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A Novel Method for Controlling Smartphone by Head Movements and Eye Blinks

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ABSTRACT:Smartphones are handheld devices for messaging, calling, browsing internet, etc. This project allows to handle Smartphone using head movements and eye blinks. A mouse pointer will appear on the screen. The motion of the pointer can be done using head movement. The selection is done through eye blinks. The proposed algorithm will help to control the motion of the pointer & the selection. Thus, this project can be helpful for those whose hands got injured.

KEYWORDS: Machine vision, vision assistant, eyeball tracking, Data Acquisition, Pointer movement algorithm, Blink detection algorithm.

I. INTRODUCTION

Smartphones are portable device used for calling, messaging, taking pictures, etc. They help to run “apps” which are helpful in performing various programs for the smartphones. Most of these apps are pre – installed within the system and some are downloaded from the app stores. So the smartphone fulfils the human needs through apps and other features.

Mobile phones are usually handled with hands. The proper use of the finger helps to select or deselects the items on the phone. Now most of the smartphones are touchscreen. So the selection process is much easier.

It is very difficult to handle a smartphone if the hands got injured. The project puts a solution for this problem. This project is mainly used to fulfil the operation of controlling a Smartphone using head movement and eye blinks. The project uses to help the people who are not able to use Smartphone with their own arms. This project includes the basic functions of mouse pointer movements and selection. Which is done using an accelerometer which calculates the movement of the head which is done by comparing the angler with the horizontal axis, a Neuroskymind wave headset is also used tosense the eye blinks by detecting the neuron signal produced by the brain. All the operations and processing are done on an Arduino board version Arduino Leonardo which is micro controller.

II. RELATED WORK

Reading Auxiliary Apparatus (RAA) is a device used to handle reading a paragraph or document from the computer without the use of hands. Itbasically uses the technique of Electrooculography (EOG) which helps to detect the eye signals and handle these signals for reading each line. There are 3 types of eye movements, Saccades,Fixation and Blink. The main process in RAA is that when the eye consecutively blinks 2 times it will “Start magnifying “. For 3-times it will “close”. Here 6 bio-electrodes are used. Mainly four processes are done before using it. They are Signal Acquisition, Pre-processing,Detection of Basic Eye Movement Types and Human-Computer Interface.[3] describes more about this topic.

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A low cost eye based Human Computer Interface (HCI) developed for amputees and paralyzed persons that provides the functionality of an input device based on eye actions. For initialization, the subject just holds his/her head still for a few seconds. Using involuntary blinks that would naturally occur during this time, the system locates the user's eye pair as well as forms online templates of the open and shut eyes of the specific user. The located eyes are tracked in real time using template matching and histogram back projection. To detect the iris, the eye image is subjected to image conditioning. Continuous gazes does the mouse clicking action ([1] reveals this process).

In [2], the paper proposes an innovative and low-cost wearable device to control the Smartphone with eye winks. The system records muscular potentials by means of two electrodes. Eye winks are then transformed into commands and streamed to the Smartphone via Bluetooth. The commands received are mapped into specific actions through an app that is installed on the Smartphone.

The comfortable wheelchair locomotion for severely disabled people, the control over their eye movements has been utilized to develop an algorithm.As mentioned in [4], the direction of motion can be controlled based on the point of gaze or the position of the eyeball which is achieved using eyeball tracking. A USB webcam is used to send real-time eye movement data as input. The eyeball motion tracking hardware includes a USB web camera which is positioned on the head of the user. The live input from the webcam is then processed using image processing techniques. After successful template matching of the eyeball, object tracking comes into the picture, and eyeball movements are tracked continuously. These movements of eyeball generate signals that are further utilized to guide the direction of motion of the electric wheelchair system.

III. PROPOSED APPROACH

A wide varieties of operations can be performed using a smartphone. The phone can be used for calling, taking photos, messaging, etc. But for all this, the need for selection is important. Usually hands are preferred for selection, i.e., either by pressing or by sliding of the screen. The project will help to handle smartphone using head and eye blinks.

This project basically focuses on control the smartphone using head and eye blinks. Each selection will be done using blinks while movement of the pointer by head. The key factor in this project is a microcontroller & a mindwave headset. Arduino microcontroller helps to execute the codes which had been already stored. The code for the coordinatesare stored in the microcontroller. The algorithm which performs the movement of the mouse pointer is given below:

A. Pointer movement algorithm

Steps:

1: Start
2: Include Header files.
3: Declare variables for pins of the accelerometer.
4: Define resolution for screen and limits for the accelerometer.
5: Activate the microcontroller as mouse using the function "Mouse.begin()".
6. Define a function "loop()"
    6.1: Read the input from accelerometer using the function "analogRead()" [x,y,z parameters & store them into separate variables].
    6.2: Using the map() and constrain() the accurate coordinates for the mouse pointer is located.
    6.3: Mouse.move() will send coordinates to smartphone.
7: Stop.

Fig.3.1. shows a screen shot for the mouse pointer on the screen.

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The selection process is done by using a mind wave headset. The technique behind this headset is Electroencephalography (EEG). It senses the electrical activities of the brain. The use of this headset will help to capture the eye blinks. This project uses 2 eye blinks for the selection process.

B. ***Eye blink detection algorithm:***

1. Obtain readings from an EEG headset by connecting to it.
2. Capture data's for eye blinking.
3. Read eye blink data as 2 eye blinks within 5ms.
4. Send click command if 2eye blinks are detected.

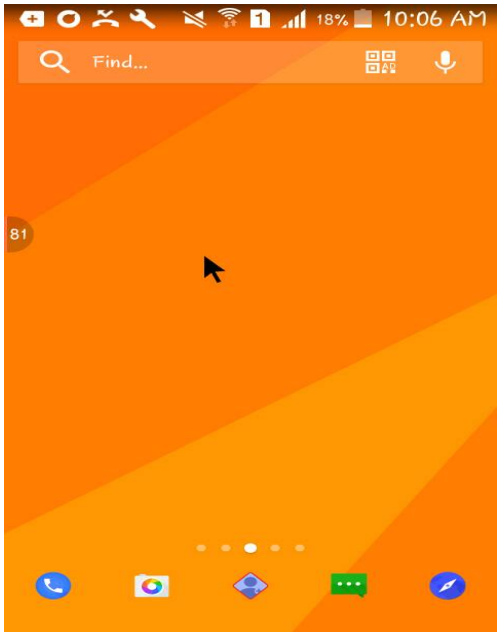

Fig.3.1. Screen shot of the mouse pointer on the screen

IV. SIMULATION RESULTS

After proper connections are made, a mouse pointer will be appeared on the screen of the smartphone. This pointer will help to perform the basic operations on phone such typing text, calling, taking a picture, etc. The pointer's movement is handled using the head. The movement of the head will make the pointer move, i.e., if the head moves slightly to right the pointer will move towards the right side. Similarly for left, up and down movements of the pointer.

The selection procedure is obtained using the neuroskymind wave headset. The pointer makes selection whenever the eye blinks after focusing the targeted item. 2 eye blinks is measured for making selection process. Thus, this project helps to manage smartphone using head and eye movements.

V. CONCLUSION AND FUTURE WORK

This project helps to handle smartphone using head and eye blinks. Accelerometer helps to capture the head movements which are further processed in the microcontroller for obtaining the mouse coordinates. These points will be given to the smartphone.

A mouse pointer will appear on the screen and can be moved by using head movements. Neurosky headset is used for the click option. So the clicking is done by blinking eyes.

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Thus, this project helps people who got handicapped or those who could not handle the smartphone using hand.

The future scope of this project is the implementation of Iot(Internet Of Things), which is one of the growing technologies. By adding Iot, this project will help to handle home appliances using the smartphone.

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