

Front Page of the Report

[Please ensure the front page of your report contains the following:]

Title

ITD102 Mini-Project Raspberry Pi camera
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Team

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Here is our video link:

<https://youtu.be/v9Kx3bveweo>

Student 1

Name	Wanqing He (Erin)
Statement of contribution to the project, what did you do?	Report
Signature	Erin

Student 2

Name	Xinying Ren (Airica)
Statement of contribution to the project, what did you do?	Report
Signature	Airica

Student 3

Name	Junhao Li (Jerry)
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Statement of contribution to the project, what did you do?	Make raspberry pi
Signature	Junhao Li

Student 4

Name	Arin Kim
Statement of contribution to the project, what did you do?	Make raspberry pi
Signature	Arin Kim

Project objective:

Currently, computer and mobile phone has only a single fixed camera on it. They are not able to spin in 180 direction intelligently. At the same time, the smart rotating camera can be security camera (surveillance camera). Also be installed in the corner of the house to ensure safety. To solve this problem, we decide to use Tilt and Pan Servo Bracket and a special camera for raspberry pi to realize the intelligent camera.

The working principle of this design is to install the camera on a motor that can rotate 180 degrees. The motor drives the camera to rotate and record the real-time situation. Then input the IP address of user's computer or smart phone with :8000(this is port number which is set in code, if want to change another port number just change that in code) into the website's pages of a computer or smart phone to watch the real-time status of the camera shooting.

Review and Discussion of Technologies Used

(5 pages max): High level discussion of the technologies used, why were they used, alternatives, how they work (high level) and how they relate to the technologies presented in lectures.

CMOS Sensor Interface (CSI)

CMOS image sensors are divided into two categories, non-intelligent and intelligent. These non-intelligent image sensors simply support traditional camera timing (field and row synchronization) and then output a Bayer as well. Statistical data, while the smart sensor supports CCIR656 video decoding format, and also provides some additional image processing (e.g., image compression, image filtering pre-processing, and a variety of data output formats)

CSI includes the following capabilities:

- Front-end-configure the logical interface to support most common available CMOS camera interfaces.
- Support CCIR656 video interface and traditional camera interface.
- 8-bit data port, support convenient YCC, YUV, Bayer or RGB data format input.
- Fully controllable 9-bit or 16-bit data to 32-bit FIFO for packaging.

Principle of operation

CSI is designed to support the timing sequence of common sensor interface and video interface of CCIR656. Traditional CMOS sensors typically use SOF, HSYNC, and PIXCLK signals output to Bayer of YUV. Intelligent CMOS sensors, which typically have image processing in their chips and often support code mode if transmission, use embedded sequential coding to replace SOF and BLANK signals. The timing code is based on CCIR656.

<https://www.cnblogs.com/lifan3a/articles/5010633.html>

Base Http Service

BaseHTTPServer: provides the basic Web service and processor classes, HTTPServer and BaseHTTPRequestHandler.

This module defines two classes that implement the HTTP service (Web server). Typically, this module is not use directly, but is used as a base class to build a functional Web server. The first class, HTTPService, is a subclass of Socketserver TCPService. It creates and listens on HTTP sockets, sending requests to a handler. The code for creating and running the server as below:

```
with picamera.PiCamera(resolution='640x480', framerate=24) as camera:
    output = StreamingOutput()
    #Uncomment the next line to change your Pi's Camera rotation (in degrees)
    #camera.rotation = 90
    camera.start_recording(output, format='mjpeg')
    try:
        t1 = threading.Thread(target = motor_run)
        t1.start()
        address = ('', 8000)
        server = StreamingServer(address, StreamingHandler)
        server.serve_forever()
    finally:
        camera.stop_recording()
```

Base command:

```
1 | python -m http.server 8000
```

picamera (request, address, StreamingServer) is used to handle HTTP requests to the server. Individually, it cannot respond to any actual HTTP request and must be subclassed to handle each request method. For example, GET and POST.

Command Html GET and Post method

Get: Request data from the specified resource. The query string (name/value pair) is sent in the URL of the GET request.

Post: Commits the data to be processed to the specified resource. The query string (name/value pair) is sent in the body of the HTTP message of the Post request.

https://www.w3schools.com/tags/ref_httpmethods.asp

<https://docs.microsoft.com/en-us/dotnet/framework/wcf/samples/basic-http-service>

Streaming Video

Streaming media is sent in compressed form through the internet and displayed by viewers in real time. With streaming video or streaming video, Web users do not have to wait to download the file to play it. Instead, the media is sent as a continuous data stream and plays when it arrives. Users need a player, which is a special program to unzip and send video data to display and audio data to speakers. The player can be part of the browser or can be download from the software manufacturer's website.

Streaming video is usually sent from pre-recorded video files, but can be distributed as part of a live feed. In live broadcast, the video signal is converted into a compressed digital signal and transmitted from a special Web server capable of multicasting, while sending the same file to multiple users.

Alternative

Node.js (JavaScript)

Node.js is a platform built on the Chrome JavaScript runtime. Pi-camera-connect is a library that captures data from raspberry pi cameras and transmits them directly to NodeJS. There are many NPM modules connected to raspberry pie cameras. It have more advantage. Speed, using the built-in MJPEG resolver, JPEG images can be captured in 33ms with high efficiency. Efficient, import pictures and video streams directly into nodes as buffers, save all data in memory, and eliminate disk I/O. Modern, uses the latest ESNEXT features and the latest development practise. Structure, with TypeScript definition file.

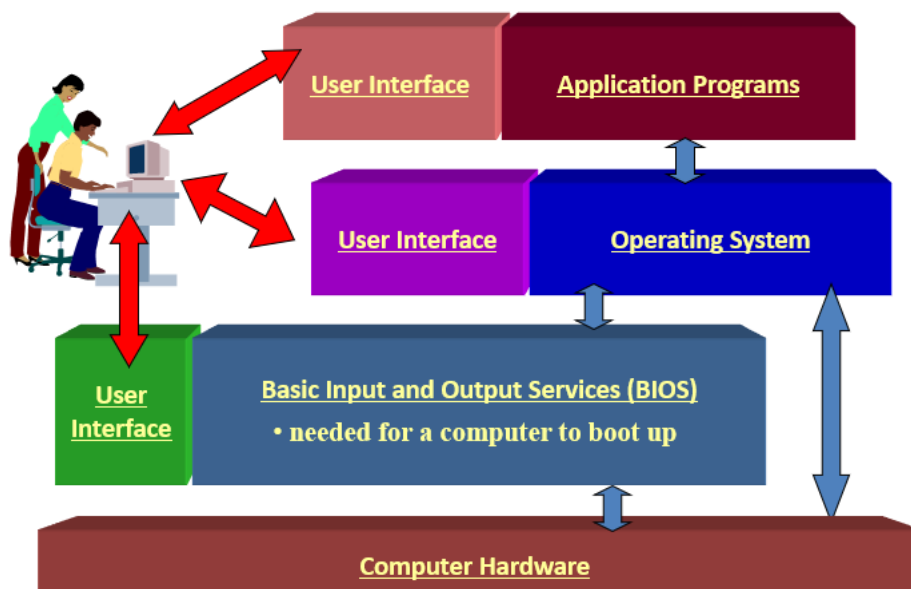
<https://www.npmjs.com/package/pi-camera-connect>

Through this unit, we understand what we learned in lecture and them to complete the mini project. In terms of the network, Static Web site, the request page is delivered by the web server the contents of these HTML files. When a web page

request (the user clicks a link or enters a URL), page's server to store the returned HTML document to the user's computer and browser to display it. Using the HTTP protocol: hierarchical protocols on TCP/IP to obtain web pages. Web Browser issues HTTP GET request at a URL. Receive a response containing HTML data (web page). Web browser displays the HTML data. The Http specification defines several verbs: GET, POST, HEAD, OPTIONS, PUT DELETE, TRACE AND CONNECT. At the same time, we used GET and Post to build up this project.

In this mini project, Putty is also used by us to write code into raspberry pi. In a general way, System software is programs that support the execution and development of other programs.

Computer Software Relationships



The picture from ITD102 Week 5 Lecture note

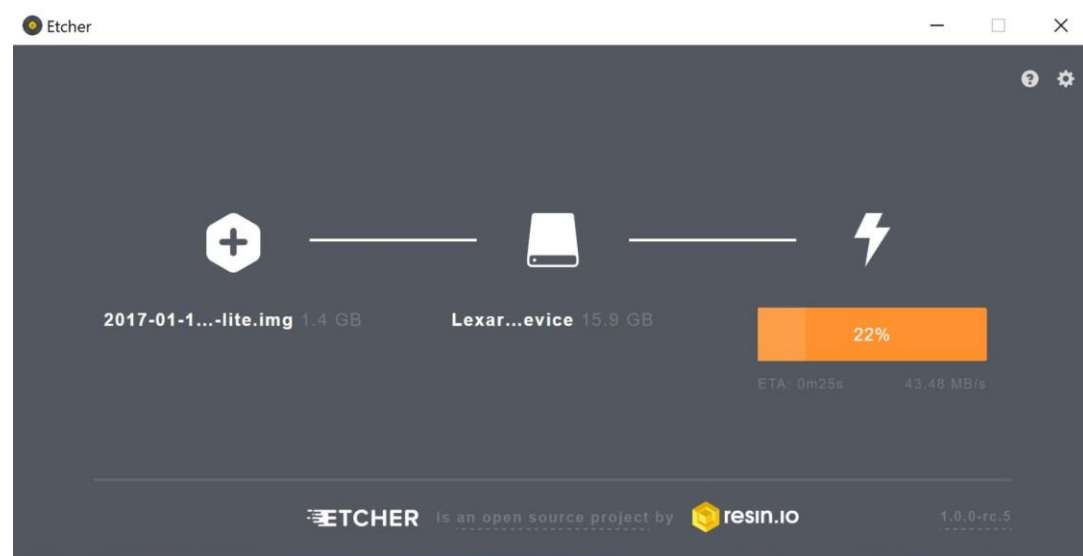
Design and Implementation

We prepared these things before we started:

- 1, one Raspberry Pi
- 2, Tilt and Pan Servo Bracket
- 3, special camera for raspberry pi
- 4, one SD card
- 5, a power supply which has a higher amp output.
- 6, 3 Aux cord
- 7, Wi-Fi
- 8, One USB Hard drive

The first step we set up raspberry pi then through Etcher to flash the SD card.
(sample below)

Etcher is a tool for quickly burning mirrored files to a USB device or SD card. Etcher's interface is simple and beautiful. Select the image you want to burn (support .iso, .img, and .zip files), then select the target device you want to burn, and click the button to burn it. If you plug in only one device, it will automatically recognize it, without having to choose. it is a cross-platform tool that supports Mac, window and Linux.



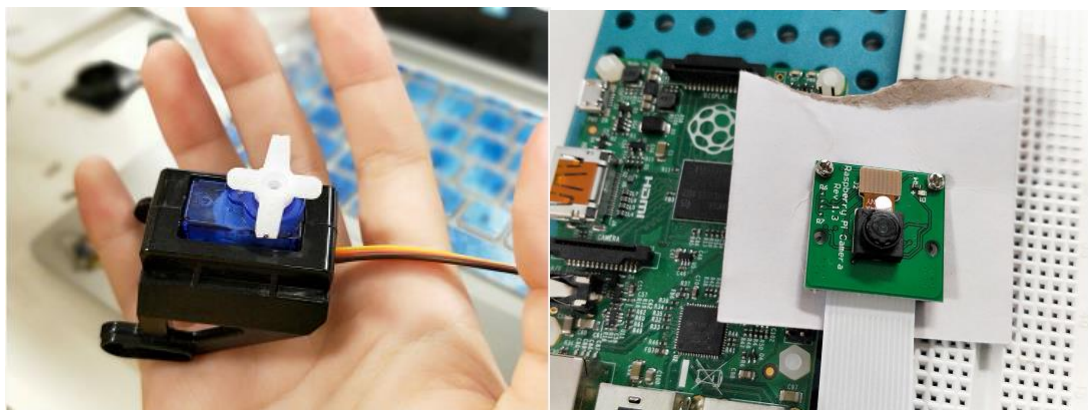
PuTTY, is a free and open source program that integrates virtual terminal, system console and network file transfer. It supports a variety of network protocol, including SCP, SSH, Telnet, rlogin and the original socket connection. It also be connected to a serial port.

Start assembling components

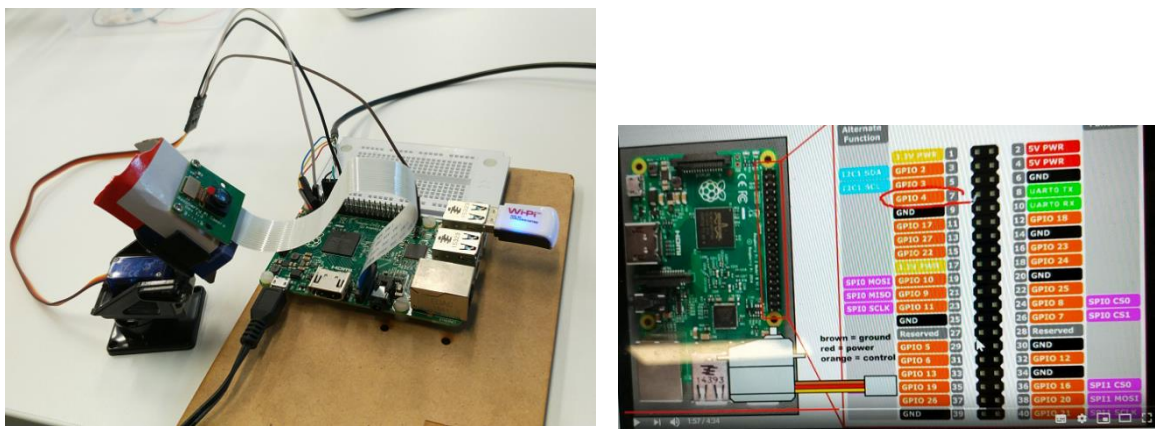


(sample below)

Insert the servo into one side of the pan bracket. Make sure that the servo shaft is at the opposite side from the pivot point for the tilt bracket.



Attach the 4-armed servo horn to the servo shaft using one of the short screws as shown. Insert the camera into raspberry pi.

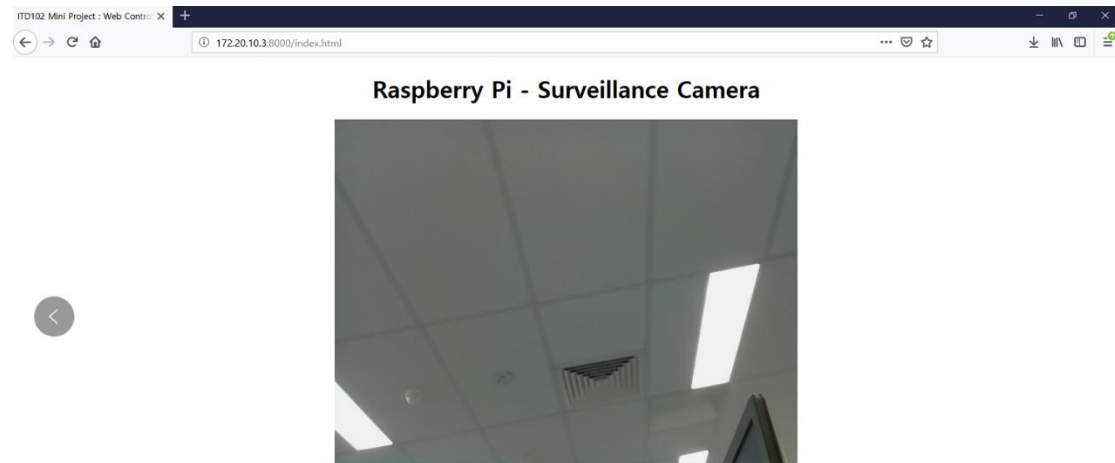


Set up according to the chart with 3 auxiliary cord.

When all the components are assembled, we can open the PuTTY to enter the user name and password to login.

Name: Pi

Password: raspberry



Build a Base Http Service in python. The photos taken were sent to the server

```
pi@raspberrypi:~$ nano new_one.py
```

A screenshot of a PuTTY terminal window titled 'COM3 - PuTTY'. The terminal shows the GNU nano 2.7.4 text editor editing a file named 'new_one.py'. The code in the editor includes imports for os, io, picamera, logging, socketserver, RPi.GPIO, time, and threading, along with http.server. It also shows HTML template code for a web page titled 'ITD102 Mini Project : Web Controlled Servo CCTV'. The page content is 'Raspberry Pi - Surveillance Camera'. A status bar at the bottom of the terminal shows various keyboard shortcuts like ^G Get Help, ^O Write Out, etc. A message '[Read 486 lines]' is visible in the editor's status area.

Use nano to edit. Write the code in Python to nano.

```
pi@raspberrypi:~$ python3 new_one.py
```

Python 3 running file new_one.py

First, start the camera function

```
sudo raspi-config
```

Select Enable Camera to make sure the raspberry Pi turns on the Camera.

```
raspistill -o a.jpg -rot 180
```

Rot is rotated by 180 degrees.

raspistill: parameter

-v: Debugging information view

-w: image width

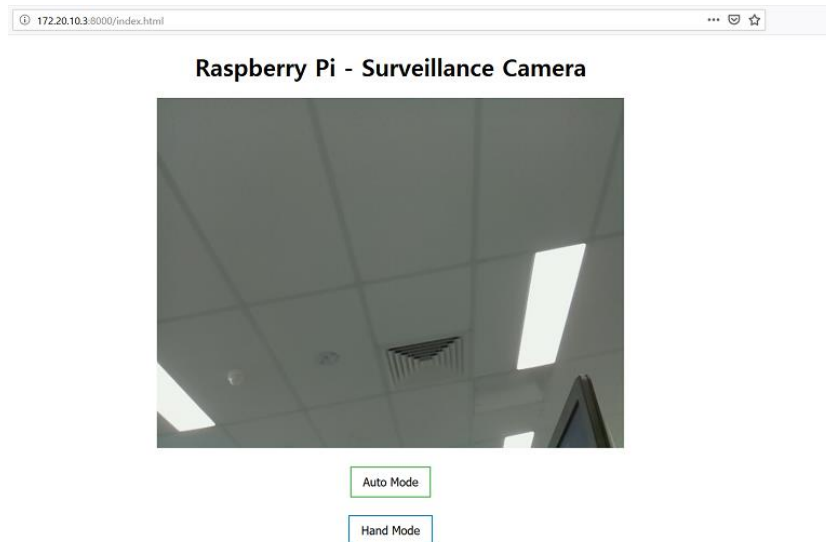
-h: image Height

-rot: image rotation angle, only 0, 90, 180, 270 degrees are supported.

-o: the image output address, such as image.jpg, sends the output to the standard output device if the file name is "-".

```
sudo apt-get update  
sudo apt-get install vlc
```

The first line is to update the software database, the second line is to install vlc. In addition, the experimental is that when user enters the IP address of the computer or smart phone with port number :8000, the page will display two options: automatic mode and hand mode. Automatic mode is to repeat 0-180 degrees rotation. Hand mode is input rotation angle to allow the user to set the camera orientation.



```
elif '/index.html' in self.path:

    global Mode
    global InputValue
    InputValue = "q"
    Mode = -1
    self.methods(PAGE)
```

The button control is reset through this code.

```
def Main():
    global Mode
    Mode = -1
    while True:
        #Mode_Select().Main()
        if Mode == 0:
            Auto_Mode().Main() ###Auto mode methods
        elif Mode == 1:
            print("Manual_Mode successful")
            Manual_Mode().Main()
        elif Mode == "Exit":
```

Control the entire running program.

The Linux system management command we use

```
apt-get update
```

Apt-get update: update the list of available packages and their version, but do not install or upgrade any packages.

```
apt-get upgrade
```

An updated version of the actual installation package. After updating the list, the package manager know the available updates for the software you have installed.

```
Sudo apt-get
```

Once the package database is updated, the installed packages can be upgraded. The most convenient way is to upgrade all packages with available updates.

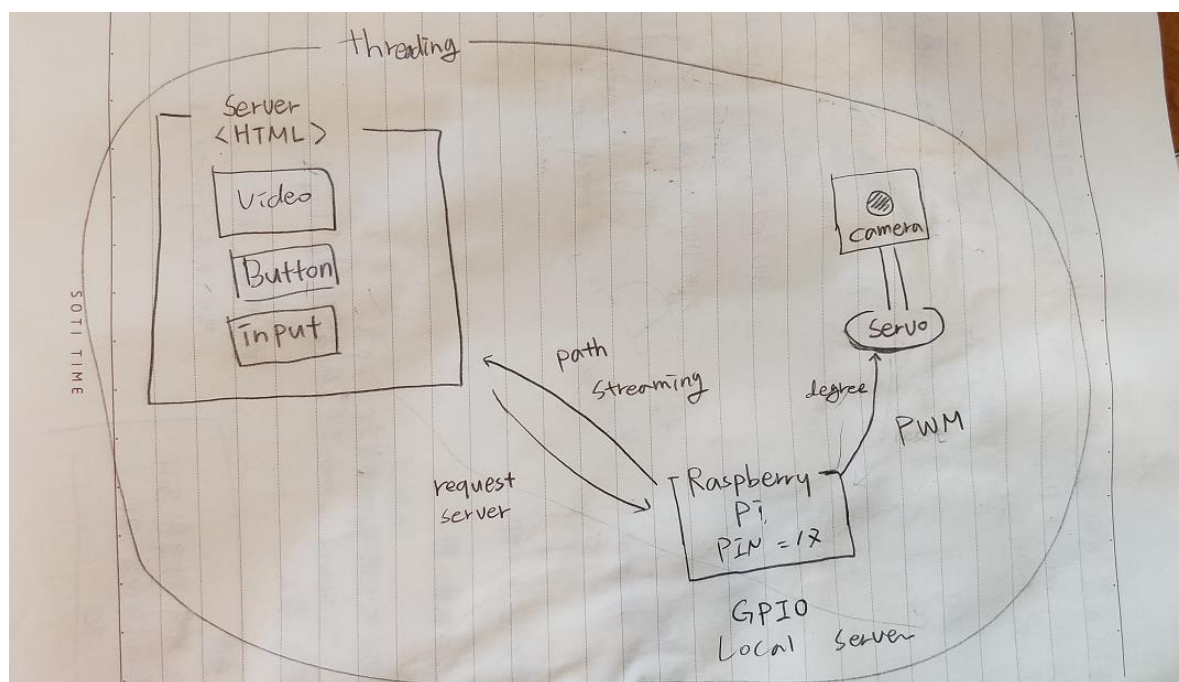
```
install rpi.gpio
```

If it isn't already installed it will be installed. If it is already installed it will be upgraded if a newer version is available

```
Ls
```

The ls command is used to display a list of targets, and is one of the most popular commands in Linux. The output of the ls command can be coloured to partition different types of files.

Overview the project diagram



Reference lists:

BillWagner. (2017), Basic HTTP Service, Retrieved from <https://github.com/dotnet/docs/blob/master/docs/framework/wcf/samples/basic-http-service.md>

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