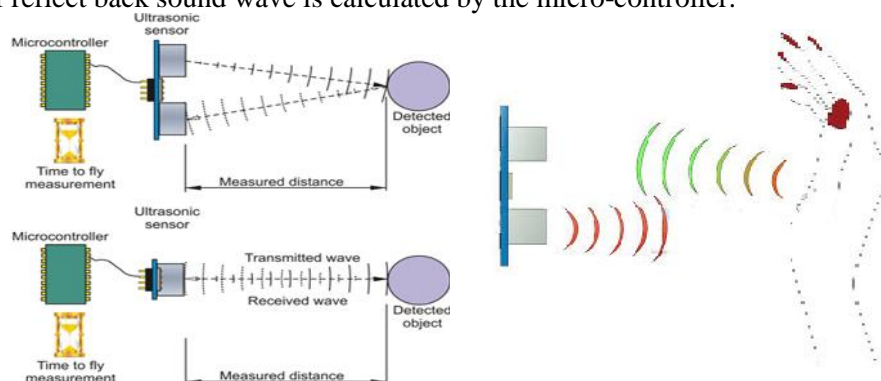


Figure 3. Ultrasonic sensor working diagram [10] Figure 3 a) diagrammatic view

This model has following hardware components; these are two ultrasonic sensor (HCSR-04) and Arduino UNO board. In figure 4 shows the circuit diagram of model. System software includes Arduino IDE and python GUI. To run this model, the python code should run on python GUI first. It matches gestures with predefined conditions and prints on python output shell as shown in figure: i). Interaction between python and Arduino program happens by writing arduino port number into python program. Table No.1 shows the mapping between the hand gestures and output produced by the system.

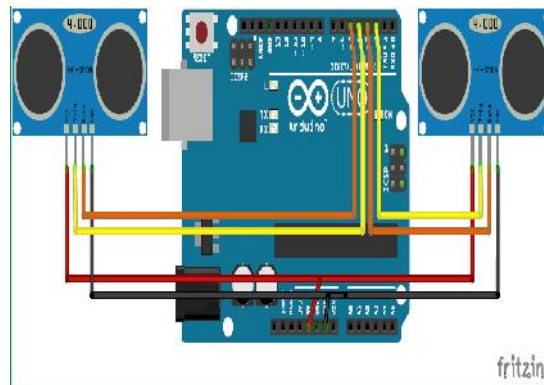


Figure 4: Circuit diagram of system

Table No: 1

Hand Gesture	Output Produced by system		
	Video	Audio	PDF
Right hand push in	Backward	Backward	Zoom in
Right hand pull out	Forward	Forward	Rotate page right
Left hand push in	Play	Page up	Rotate page left
Left hand pull out	Pause	Page down	Zoom Out

IMPLEMENTATION

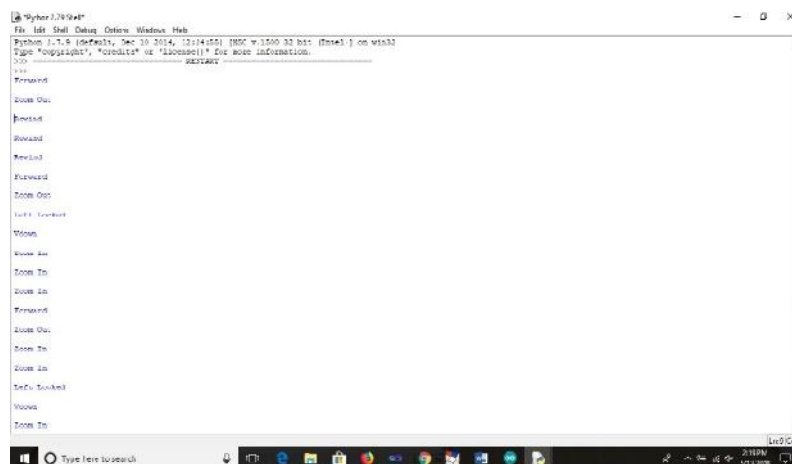


Figure i) Python GUI output screen



Figure a) 1] Show forward video



Figure a) 2] show backward video



Figure a) 3] show play video screen

b) Implementation on Audio

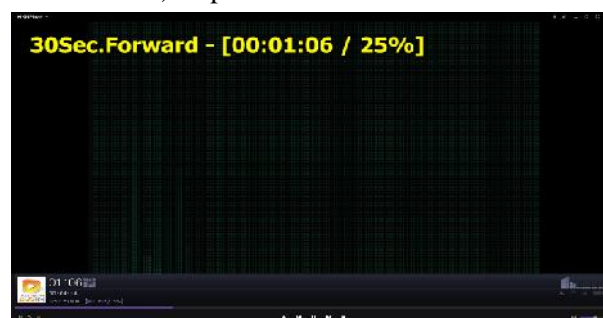


Figure b) 1] Audio clip forwarded



Figureb) 2] Audio clip rewind

C] Implementation on PDF or document

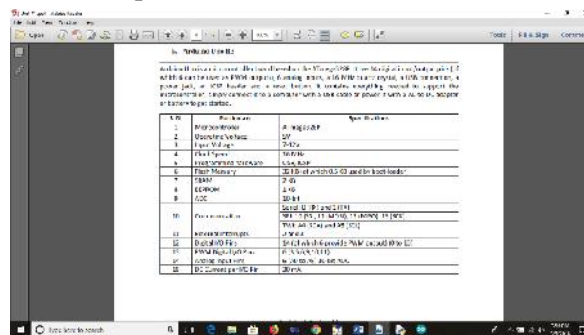


Figure C) 1] Show page up

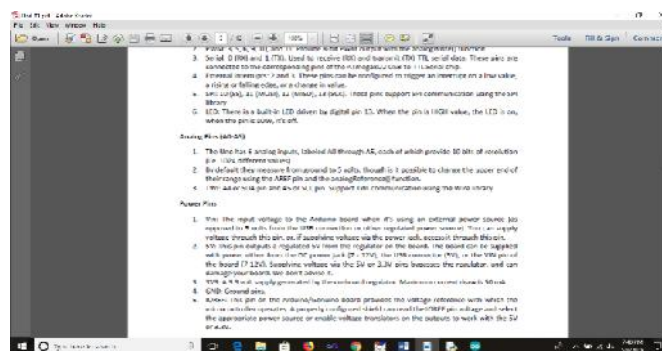


Figure C) 2] Show page down

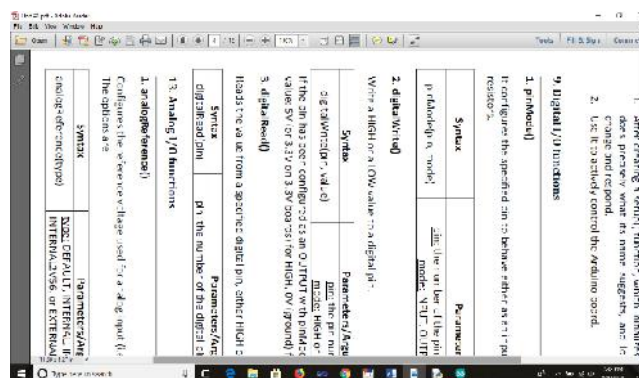


Figure C 3] Show page rotate

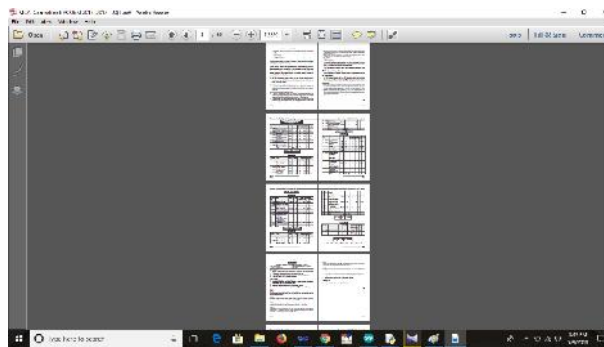


Figure C 4] Show page

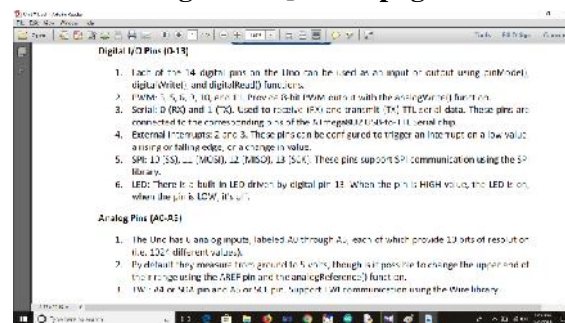


Figure C 5] Show page Zoom In

BENEFITS OF THE PROJECTED SYSTEM

- ⌋ 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.

OBSERVATION

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.

FUTURE SCOPE

Hand gesture technique is not only limited to gaming, using basic function of computer it can be useful for medical applications [9]. 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.

CONCLUSION

This article presents one of the solution among various others, for operating a computer using hand gestures. It is one of the easiest way 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.

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