

Low cost IP address based Telescope

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Abstract—In this world all the technologies are developing day by day. But telescope views gives very difficult to see and also it gives more strain to our eyes, by viewing the particular object. So in this project IP based telescope is introduced. In existing system distant objects are viewed closer through telescope and there is no recording function, it cost more. And also eyes are painning too, because of using through one eye. So we cannot continuously see particular object or something others. But the proposed idea deals about the telescope connect with smart world like tablet, smart phone and all. Low cost telescope using Raspberry pi which has recoding function and it is cost efficient. In this distant object can be viewed closer output of the through smart phone or tablet. In this system by using Windows OS is embedded through Secure Digital (SD) card. The raspberry pi system is connected with public network through Wi-Fi and can be visible for a particular IP address. To see the video particular IP address can be accessed so that it can be viewed in a monitor with larger view.

Index terms – Telescope,Raspberry-pi,wifi,pi-camera,python commands, Stepper motor.

I. INTRODUCTION

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. There are currently four Raspberry Pi models. They are the Model A, the Model B, the Model B+ and the Compute Module (currently only available as part of the Compute Module development kit). All models use the same SoC (System on Chip - combined CPU & GPU), the BCM2835, but other hardware features differ. The A and B use the same PCB, whilst the B+ is a new design but of very similar form factor. The Compute Module is an entirely different form factor and cannot be used standalone.

The Model B+ is an updated revision of the Model B. It increases the number of USB ports to 4 and the number of pins on the GPIO header to 40. In addition, it has improved power circuitry which allows higher powered USB devices to be attached and now hot-plugged. The full size composite video connector has been removed and the functionality moved to the 3.5mm audio/video jack. The full size SD card slot has also been replaced with a much more robust micro SD

slot. Current monitors on the USB ports mean the B+ now supports hot-plugging. Current limiter on the 5V for HDMI means HDMI cable-powered VGA converters will now all work. 14 more GPIO pins. EEPROM readout support for the new HAT expansion boards. Higher drive capacity for analog audio out, from a separate regulator, which means a better audio DAC quality. No more back powering problems, due to the USB current limiters which also inhibit back flow, together with the "ideal power diode". Composite output moved to 3.5mm jack. Connectors now moved to two sides of the board rather than the four of the original device. Ethernet LEDs moved to the Ethernet connector. 4 squarely-positioned mounting holes for more rigid attachments to cases etc. The power circuit changes also means a reduction in power requirements of between 0.5W and 1W.

II. HARDWARE RESOURCES USED COMPATIBLE TO RASPBERRY-PI

A. Wifi dongle

Although the Raspberry Pi Model B comes with built-in 100Mbps wired Ethernet, it can also use Wi-Fi via a USB dongle. Edimax Technology Co.,Ltd EW-7811Un 802.11n (RTL8188CUS 802.11n) WLAN Adapter

It connects to Raspberry Pi by way of a short ribbon cable. e camera is connected to the BCM2835 processor on the Pi via the CSI bus, a higher bandwidth link which carries pixel data from the camera back to the processor. This bus travels along the ribbon cable that attaches the camera board to the Pi. The sensor itself has a native resolution of 5 megapixel, and has a fixed focus lens onboard. In terms of still images, the camera is capable of 2592 x 1944 pixel static images, and also supports 1080p30, 720p60 and 640x480p60/90 video.

B. SD card

The SD card is installed with Raspberry Pi's operating system "Raspbian wheezy". Here TRANSCEND SD 16GB

CLASS 5 MEMORY CARD (the class indicates how fast the card is) is used.

C. Telescope

- 10x zoom telescope mounted on Raspberry pi camera.
- Minimum focus length - 3 meter
- Maximum focus length - 500 meter
- Size of the telescope – 30 X 75 mm

III. Implementation and methodology

Raspberry pi connect from the remote pc by using SSH(secure shell).This board to laptop connect via using lan cable. To view the Raspberry pi desktop on remote PC using putty software.Finally to see the particular live stream video from raspberry pi configuration.

A. Raspbian wheezy OS installation

In order to use the Raspberry Pi, an Operating System (OS) is needed to be installed onto a SD card. An Operating System is the set of basic programs and utilities that allow your computer to run. Use the SD formatter tool and select "FORMAT SIZE ADJUSTMENT" option to "ON" and format the SD card. Now Insert the SD card and then run Win32DiskImager. Select the Image file (2014-09-09-wheezy-raspbian) and your SD card, then click "Write"[4].

B. IP address configuration

In order to use the PC's monitor to view the RPi desktop through Ethernet it needs a an IP address. To know the IP address of the PC which is connected to the Raspberry pi through Ethernet, go to cmd prompt window and type "ipconfig". Get the IP address of Ethernet port and the edit the cmdline file and add "ip=192.168.137.100::192.168.137.1" at the last of the first line and save the file.

IP address -> 192.168.137.100 :: 192.168.137.1
Pi's address PC address

C. Putty Configuration

Putty supports many variations on the secure remote terminal, and provides user control over the SSH encryption key and protocol version, alternate ciphers such as 3DES, Arc four, Blowfish, and DES, and Public-key authentication. In a Raspberry Pi, SSH is enabled in default. So it's possible to connect to the Raspberry Pi remotely using the Login id and password.

Login: pi Password: raspberry



Fig 3.5: Raspberry Pi login

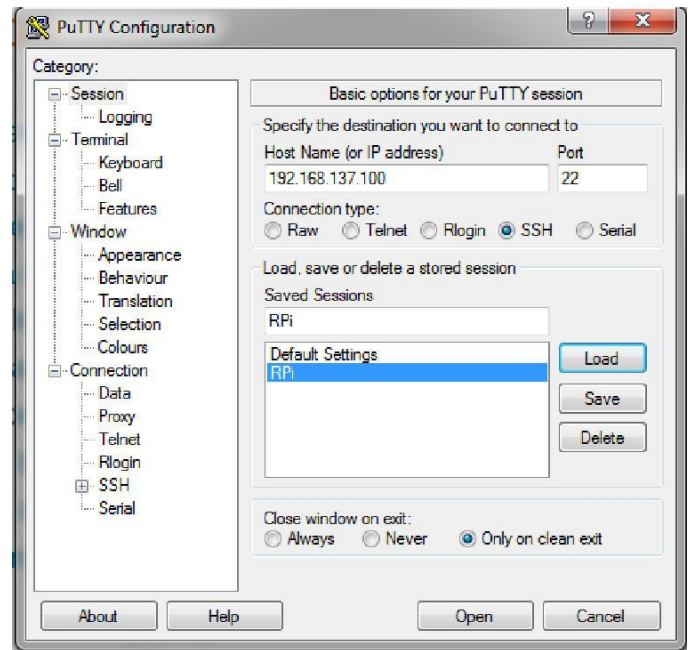


Fig 3.6: PuTTY window

D. Updating and upgrading

The RPi OS needs to be updates periodically and the system software ie., packages should be upgraded to achieve a proper working of RPi. The OS is updated and upgraded using the following commands.

- \$ Sudo apt-get update
- \$ Sudo apt-get upgrade

E. installing gpio header

The RPi.GPIO python module offers easy access to the general purpose IO pins on the Raspberry Pi.

- \$sudo apt-get update
- \$sudo apt-get install python-dev
- \$sudo apt-get install python-rpi.gpio
- \$sudo apt-get -y install python3-rpi.gpio

F. WIFI configuration

In order to configure Wi-Fi module, boot the Raspberry Pi without the Wi-Fi adapter plugged in usb port. Open a

Terminal session by clicking on the LX Terminal icon, and enter the following command into it:

```
$sudo nano /etc/network/interfaces
```

Edit this file and configure for Wi-Fi The word

SSID is visible:

```
auto lo
iface lo inet loopback
iface eth0 inet dhcp
allow-hotplug wlan0

auto wlan0
iface wlan0 inet dhcp
wpa-ssid "ssid"
wpa-psk "password"
```

SSID is hidden:

```
auto lo
iface lo inet loopback
iface eth0 inet dhcp
auto wlan0
allow-hotplug wlan0
iface wlan0 inet dhcp
wpa-scan-ssid 1

wpa-ap-scan 1
wpa-key-mgmt WPA-PSK
wpa-proto RSN WPA
wpa-pairwise CCMP TKIP
wpa-group CCMP TKIP
wpa-ssid "Secret SSID"
wpa-psk "SSID PSK"
iface default inet dhcp
```

Then press `ctrl + x`, save the file and exit the nano editor. After that reboot the system using “`sudo reboot`” command and plug in the Wi-Fi adapter. Now the Raspberry Pi will detect the Wi-Fi SSID and connect to it. Now the Pi can be place in the Wi-Fi coverage area and can be accessed within the network. To login to RPi, the WLAN IP address is required.

IV. Raspberry pi web server setup

Set up a web server on your RPi and install WordPress, a content management system that makes creating websites easier.

A. Set Up Apache Web Server

Apache is a popular web server application you can install on the Raspberry Pi to allow it to serve web pages. On its own,

Apache can serve HTML files over HTTP, and with additional modules can serve dynamic web pages using scripting languages such as PHP.

First install the `apache2` package by typing the following command into the terminal:

```
$sudo apt-get install apache2 -y
```

B. Test The Web Server

By default, Apache puts a test HTML file in the web folder. This default web page is served when you browse to `http://localhost/` on the Pi itself or `http://192.168.1.10` (whatever the Pi's IP address is) from another computer on the network. To find out the Pi's IP address, type `hostname -I` at the command line. Browse to the default web page, either on the Pi or from another computer on the network, and you should see the following:



Fig 4.1: Testing apache
This means you have Apache working!

C. Installing Motion:

First, we need to give Raspbian the camera support.

- `$ sudo apt-get install rpi-update`
- `$ sudo rpi-update`
- Now we need to install motion.
- `$sudo apt-get install motion`
- `$ sudo nano /etc/motion/motion.conf`

D. Configuration Of Motion

First we need to change `daemon` to `on` so it starts when the Pi boots. To change this, change `daemon off,` to `daemon on.` Next thing we want to change is the resolution. You can leave it at `320 x 240` or change it to something higher (`320x240` is fine). Next change `webcam localhost on` to `off.` This allows us to view the camera feed from another device instead of just the Raspberry pi. Now CLRT^X answer Y to the question of if you want to save and hit enter

- Lastly, we need to set up motion to start when the Pi boots.
- `$sudo nano /etc/default/motion`
- In this file change `start_motion_daemon = no` to
- `$start_motion_daemon=yes`
- Now we should reboot the Pi so it makes the changes.
- `$sudo reboot`

Now the motion is configured. Plug in a compatible webcam and it should stream video to Pi's IP Address followed by :8081

Example: <http://192.168.137.100:8081>

V. Result

A code is written in python language to control the stepper motor. A motor driver is used between motor and raspberry pi. The delay and step input is varied to achieve the required speed and angular rotation.



Fig 5.1: Stepper motor control

Fig5.1 shows how the motor and the raspberry pi is interfaced along with the LM293 driver circuit.

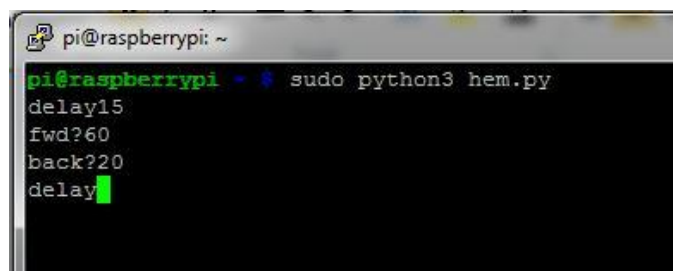


Fig 5.2: Control speed and steps

Fig 5.2 shows that the python program is executing and motor is controlled by giving the required delay time and steps of rotation.



Fig 5.3 pi camera connected with raspberry pi board

Fig 5.3 shows a Raspberry pi camera plugged in RPi's camera slot. This is pi camera so no need to connect USB port. Directly connect to camera slot in this board.

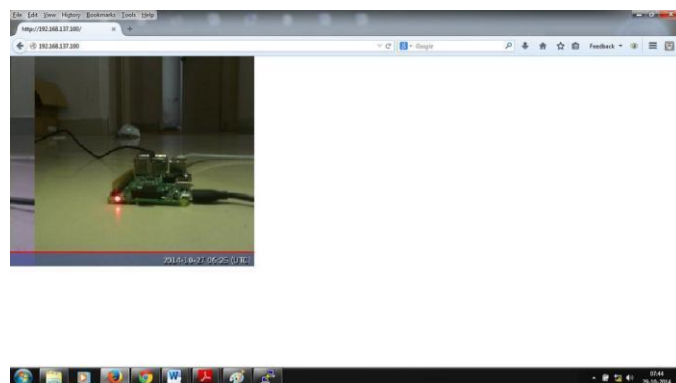


Fig 5.4: Live stream in Mozilla browser

The live stream is viewed in browser by entering the IP address with the port number ie.,192.168.137.100:8081. This stream can be accessed within a network and Fig 5.4 shows the live stream of the camera



Fig 5.5: Telescope using on Raspberry pi board

In this project I mounted the telescope in front of the raspberry pi camera.



Fig 5.6: Telescope output

Fig 5.6 left hand side photo is not using telescope in raspberry pi camera. In right hand side photo is telescope used in pi camera. In this view are live stream on any web browser. For example we can see output <http://192.168.137.100:8081> this particular IP address. This is my final output for LOW COST IP ADDRESS BASED TELESCOPE.

VI. CONCLUSION AND FUTURE WORK

A. Conclusion

In this project model live stream of distance object can be viewed in mobile phone, tablet and computer. Its fully controlled by IP address.

B. Future work

To create an android and ios mobile application for this project. In that application contain that can operate the camera function with in remote access. For example zoom in, zoom out for the camera angle. And we can manually change the camera direction, rotation by using stepper motor.

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