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Intelligent Voice Over System for Disabled People

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Abstract— The problem of multimodal interaction is discussed. The use of blinking and winking, interpreted as Eye gestures, is considered. The main aim of this study is to propose a simple method that allows the recognition of the state of the eye: open or closed; and to distinguish between blinking and winking. A Few people and groups are not able to operate the computer because of their illnesses. In this scenario, it is sound, to introduce a method of computer operation, which is easily accessible, even considering the disabilities of the differently abled. A Human-Computer Interaction system that is designed for individuals with severe disabilities to simulate control of a traditional computer mouse is introduced. A specific human computer interaction system using eyeball movement is presented. But in this system, we use eyes instead of mouse which provides a unique way of operating the computer with the help of eyeball movements. This system tracks the eye movements of the user with arduino data and simulates the eye movements into mouse cursor movements on screen and also detects the user's eye staring at the icon and will translate it into click operation on screen. Embedded c to read sensor value to controller, and control pushes the data to computer via serial communication. Python reads serial data from USB and converts signal data to UI interface with pre-trained data and conditions. The main aim of this system is to help the user to control the cursor without the use of hands and is of great use especially for the people with disability.

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Keywords: ***Polypropylene, Acacia, Wear test, Taber abraser.***

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I. INTRODUCTION

Lately, there has been an enthusiasm for creating characteristic communication among humans and the computer. There are a few examinations for Human-PC communication. The vision-based interface approach removes movement data with no high valued gear through a video- picture input. Accordingly, vision-based methodology is considered a compelling strategy to develop human computer interface frameworks. For vision-based human computer association, identification of the eye is a major issue. Eye following process is recognized by the crisis of intelligent applications. In spite of everything, to promote a dream based multimodal human PC interface framework, eye following and its acknowledgment is completed. Constant eye input has been used most of the time for incapacitated customers, who can use their eyes for input.

A computer interaction based on a regular mouse requires a human hand and plane surface for its operation which is not adequate for fixed pointing on the computer screen. These modern computer mice are wireless and use the light sensor to detect its movement. The operation of these mice also depends on the plain and unobstructed surface to effectively poll the user movement additionally, the need for hand limits the use of above mouses for the handicap people. A large number of people with hand disabilities pay much attention to this kind of technology for computer interaction because no hand or GUI is required to control the computer mouse.

However, a hand-free operation of the pointing device or mouse is needed to make the computer-access for the disable people as well as to remove the strain in the finger and cut down the joint pain. There are many known solutions that allow for mowing the cursor without using hands. For this purpose, the identification of head movements based on the head image or facial image analysis is often used. It is also possible to use additional sensors, e.g. accelerometers, or gyro sensors. However, cursor movement control is not enough to replace a computer mouse. The basic motivation for undertaking the research is the need for effective and hands-free generation of system events that are normally provided by the mouse keys. We chose to use blink/ wink to solve the problem. It is the simplest action that is always available and does not interfere with the tasks in most situations.

The main aim of this study is to develop a simple method that allows the recognition of the state of the eye (open/closed) and to distinguish between blinking and winking. We also consider two applications where the blink and wink action plays the decisive role. In such a situation,

the eye state recognition should work rapidly, effectively, and correctly irrespective of the environment and the external factors. In this project , the control of the mouse pointer's position is presented with respect to the movement of the human head. When the user tilt his head in the left-right or forward-backward direction, the system performs the mouse pointer movement action. Accordingly, for calling the pointer to move in horizontal direction, the condition is to tilt the head to right (for right moving) or to left (for left moving).

In our existing work the cursor is controlled by eye movement using deep learning. By using raspberry pi, a single board application, we designed a system where people can move the cursor and select a specific folder using merely their EYE. However, physically disabled people face so many challenges to operate these devices because of their illness. Devices used in existing systems: Accelerometer, gyroscope, complementary filter. The proposed system carries the human head gesture and eyes to perform the movement and clicking event of the mouse cursor.

A combined three-axis accelerometer and gyroscope is used to detect the head gesture and translate it into the position of the mouse cursor on the computer monitor. To perform the left and right-clicking event, the user needs to shut down the left and right eye for a moment while opening another eye. This paper also carried out the design of a deep learning approach to classify the individual openness and closeness of both human eyes with average accuracy that ensures the comprehensive control over the clicking performance. Currently we use a remote gadget or a mouse to operate and control a Laptop or PC. However, physically disabled people face so many challenges to operate these devices because of their illness.

In the existing technique people require their hands to operate these devices. Longer processing time due to working with several images. Lower accuracy because information about the opened / closed eye is extracted from the single image. Difficult to find an optimal feature.

II. IMPLEMENTATION

In our proposed system the cursor is controlled by eye movement using some hardware like a blink sensor, accelerometer and a transparent glass. By using this hardware, we designed a system where people can move the cursor and select a specific folder using merely their EYE. The Arduino is connected to the blink sensor and accelerometer. Finally, all these hardware are integrated with python. These electronic gadgets give more adaptability because they are easily accessible to the customers. Our proposed technique shows accuracy and speed, which are sufficient for some genuine time applications and which enable debilitated people to identify numerous computer exercises. Moreover newly created assistive multimodal electrical devices can be effectively utilized without usage of the person's hands, and the computer can be controlled even with incapacities of their fingers or arms. The basic motivation for undertaking the research is the need for effective and hands-free generation of system events that are normally provided by the mouse keys. We chose to use blink/ wink to solve the problem. It is the simplest action that is always available and does not interfere with the tasks in most situations. The main aim of this study is to develop a simple method that allows the recognition of the state of the eye (open/closed) and to distinguish between blinking and winking. We also consider two applications where the blink and wink action plays the decisive role. In such a situation, the eye state recognition should work rapidly, effectively, and correctly irrespective of the environment and the external factors . The proposed system is a virtual interactive module for the users and can be used as an alternative module of touch screen technology. In this system, after the input is taken from the user, the real-time video input is processed and face recognition is performed. A point on the user's face would control the cursor on the screen and the right and left wink would implement the right and left click respectively.

Eyesight is the most complex sense of humans. The eye ensures the reception of visual impressions; it is a complex instrument, but a very delicate one. The eyelids (upper and lower) serve a very important protective function.

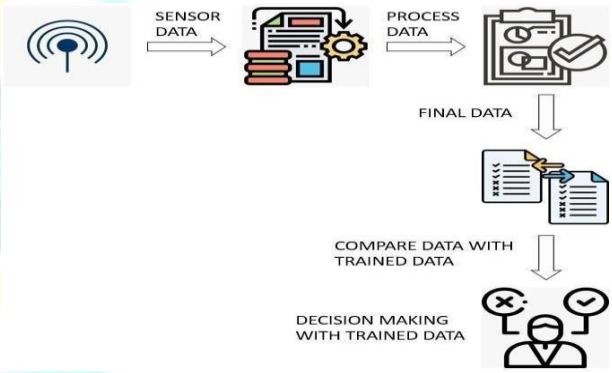


Fig 4.1System Architecture

During the normal functioning of the sense of sight, blinking ensures the appropriate wetting of the cornea of the eye through an even distribution of tears. At the same time, this mechanism causes the natural removal of fine impurities from the surface of the cornea. Under difficult ambient conditions, closing the eyelids protects against dust and other impurities. The closing of the eyelid's blocks (in fact significantly reduces) the amount of light during sleep.

The physiology of the eye and the blinking mechanism have been well known for a long time and have been documented. Depending on individual predispositions and external conditions, a human being blinks approximately 6–30 times/min (on average, approximately 16 times/min). Mental and emotional activities affect the frequency of blinking. verbal engagement, as well as anger, excitement, stress, fear, and fatigue, can increase the frequency by several times. In contrast, reading or absorbing visual work (the concentration of drivers, for example), and above all, working at the computer, reduces the frequency of blinking. Environmental factors have an independent influence. Low humidity, cigarette smoke, and pollution naturally stimulate the blinking mechanism to work more frequently.

The expected solution requires the consideration of various aspects. On the one hand, we took into account the solutions reported in previous studies. On the other hand, we analyzed the physiological properties of the eyes and the versatility of the considered applications. Therefore, we propose the following assumptions for our solution of the blink and wink recognition: & it should allow us to distinguish blinking from winking on the basis of the analyzed eye closure time. & It should work correctly with any position of the head and any gaze direction. & It should work correctly when the face is obscured (partially and almost completely). & it should work effectively in real time, so the method should be simple and fast.

The simplest solution, known from past research, would be to use a set of cameras, implement an appropriate face recognition algorithm, separate the eye image, and finally, analyze the eye state. However, such a solution does not meet our assumptions, and under real conditions, it would be very difficult to implement and ineffective. This solution allows us to simplify the complicated image analysis as much as possible. A system architecture diagram is the distribution of the functional correspondences. These are formal elements, the embodiment of concepts and information. Architecture defines the relations between elements, amongst features, and the surrounding elements.

A. Angle Sensor Value

Accelerometer consists of a micro-machined structure built on top of a silicon wafer. This structure is suspended by polysilicon springs. It allows the structure to deflect at the time when the acceleration is applied on the particular axis.Due to deflection the capacitance between fixed plates and plates attached to the suspended structure is changed. This change in capacitance is proportional to the acceleration on that axis.The sensor processes this change in capacitance and converts it into an analog output voltage. While accelerometers measure linear acceleration, MEMS gyroscopes measure angular rotation. To do this they measure the force generated by what is known as The Coriolis Effect.

B. Measuring Acceleration:

The MPU6050 can measure acceleration using its on-chip accelerometer with four programmable full-scale ranges of ±2g, ±4g, ±8g and ±16g. The MPU6050 has three 16-bit analog-to-digital converters that simultaneously sample the 3 axis of movement (along X, Y and Z axis).

C. Measuring Rotation:

The MPU6050 can measure angular rotation using its on-chip gyroscope with four programmable full-scale ranges of ±250°/s, ±500°/s, ±1000°/s and ±2000°/s. The MPU6050 has another three 16-bit analog-to-digital converters that simultaneously samples 3 axes of rotation (around X, Y and Z axis). The sampling rate can be adjusted from 3.9 to 8000 samples per second.

D. Microcontroller Processing

Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analog components needed to control non-digital electronic systems. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.

The Arduino IDE and the Processing IDE will communicate with each other through serial communication. The Processing IDE has a serial library which makes it easy to communicate with the Arduino. When we move the potentiometer knob, the Arduino will send a value between 0 and 255 to the Processing IDE. Arduino Uno Rev. 3 Microcontroller Board is based on the Microchip Technology ATmega328 8-bit Microcontroller (MCU). Arduino Uno features 14 digital input/output pins (six of which can be used as PWM outputs), six analog inputs, and a 16MHz quartz crystal.

E. PySerial

When using PySerial, a few parameters need to be configured (in a similar fashion to setting up UART peripherals on microcontrollers), and these include. Baud rate – How fast your COM port operates. Arduino projects tend to operate at 115200 Port – The name of the port being used (find this in device manager) Parity bits – These are used for error correction but are not normally used. Stop bits – Only one stop bit is ever used unless there are timing issues Timeout – Used to prevent the serial port from hanging. In addition to defining the parameters shown above, the serial module needs to be imported. The code extract below shows how to import the serial module and configure the UART port to use COM3 at 115200 baud with no parity, one stop bit, and a timeout of two seconds. It's easy to find the COM port your USB-to-serial device is located in when using the device manager. Open the start menu and type "Device Manager". When the device manager loads, look for the section called "ports" and expand it. Most Windows machines have a COM1 port by default that is used for internal communication, so don't use that COM port. Assuming that you only have one COM device connected, the second COM port will be your microcontroller.

F. User Interface With Data

PyAutoGUI lets your Python scripts control the mouse and keyboard to automate interactions with other applications. The API is designed to be simple. PyAutoGUI works on Windows, macOS, and Linux, and runs on Python 2 and 3.

G. Cursor Control With Python

pyautogui is a module that can do many different dynamic things, including sending virtual keypresses and mouse clicks to Windows. With it, we can get the current position of the mouse. To determine the mouse's current position, we use the statement, pyautogui.position().This function returns a tuple of the position of the mouse's cursor. The first value is the x-coordinate of where the mouse cursor is. And the second value is the y-coordinate of where the mouse cursor is. Move() will move mouse pointer at (0, 50) relative to its original position. For example, if mouse position before running the code was (1000, 1000), then this code will move the pointer to coordinates (1000, 1050) in duration 1 second. Click() code performs a typical mouse click at the location (100, 100). We have two functions associated with the drag operation of the mouse, dragTo and dragRel. They perform similar to moveTo and moveRel functions, except they hold the left mouse button while moving, thus initiating a drag.

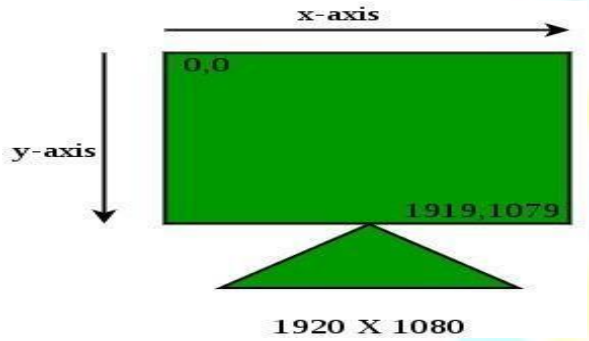


Fig 4.45 Cursor Control

Multimodal interaction is a method of communication that plays an increasingly important role in the technical applications of everyday life. From year to year, new devices use more and more interesting methods of control and communication: touch, gestures, and body language; what else does the future hold? The use of eye gestures (as blinking/winking interpretation) is a relatively new form of communication, but with "visible" potential. Blinking is a simple physiological activity to which we do not attach much significance. However, this activity can be very useful in multimedia applications. Supporting communication with a computer for disabled or paralyzed people is a difficult but very important task. For these people, blinking/winking can be an effective way of transmitting information or controlling devices. Certain advanced applications of this method of communication have also been reported thus far. A computer mouse is the most popular pointing device today, which allows not only the selection of an appropriate object but also the generation of an appropriate system event. Whilea dedicated environment for the execution of eye controlled programs has undoubtedly a number of advantages, it has some limitations as well. First of all,it constrains the user to employ only the software available in the suite: any other application installed on the computer cannot be controlled by means of the eyes.Moreover, program suites are often associated with specific eye trackers: if, for any reason, the user wants to change the device, the old applications may not work properly on the new system. When the market of eye trackers will expand the decrease of prices is likely to accentuate such problems. An application that replaces the clicking of the mouse keys by eye gestures can be considered. Such an application would be universal, but the basic problem is the correct recognition of the user's winking. We can also consider a different application where the registration of blinking can be a sign of human presence. Such identification can sometimes be simpler than the analysis of a thermogram or a search for other signs of life such as heart rate or periodic local changes in the level of carbon dioxide. In both these situations, the success of the application depends on the correctness of the recognition of the closing and opening of the eyes.

H. PYTHON

Python is a high-level, interpreted, interactive and object-oriented scripting language. Python is designed to be highly readable. It uses English keywords frequently where as other languages use punctuation, and it has fewer syntactical constructions than other languages. There are many frameworks, tools, and libraries that support UI test automation with Python, such as pytest, nose, PyQt, and more. A lot of developers use Selenium Webdriver which supports testing with Python among other languages.Python is Interpreted − Python is processed at runtime by the interpreter. You do not need to compile your program before executing it. This is similar to PERL and PHP.·Python is Object-Oriented − Python supports Object-Oriented style or technique of programming that encapsulates code within objects.

PyAutoGUI is essentially a Python package that works across Windows, MacOS X and Linux which provides the ability to simulate mouse cursor moves and clicks as well as keyboard button presses. PyAutoGUI is a library that allows you to control the mouse and keyboard to do various things. It is a cross-platform GUI automation Python module for human beings. As it is a third party library, we need to install it. PyAutoGUI lets your Python scripts control the mouse and keyboard to automate interactions with other applications. The API is designed to be simple. PyAutoGUI works on Windows, macOS, and Linux, and runs on Python.

I. Arduino IDE

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

The Arduino board is connected to a computer via USB, where it connects with the Arduino development environment (IDE). The user writes the Arduino code in the IDE, then uploads it to the microcontroller which executes the code, interacting with inputs and outputs such as sensors, motors, and lights.

J. HTML

The Hyper Text Markup Language or HTML is the standard markup language for documents designed to be displayed in a web browser. It can be assisted by technologies such as Cascading Style Sheets and scripting languages such as JavaScript. HTML is the language for describing the structure of Web pages. HTML gives authors the means to: Publish online documents with headings, text, tables, lists, photos, etc. Retrieve online information via hypertext links, at the click of a button.

K. CSS:

I. Cascading Style Sheets is a style sheet language used for describing the presentation of a document written in a markup language such as HTML. CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript. CSS is among the core languages of the open web and is standardized across Web browsers according. Previously, development of various parts of CSS specification was done synchronously, which allowed versioning of the latest recommendations. You might have heard about CSS1, CSS2.1, CSS3. However, CSS4 has never become an official version. We can change the appearance and the layout of the webpage by using CSS. We can also define how a website's view changes in different screens like desktops, tablets, and mobile devices. CSS is not a programming language, like C++ or JavaScript.

L. XAMPP

XAMPP is one of the widely used cross-platform web servers, which helps developers to create and test their programs on a local webserver. It was developed by the Apache Friends, and its native source code can be revised or modified by the audience. It consists of Apache HTTP Server, MariaDB, and interpreter for the different programming languages like PHP and Perl. It is available in 11 languages and supported by different platforms such as the IA-32 package of Windows & x64 package of macOS and Linux. XAMPP is an abbreviation where *X* stands for Cross-Platform, A stands for Apache, M stands for MYSQL, and the Ps stand for PHP and Perl, respectively. It is an open-source package of web solutions that includes Apache distribution for many servers and command-line executables along with modules such as Apache server, MariaDP ,PHP, and Perl.

XAMPP helps a local host or server to test its website and clients via computers and laptops before releasing it to the main server. It is a platform that furnishes a suitable environment to test and verify the working of projects based on Apache, Perl, MySQL database, and PHP through the system of the host itself. Among these technologies, Perl is a programming language used for web development, PHP is a backend scripting language, and MariaDB is the most vividly used database developed by MySQL.

MPU6050 sensor module is complete 6-axis Motion Tracking Device. It combines 3-axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor all in small package. Also, it has additional feature of on-chip Temperature sensor. It has I2C bus interface to communicate with the microcontrollers. It has Auxiliary I2C bus to communicate with other sensor devices like 3-axis Magnetometer, Pressure sensor etc.If 3-axis Magnetometer is connected to auxiliary I2C bus, then MPU6050 can provide complete 9-axis Motion Fusion output.Let's see MPU6050 inside sensors. MPU6050 is a Micro Electro-mechanical system (MEMS), it consists of three-axis accelerometer and three- axis gyroscope. It helps us to measure velocity, orientation, acceleration, displacement and other motion like features.

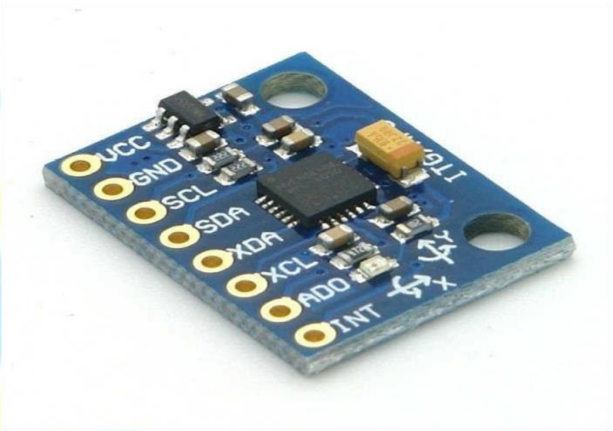
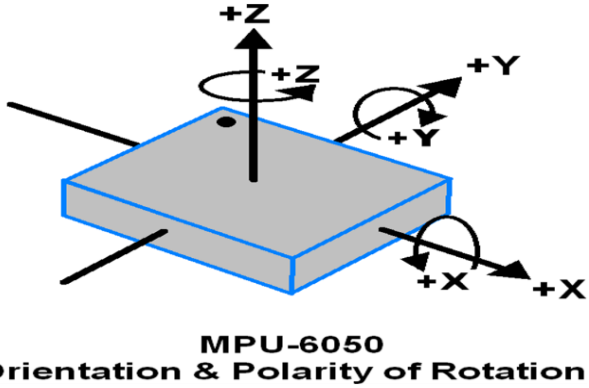


Fig 5.4.2 MPU 6050 Sensor

The MPU6050 includes an embedded temperature sensor that can measure temperature over the range of -40 to 85°C with accuracy of ±1°C. Note that this temperature measurement is of the silicon die itself and not the ambient temperature.

3-Axis Gyroscope : The MPU6050 consist of 3-axis Gyroscope with Micro Electro Mechanical System(MEMS) technology. It is used to detect rotational velocity along the X, Y, Z axes as shown in below figure.



MPU-6050
Orientation & Polarity of Rotation

MPU 6050 Sensor

The eye blink sensor is an infrared sensor. It contains two parts. A transmitter and a receiver. The transmitter continuously emits infrared waves onto the eye. While the receiver continuously looks for variations in the reflected waves which indicates that the eye has blinked .If the eye is closed that means it will give high output. If the eye is open then it will give a low output. This sensor can be used in a very different variety of robotics and mechatronics projects as it provides excellent results and is very economical .The eye blink sensor illuminates the eye with infrared light and monitors the changes in the reflected light. The infrared light reflected from the eye is used to determine the results. The sensor output is active high for Eye close and can be given directly to microcontroller for interfacing application .

Fig 5.4.3 Blink Sensor

III. RESULTS

The test results of the correctness of recognizing the state of the eye on the basis of an image analysis are summarized. The correctness of recognizing the open eye was very high. The introduced algorithm for recognition, based on the analysis of the reflection of radiation, allowed us, with almost 100% correctness, to identify open eyes (99.94%). The correctness of the recognition of closed eyes was slightly lower; it was 99.42%. The incorrect recognition was in most cases caused by a diffused reflection of the radiation in the area of the eyelashes. The total correctness of the eye recognition was 99.68%.

IV. CONCLUSIONS

An eye movement-based cursor control using Arduino and Python is developed. The above experimental results show that we can control the functions of cursor efficiently without the use of the mouse. The operations performed using this system are easy in terms of controlling the cursor. This system is a possible solution to all the problems that are faced due to the existing manual of controlling the cursor with the help of the mouse which is not possible in case of people with disability. This system offers users with new means to control the computer system. The work can be extended to improve efficiency of the system in terms of covering all the mouse functions using eyeball movements. Presently,this system can be useful for the overall operational behaviour by interacting with the computer system without the use of mouse. Through Eye movement-based cursor control system, it can be concluded that there can be considerable development in the field of human computer interface with the use of IoT.

V. FUTURE ENHANCEMENT

A system that enables a disabled person to interact with the computer was successfully developed and tested. The method can be further enhanced to be used in many other applications. The system can be adapted to help the disabled to control home appliances such as TV sets, lights, doors etc. The system can also be adapted to be used by individuals suffering from complete paralysis, to operate and control a wheelchair. The eye mouse can also be used to detect drowsiness of drivers in order to prevent vehicle accidents. The eye movement detection and tracking have also potential use in gaming and virtual reality.

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