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WIRELESSY CONTROLED COMPUTER WITH GESTURES.

WCCG.

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Info.

- **Project title.**

Wirelessly controlled computer with gestures. (WCCG)

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- **Project Challenge Area.**

Wireless communications/networks.

- **Project ID.**

854

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Abstract.

This project describes the implementation of wireless controls and gestures into the potential future computers and laptops. The project lies in the Wireless communications/networks challenge area. It considers problems with their installation, discusses possible solutions through various network technologies and indicates how to optimize the use of such technology in controlling the computers instead of the ordinary mouse and keyboard.

Introduction.

High-performance home appliances have been developed with the development of technology in recent years, such as TV, game machine and personal computer, etc. However, the user interfaces to control them are designed focusing on the device. It is not a user-centric approach, focusing on the ease of use for people.
For example, besides the most frequently used functions like volume buttons and channel buttons, TV remotes have many buttons for advanced operation. It is prone of causing a trouble for user operation because there are too many buttons to be
easily used. Similarly, the keyboard and the mouse used by the PC operations are also as a complex interface. A lot of keys, such as alphabet keys, a numeric keypad, function keys, and the other key for a special operation are installed in the keyboard.

On the other hand, the mouse is easy-to-understand interface. The mouse operation are the cursor movement caused by moving the mouse and the clicking something. However, if the graphical user interface of the application operated by the mouse is in the complex, the mouse operation also becomes complexity.
The problem of complexity of the mouse operation is that the operation method is different each application in the PC operation. It is possible to perform similar operation between another applications by using the shortcut operations used some control keys on the keyboard. However, the shortcut operation is simple to a person of skill who are familiar to PC operation, but also it is difficult to peoples who never use most of the PC and only use occasionally.

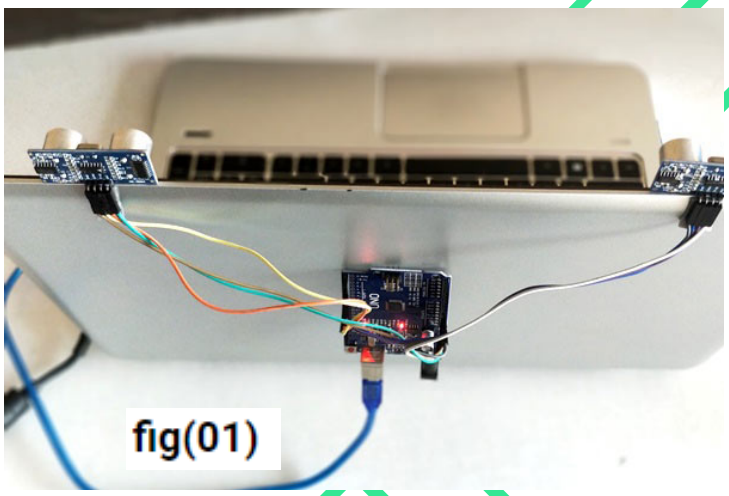
Goal.

Gesture operation can be considered as an easy-to understand and easy-to-use method to operate the PC in an easy-to-understand and easy-to-use without using traditional mouse or keyboard. We are doing a hand gesture that mimics the operation of the habitual actions, like pushing or throwing, in daily life. Therefore, these hand gestures are easy to understand for everyone and easy to use for anyone. Moreover, they are also intuitive gestures that are able to operate naturally.
By associating these hand gestures with a shortcut operation on the PC, it is possible to perform similar operations even among multiple applications using hand gestures. So my main goal out of this project is to start implementing the use of gestures on the computer as it's an easy, futuristic input method for the computers.

Overview.

Human Machine Interface or HMI is a system comprising of hardware andsoftware that helps in the communication and exchange of information between the user (human operator) and the machine.

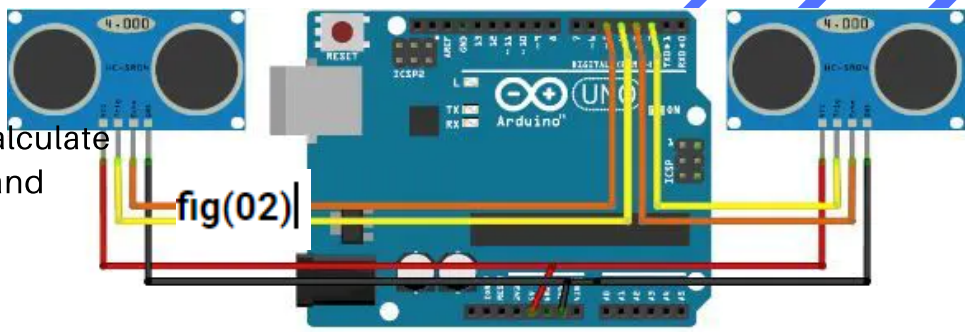
We normally use LED Indicators, Switches, Touch Screens and LCD Displays as a part of HMI devices. Another way to communicate with machines like Robots or Computers is with the help of Hand Gestures.
Instead of using a keyboard, mouse or joystick , we can use our hand gestures to control certain functions of a computer like playing/pausing a video, moving left/right in a photo slide show, scrolling up/down in a web page and many more.


fig(01)

In this project, I have implemented a simple Arduino based hand gesture control where you can control a few functions of your web browser like switching between tabs, scrolling up and down in web pages, shifting between tasks (applications), playing or pausing a video and increase or decrease the volume (in VLC Player) with the help of hand gestures.

Approach, tools and techniques.

The principle behind the Arduino based Hand Gesture Control of Computer is to use two Ultrasonic Sensors with Arduino, fig(02), place your hand in front of the Ultrasonic Sensor and calculate the distance between the hand and the sensor.

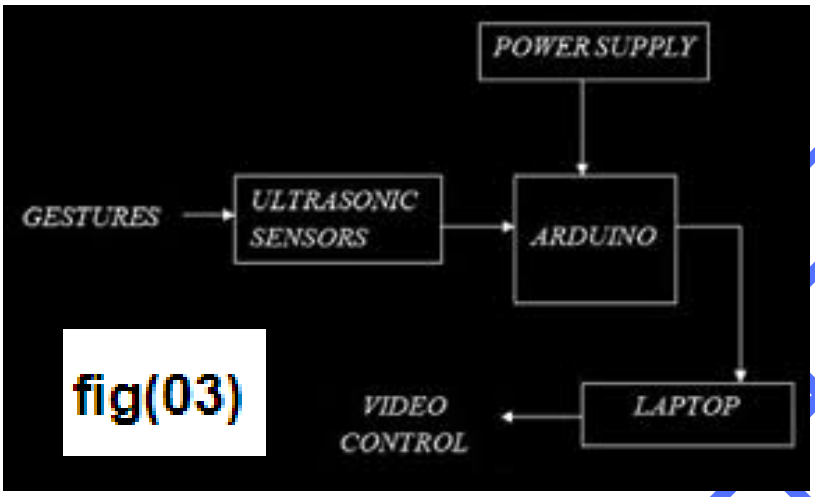


Using this information, relevant actions in the computer can be performed. The position of the Ultrasonic Sensors is very important. I have placed the two Ultrasonic Sensors on the top of a laptop screen at either end. The distance information from Arduino is collected by a Python Program and a special library called PyAutoGUI will convert the data into keyboard click actions.

system modules.

The block diagram of the Arduino part of the project is shown in fig (03).
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.

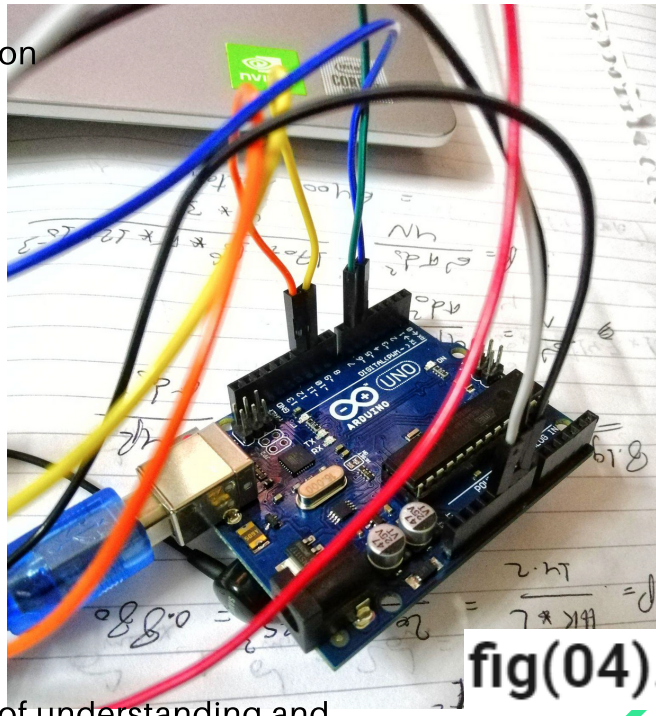
Arduino UNO x 1.
Ultrasonic Sensors x 2.
USB Cable (for Arduino).
Few Connecting Wires.



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.

Impact on society.

As technology trends to make human life easier and safer. So our main aim is to reduce the effort of interaction with computers through input devices using simple gestures. Scientists are trying to figure out how to change that and make digital interactions more human. One way they want to accomplish this is through gestures is shown fig(04). Computers should be "smart enough to reliably recognize non-verbal cues from humans in the most natural, intuitive way possible". Hand gestures are an important modality for human-computer interaction. Compared to many existing interfaces, hand gestures have the advantages of being easy to use, natural, and intuitive. Successful applications of hand gesture recognition include computer games control, human-robot interaction, and sign language recognition, to name a few. Vision-based recognition systems can give computers the capability of understanding and responding to hand gestures.

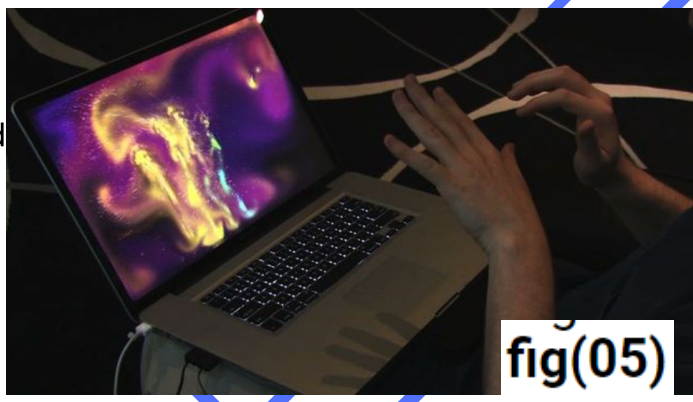


fig(04)

My prototype is not so much intricate and intended to control some basic features of the computers, discussed above, that hierarchical marking menus can be used to develop gestural command sets. However, so far, I have only designed the first example of a control gesture system for controlling some functions in computers and furthermore, we can work on GESTURE-BASED APPLICATIONS that focuses on enhancing the user experience.

This project is considered both applicable and not expensive for electronics companies to
manufacture and sell it separately or add it as a feature into laptops and computers, hence it can
achieve a significant impact on the market and users will find it both buyable and useful.

Features.



Gesture 1: Place your hand in front of the Right Ultrasonic Sensor at a distance (between 15CM to 35CM) for a small duration and move your hand away from the sensor. This gesture will Scroll Down the Web Page or Decrease the Volume.

Gesture 2: Place your hand in front of the Right Ultrasonic Sensor at a distance (between 15CM to 35CM) for a small duration and move your hand towards the sensor. This gesture will Scroll up the Web Page or Increase the Volume.

Gesture 3: Swipe your hand in front of the Right Ultrasonic Sensor. This gesture will move to the Next Tab.

Gesture 4: Swipe your hand in front of the Left Ultrasonic Sensor. This gesture will move to the Previous Tab or Play/Pause the Video.

Gesture 5: Swipe your hand across both the sensors (Left Sensor first). This action will Switch between Tasks.

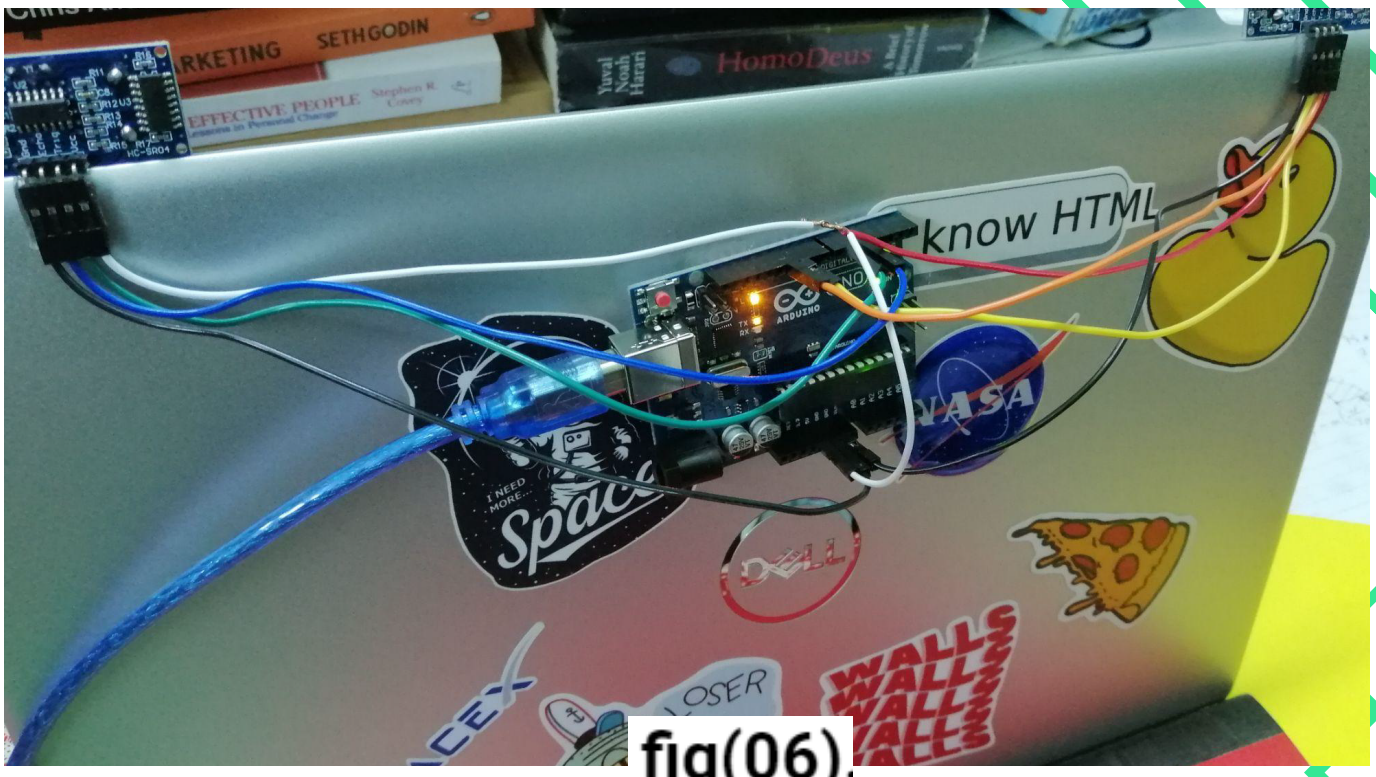
Novelty and options.

The hand gesture computers have been developed in the last couple of years and used in many applications like controlling videos played on VLC but my project is more developed to use hand gestures in shifting between different tasks in the computers and controlling google chrome.
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/previous Tab in a Web Browser
- Scroll Down/Up in a Web Page
- Switch between two Tasks (Chrome and VLC Player)
- Play/Pause Video in VLC Player
- Increase/decrease Volume

Deliverables on marketing.

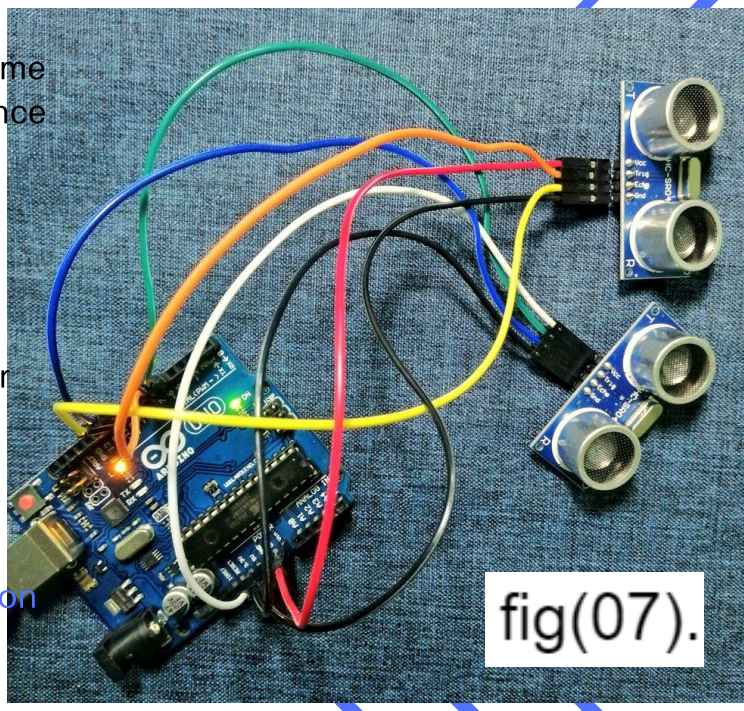
The final project outcome is to provide easy controlling gestures with the computers.
This project is considered both applicable and not expensive for electronics companies to manufacture and sell it separately or add it as a feature into laptops and computers, hence it can achieve a significant impact on the market and users will find it both buyable and useful. As shown in **fig(06).**
I also foresee that customers will find it a luxury but with a low price to use this hand-gesture system on their personal laptops and computers so it's so likely to achieve good market share among electronic devices.



fig(06).

Recommendations.

The wireless gesture prototype could be improved in technical and financial ways to come up with better results and long-term maintenance by developing its sensors and mechanism or materials.


fig(07).

1. An industrial partner could help make the hardware of the project more embedded and hidden inside the computer itself like any other hardware object contained in it. As shown in fig(07).
2. It's preferred to use project the ultrasonic sensors of type MA40H1S-R shown in fig (08) which is a compact and low-profile configuration suitable for surface mounting.

Transmission-reception combined type, allowing for distance detection in confined spaces. They are transmission- or reception-only and capable of both short- and long-range distance detection. In addition, they can be used to detect moving objects by making use of the doppler effect to detect fluctuations in the received waveforms.

3. Alternating the Arduino with printed circuit board inside the computer, powered and connected to the MA40H1S-R sensors.

Part number	MA40H1S-R
Appearance	
Frequency	40kHz
Size	5.2×5.2mm, t=1.2mm
Features	Compact, suitable for surface mounting
Applications	Distance detection and object detection

fig (08)

Equipment and tools

Arduino Uno. no. of item. 1

Specifications: It's an open-source and extensible hardware and software to read the inputs from sensors(Ultrasonic sensors)and turn them into output.

Justification (why is this item needed?): Used specifically in my project to read the inputs of 2 Ultrasonic sensors using the Arduino code written in C++ and convert that input into actual output (which is input in the python code)

Cost. 155 EGP

Arduino IDE software.

Specifications: The software coding or integrated development environment on which the code is written and uploaded to the hardware (Arduino and ultrasonic sensors.)

Justification (why is this item needed?): Wrote and run the Arduino code part on it.

Cost. Free.

Ultrasonic sensors. no. of items. 2

Specifications: The configuration pin of HC-SR04 is VCC (1), TRIG (2), ECHO (3), and GND (4). The supply voltage of VCC is 5V and you attach TRIG and ECHO pin to any Digital I/O in Arduino Board to power it. Specifications Power Supply: DC 5V

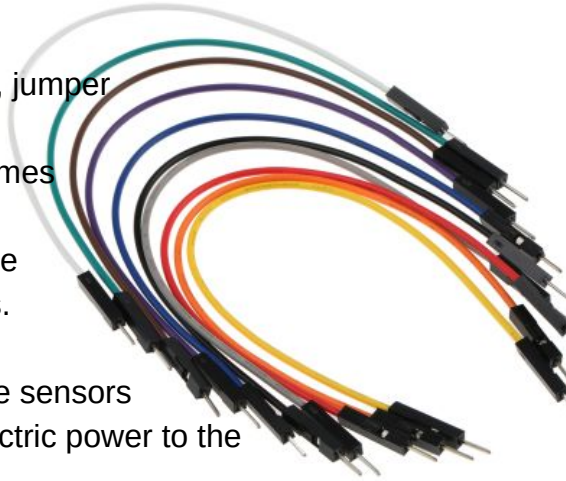
Working Current: 15mA
Working Frequency: 40Hz
Ranging Distance : 2cm – 400cm/4m
Resolution : 0.3 cm
Measuring Angle: 15 degree
Trigger Input Pulse width: 10uS
Dimension: 45mm x 20mm x 15mm.

Justification (why is this item needed?): Read the distance measured between the hand of user and the computer, and detect whether your hand in front of the Right or the left Ultrasonic Sensor at a distance (between 15CM to 35CM) for a small duration or even swiping it in front of the two sensors.

Cost. 80 EGP.

Equipment and tools

Arduino Uno. **no. of item. 10**



Specifications: jump wire (also known as jumper, jumper wire, jumper cable, DuPont wire or cable) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them –simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components.

Justification (why is this item needed?): Used to connect the sensors to the Arduino board (trig, echo, GND and VCC) to give the electric power to the sensor modules(GND, VCC) and transfer data (Echo,Trigger).
Cost. 20 EGP.

Arduino Code.

Specifications: it's the C++ code language of the Arduino board.
Justification (why is this item needed?): you can preview my Arduino code here.
https://drive.google.com/file/d/1ehyiqSG8WaJanyDeNq-utVFWpGR3Den7/view
Cost. Free.

Python Code.

Specifications: It's the python code which mainly controls some functions in the keyboard and mouse and mimics some of those buttons and moves.
Justification (why is this item needed?): you can preview my Python code here.
https://drive.google.com/file/d/1rvIejdgkbTN8DNfvIp6Pzc6QguZX7ml9/view
Cost. Free.

Double face tape

Specifications:To stick two things to each other.
Justification (why is this item needed?): Used to fix the ultrasonic sensors on each edge of the laptop screen and the Arduino board on the back of the laptop.
Cost. 15 EGP

Conclusion.

In this report, a system using the hand gestures was developed to operate the PC.

The hand gestures could be recognized with a high recognition rate by using.
I defined the association of the operations
of typical applications used very often with the hand gestures, and experimented for the evaluation of the usability. As a result, we could develop an interface focusing on the ease of use of PC by using the hand gestures.

So far, PC operation is adopted as a case study. However, it is possible to apply the hand gestures to various systems. In addition, the operations of the hand gestures do not depend on size of the target device. The user can freely operate even small devices such as mobile devices. At the modern times when a lot of people use the mobile device, the hand gestures are suitable for the operation.

In this study, we have invested the operation of the hand gestures in a static position, such as the user sitting in a chair. In the future, if the hand gestures are used for operation of the mobile devices, it is necessary to remove noise such as shaking during walking. The dynamic position of the user must be considered to develop a system. It is expected to redefine the hand gestures and the recognition algorithm to deal with such kind of requirement.