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REVIEW ON SMART HELMET USING INTERNET OF THINGS

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Abstract—*The advancement of wearable technologies in the recent times has taken human computer interaction at a higher grade. Wearable technology is related to both ubiquitous computing and the development of wearable gadgets. Wearable's make technology prevalent by interlinking it into day to day life. Go Pro cameras have changed the way adventure sports are recorded, shared and relived. Being a head strapped camera, it allows for a complete hands-free experience and thus not being a hindrance in the sporting activity. In the light of recent gesture controlled devices an implementation is being done on a low cost, portable head mounted camera that will capture images with just the blink of an eye and with the concept of Internet of Things this project can enable the user to give his current location and also stream live videos over the Internet. It involves measure and control of the eye blink using IR sensor. By using Raspberry Pi development board, the interfacing of IR module with and USB camera becomes easy and thus this project becomes cost efficient. This project has great applications in the field of traffic surveillance, hands free recording and much more.*

I. INTRODUCTION

This project uses an advanced approach to find a dedicated solution to remotely access parameters like photos, live video, location and other parameters by using advanced concept of 'Internet of Things' (IoT), eye gestures with Infrared and programming on development board (Raspberry Pi). The term Internet of Things (IoT) describes several technologies and research disciplines that enable the Internet to reach out into the real world of physical objects. The camera is controlled by blinking of eyes with the help of IR module. The photos which are captured are saved and can be remotely accessed through the computer by using VNC software and SSH protocol. The videos recorded will be directly streamed via WLAN and can be viewed by using weaved software and HTML The main aim of the project is to make it hands free and gesture controlled. The gestures we are using in this case as a controlling mechanism is eye blink detection. There are several ways to perform eye blink detection some of them being using proximity sensors and image processing. In this case we have opted to make use of a proximity sensor for eye blink detection. The proximity sensor we are using is an IR based proximity sensor. An IR sensor makes use of the reflective property of light to judge the proximity of any object in this case our eye. Once the output from the IR sensor is connected to one of the GPIO pins of the Raspberry Pi, we can now execute a python program to use this as an input to control the functions of the USB camera. As the person blinks once, the webcam which is also mounted above the helmet captures an image. With two back to back eye blinks the webcam starts capturing the video. All these data along with the location of the person involved is sent wirelessly to the remote terminal. Live stream of the surroundings is also possible. On the Raspberry Pi development board, the programming is done for interfacing the IR sensor module with the USB camera in order to capture images and videos and wirelessly accessing them via VNC software on remote terminal connected. For establishing a link between the devices, OpenCV module in python is used. OpenCV (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. It was basically developed to disseminate vision knowledge by providing a common infrastructure that developers could build on, so that code would be more readily readable and transferable.

II. THE HARDWARE SYSTEM MICRO CONTROLLER:

Raspberry pi:

The Raspberry Pi is a low-cost credit card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games. The Raspberry Pi has the ability to interact with the outside world, and has been used in a wide array of digital maker projects, from music machines and parent detectors to weather stations and tweeting birdhouses with infra-red cameras. Here we use Raspberry Pi 3. The Raspberry Pi 3 is the third generation Raspberry Pi. It replaced the Raspberry Pi 2 Model B in February

2016. Compared to the Raspberry Pi 2 it has:1.2GHz 64-bit quad-core, ARMv8 CPU, 802.11n Wireless LAN, Bluetooth 4.1, Bluetooth Low Energy (BLE).
Like the Pi 2, it also has:1GB RAM, 4 USB ports, 40 GPIO pins, Full HDMI port, Ethernet port, combined 3.5mm audio jack and composite video, Camera interface (CSI), Display interface (DSI), Micro SD card slot (now push-pull rather than push-push), Video Core IV 3D graphics core

IR Sensor:

An infrared sensor is an electronic device, which emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiation. This type of radiation is invisible to our eyes, which can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received. The eye-blink sensor works by illuminating the eye and/or eyelid area with infrared light, then monitoring the changes in the reflected light using a phototransistor and differentiator circuit.The exact functionality depends greatly on the positioning and aiming of the emitter and detector with respect to the eye. For example, a relatively robust detection of blinking is easy to achieve by arranging the detector so that it is near the eyelid, mounting the detector to the rubber eyecup of an HMD has this effect.
• Connect regulated DC power supply of 5 Volts. Black wire is Ground, Next middle wire is Brown which is output and Red wire is positive supply. These wires are also marked on PCB.
• To test sensor you only need power the sensor by connect two wires +5V and GND. You can leave the output wire as it is. When Eye closed LED is off the output is at 0V.
• Put Eye blink sensor glass on the face within 15mm distance, and you can view the LED blinking on each Eye blink.
• The output is active high for Eye close and can be given directly to microcontroller for interfacing applications.
EYE BLINK OUTPUT
5V (High) → LED ON When Eye is open.
0V (Low) → LED OFF when Eye is closed.
IR light emitted from the LED in each prototype pair of glasses does not pose a known risk to the eye (e.g. lens, cornea, retina). Maximal power output of the IR LEDs was 0.62 mW as measured at the LED lens surface using an IR sensitive light meter (Ophir Nova II Meter and Photodiode Power Sensor PD300, with appropriate filter setting). Even if the LED used in our system were inadvertently directed into the eye from the corneal surface for 8 consecutive hours, the amount of light energy delivered would be 2.13 log units below the maximal permissible exposure levels set forth by the American National Standards Institute (ANSI) code Z136 for laser safety standards (i.e. more than two orders of magnitude below a safe exposure level).

USB Webcam:

Specifications:

- Type: Portable Webcam
- Resolution(Video): 640 X 480
- Video Frame rate: 30 fps
- Resolution(Still): 0.3 megapixels
- Focus Type: Manual Focus
- Microphone: Yes
- Image Sensor: CMOS
- Field of View: 550

Camera Control

Once the output from the IR sensor is connected to one of the GPIO pins of the Raspberry Pi, we can now execute a python program to use this as an input to control the functions of the USB camera.

The program reads the value of the GPIO pin that the sensor is connected to and renames the outputs as HIGH for 3.3v and LOW for 0v. An eye shut if signified as a LOW output and eye open as HIGH. We use an eye blink detection of 2 seconds to avoid small involuntary blink to be detected. Hence, from now on in this report when the eye is kept shut for two seconds it will be referred to as one blink period.

As the program runs it keeps checking the input to the specified GPIO pin. As long as the eye is open the output will remain HIGH. During the first blink period *detection,* the program is triggered to send a command to the camera to capture an image. This image is saved as a time stamped image in one of the Raspberry pi's folders.

However, if one blink period is followed immediately by another blink period, the program goes into a loop where it instructs the camera to begin video capturing. Now video recording begins and it continues till the next blink period. At the next blink period, it breaks out of the loop. This process continues as long as the program is functional. The program can also be triggered to start at system boot using a few command line commands. This will allow the user to start using the device by just powering it up rather than logging it into the Raspberry Pi to physically initiate the program.

Access point/Hotspot

In computer networking, a wireless access point (WAP) is a networking hardware device that allows a Wi-Fi compliant device to connect to a wired network. The WAP usually connects to a router (via a wired network) as a standalone device, but it can also be an integral component of the router itself.Wireless (or wi-fi) hotspots are essentially wireless access points providing network and/or Internet access to mobile devices like your laptop or smartphone, typically in public locations. To put it more simply, they're places where you can take your laptop or other mobile device and wirelessly connect to the Internet; some devices and smartphones also act as mobile wi-fi hotspots. Here in this system, the hotspot is created in order to provide internet access to the Rpi development board.

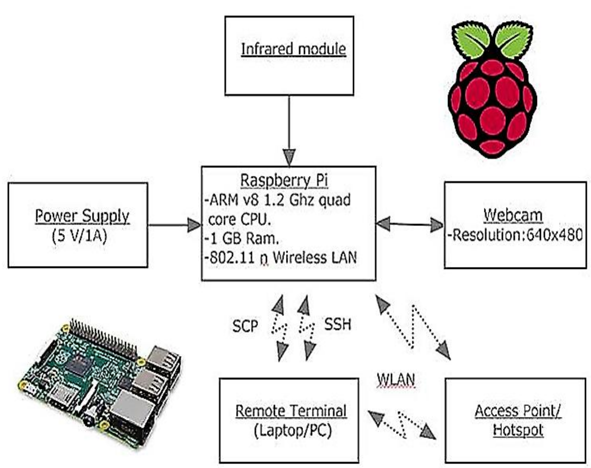
Remote Terminal:

In this system, the remote terminal used is a laptop. Here, the remote terminal is used for following purposes: Accessing GUI of Raspberry Pi wirelessly through VNC ,Give commands to the Raspberry Pi, To view the captured images, videos and live streaming, Run the python code.

III. WORKING

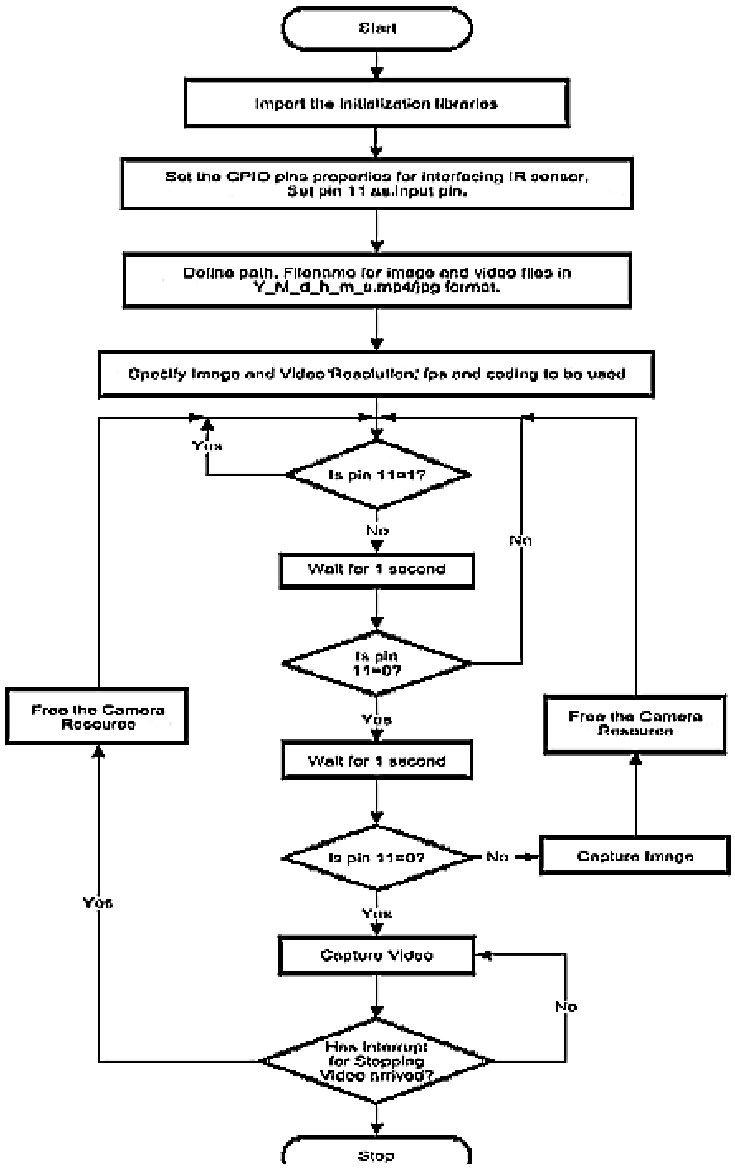
The first stage of the project is to initialize the Raspberry pi by installing the OS and connecting various devices in order to work on it. In this stage, various packages were installed and run to make various components connected to the Rpi work. Modules like fswebcam, libavtools etc. and software's like VNC were installed for the camera access part and using it for capturing photos and videos as well as accessing Raspberry Pi wirelessly over the WLAN. Motion software was implemented too for streaming the captured video live over the internet. The code was implemented on the Raspberry Pi development board for which we used Python language. Python is an interpreter, object-oriented, high-level programming language with dynamic semantics. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. The project was implemented on a helmet which was the basic purpose of the system.

Block Diagram:-



Infrared module will continuously sense the blinking of Eye and will capture image if eye is blinked for one second and record video if blinked twice for one second. The video will stop recording when Eye blinks again for a second. The camera attached to the helmet will record or capture the video or the picture. The captured video or the picture could be wirelessly accessed using VNC. VNC enables you to remotely access and control your computers from another computer or mobile device, wherever you are in the world. It is used by individuals and by organizations across every industry sector for a range of different use cases, including providing IT desktop support to colleagues and friends, and accessing systems and services on the move.

Flowchart:-



Algorithm: -

1) Import all the required packages for initialization.

2) Initialize the GPIO pins and set pin 11 as input.

3) Define path, Filename for saving Image and Video files in Y_M_d_h_m_s.mp4/jpg format.

4) Specify the Resolution, FPS and Coding to be used for capturing Images and Recording Videos.

5) Keep checking pin 11.

6) If pin 11 is 0 wait for 1 second. Now if pin 11 is 1, go to step 5 else to next step.

7) If pin 11 is 0 again wait for 1 second. Now if pin 11 is 1 then capture Image and go to step 5, else start capturing Video.

8) Check the interrupt for stopping Video recording.

9) If interrupt has arrived stop capturing video and go to step 5 after freeing the camera resource, else continue capturing Video.

IV. FUTURE SCOPE

- Wildlife Photography
- For Security
- Spy Camera and Remote Surveillance
- Adventure Sports

V. ADVANTAGES

- Remote access control
- 21st century advance wireless technology
- Portable
- Wide range of applications

VI. LIMITATIONS

- Will not work offline.
- Accuracy of the system is not high
- Equipment and installation Costs
- System crashes due to damage in interconnection.

VII.CONCLUSION

After carrying out logical analysis of the project, certain conclusions were made. If the speed is slow, the time required for the commands to get recognized and the operation to be performed is also slow. Since this conversion is carried out by VNC server, this system will not work offline. The accuracy of the system is not high. This system is made from easily available hardware which is quite affordable. Features like speech recognition and temperature sensor can be added. By using the mobile application of VNC the system can be developed to control the devices from home and also from remote location. The possibilities are immense. The field of IoT (Internet of Things) has been implemented in this system and if incorporated along with speech recognition it will widen the scope of this project.

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