Single-board Computer - Raspberry-Pi & Programming

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Plan for the upcoming 4 Sessions

Monday, 20th September (completed last week)
- Setting the Context (Why RaspberryPi?)
- Introduction, Installation & Setup - RaspberryPi

Tuesday, 21st September (completed last week)
- A Quick Intro to Python Programming
- Interfacing Sensors to RaspberryPi and GPIO Programming

Monday, 27th September (yesterday)
- Image Processing with Python - OpenCV
- Exploring new tools/libraries

Tuesday, 28th September (today)
- Build Web-interface with Python - Flask
- Run a full-fledged application with Raspberry-Pi

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Session - 4

- **Create Web Application with Flask API**
- **Build a full fledged Application**

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What are we going to do in this experiment?

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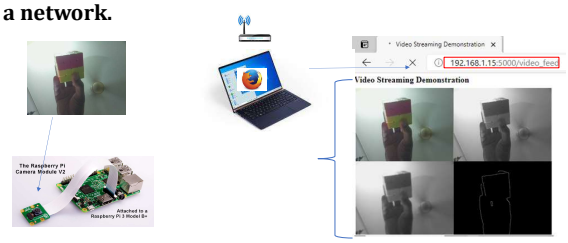
Expected Output

Live Stream Video along with the *processed frames* to the browser to be accessed with the IP address in a network.



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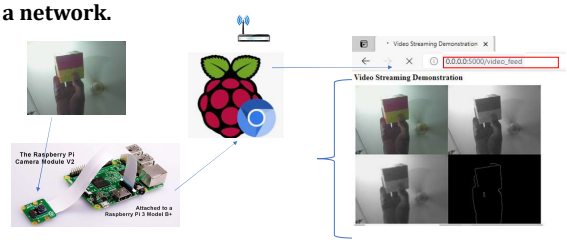
Expected Output

Live Stream Video along with the *processed frames* to the browser to be accessed with the IP address in a network.



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Web Application

- **Client Server Communication**
- Server stores and runs different services (The server is identified with an IP address; different services run on different ports)
- The Client sends a request to the server (located at a specific address)
- The server sends a response back to the client.

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Web Application

- **Running a Camera Web-Application**
- The Raspberry-Pi runs a web-application (acts as a server) (***Flask*** app)
- The Client (web-browser running on a machine in the same network – laptop, smart-phone, tab etc.) sends a request to the server (IP address of the Raspberry-Pi)
- The server sends a response (processed and merged video frames) back to the client (web-browser - Firefox/Chrome/Edge etc.).

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What are the hardware components we need for this experiment?

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All we need

Micro USB Cable for Raspberry Pi 3

Raspberry Pi 3 Module

Use Laptop to remotely login to the Raspberry-Pi

Micro SD Card

Pi-Camera Module

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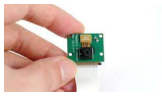
Camera Module



- This **5mp camera** module is capable of 1080p video and still images and connects directly to your raspberry pi. Connect the included ribbon cable to the **CSI (Camera Serial Interface)** port on your Raspberry Pi.
- The board itself is tiny, at around 25mm x 20mm x 9mm and weighing in at just over 3g, making it perfect for mobile or other applications where size and weight are important.
- The sensor has a native resolution of 5MP 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.
- This module is only capable of taking pictures and video, not sound.

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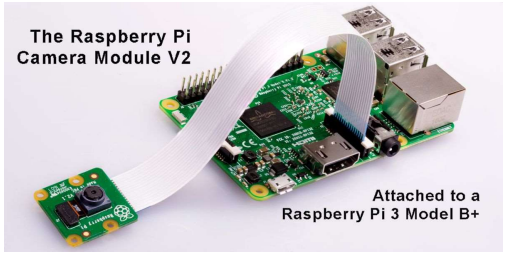
Camera connected to the R-Pi Board



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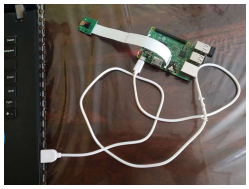
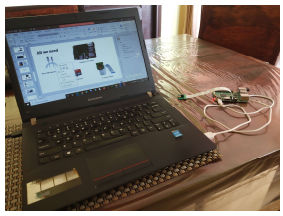
Our Set Up – Let's make it Simple





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Programming with Python

OpenCV
Open Source Computer Vision

Image Processing

Flask
web development, one drop at a time

Web Application

Let's check the code

Web browser (client app)

https://github.com/soharabhossain/Raspberry-Pi/tree/main/Camera%20Stream

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```
#---------------------------------------------------------------

# Create a Flask app
app = Flask(__name__)

# What to render at the apps web address?
@app.route('/')
def index():
    """Video streaming home page."""
    return render_template('index.html')

# Video will be streamed here
@app.route('video_feed')
def video_feed():
    """Video streaming route. Put this in the src attribute of an img tag."""
    return Response(gen(MyCamera()), mimetype='multipart/x-mixed-replace; boundary=frame')

#---------------------------------------------------------
#----------------Main Program-----------------------------
#---------------------------------------------------------

if __name__ == '__main__':

    print('\n Now running the web server.....')
    # Default port is 5000
    app.run(host='0.0.0.0', debug=True, threaded=True)
```

File to be rendered

Stream from this address will be rendered to the specified link

Port Number

IP address of the server in the local machine

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Index.html inside templates sub-directory

index - Notepad

File Edit Format View Help

```
<html>
 <head>
  <title>Video Streaming Demonstration</title>
 </head>
 <body>
  <h1>Video Streaming Demonstration</h1>
  <img src="{{ url_for('video_feed') }}">
 </body>
</html>
```

Stream will be taken from this source

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Thank You

Class material will be uploaded here:
https://github.com/soharabhossain/JoE_2021
https://github.com/soharabhossain/Raspberry-Pi/tree/main/Camera%20Stream

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