VASAVI COLLEGE OF ENGINEERING

IBRAHIMBAGH, HYDERABAD.

Project Title: **Face Recognition System**

Theme: Electronics for Warfare Applications

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ABSTRACT

Major military bases today take full advantage of technological advances to ensure physical security. Soldiers working covert operations at night may benefit from facial-recognition technology, and this development is expected to lead to enhanced real-time biometrics and post-mission forensic analysis. The scope of this project is to develop a defence and warfare application based on face recognition.

In this paper, we are implementing facial monitoring system by embedding face detection and face tracking algorithm found in MATLAB with the GPIO pins of Raspberry pi Model-B by using RasPi command such that the array of LEDS follows the facial movement by detecting the face using Haar classifier, tracking its position in the range assigned using the eigenfeatures of the face, which are detected by eigenvectors of MATLAB and by face tracking, which is been carried by geometrical transformation so that motion and gesture of the face can be followed.

In the first phase, we want to implement image processing using MATLAB to detect and recognize faces. In the second phase, we would implement the constructed model into the Raspbian OS environment and implement the same using raspberry pi. Finally, we try to focus on the practical difficulties faced, its accuracy and the training time and data required.

Keywords: Face Recognition technology, Raspberry pi & Camera Module, Classifiers & MATLAB Toolboxes.

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1. INTRODUCTION

There is undoubtedly much interest in the US for plumbing the depth and potential of various types of AI technology for defense and military use.

The main beneficiaries of this investment by the Chinese government are AI startups, and this is most evident in the facial recognition arena. Cameras are everywhere in China, and citizens accept being almost continually monitored. As a result, the development of AI-based facial recognition algorithms has taken off.

The wariness of people stems from the purpose of capturing the image or video. In a military context, its purpose is to identify, classify, verify, and if needed, neutralize any perceived threat. In the interest of security, this may seem a reasonable application. However, a major concern with facial recognition is its accuracy.

Most people take it for granted that military bases have ultra-tight security, and they would be right. However, it takes some doing as the sheer size of most of these bases means a significant investment in personnel. This could change in part due to AI.

Major military bases today take full advantage of technological advances to ensure physical security, including artificial intelligence.

The key is the strategic placement of a wide network of sensors and cameras connected to machine vision software designed to spot anomalies in the footage, which alerts human operators. At Edwards Air Force Base, for example, a system of ground-based radars sweeps over its 308,000 acres.

Human operators need to monitor these constantly, but it is easy to miss one thing out of a 100 at the end of a long shift or during a momentary distraction. AI software picks up the slack and increases the effectiveness of human operators.

Statement of problem

Data is very powerful and privacy of data is given the most importance in these cyber days. So, to put an end to the privacy issues, there emerges a need to identify the people who access the particular data.

Not just this, it can be also used to identify criminals at public places.

1.2 Objectives

The objective of our project is to address the issues discussed above. The objectives are as follows:

- To design an automatic and versatile system that addresses the issues of identification without use of human resources.
- To detect the face of criminals and unauthorized personnel and design a model using image processing.
- To establish the networking between different systems to exchange the information among them.

Scope

- In defense ministry, airports, and all other important places the technology can be used to ensure better surveillance and security.
- Preventing the frauds at ATMs in India.
- For access control verification and identification of authentic users it can also be installed in bank lockers and vaults.
- For identification of criminals the system can be used by police force also.

2. LITERATURE REVIEW

Many projects addressing similar problems have been done in international level. Use of raspberry pi and its camera for face recognition has been explained in the paper. A number of different approaches have been used by many researchers to detect face of moving persons. One of the most popular ways of face detection is based on Viola Jones Algorithm.

However, this approach is now frequently used for face detection due to its feasibility to run on any computing device. Commercially available Hardware are based on more advanced approach of face detection and provide high degree of accuracy.

Object detection is commonly referred to as a method that is responsible for discovering and identifying the existence of objects of a certain class. An extension of this can be considered as a method of image processing to identify objects from digital images.

One way to do so, it to simply classify objects in images according to color. This is the main variant used in, for example, robotic soccer, where different teams have assembled their robots and go head to head with other teams.

However, this color-coded approach has its downsides. Experiments have shown that the lighting conditions are extremely detrimental to the outcome of the game and even the slightest ambient light change can prove fatal to the success of one or the other team. Participants need to recalibrate their systems multiple times even on the same field, because of the minor ambient light change that occurs with the time of day.

So, the research and upgrading of these algorithms continue with many researchers working on the project over a long time.

3.BACKGROUND THEORY

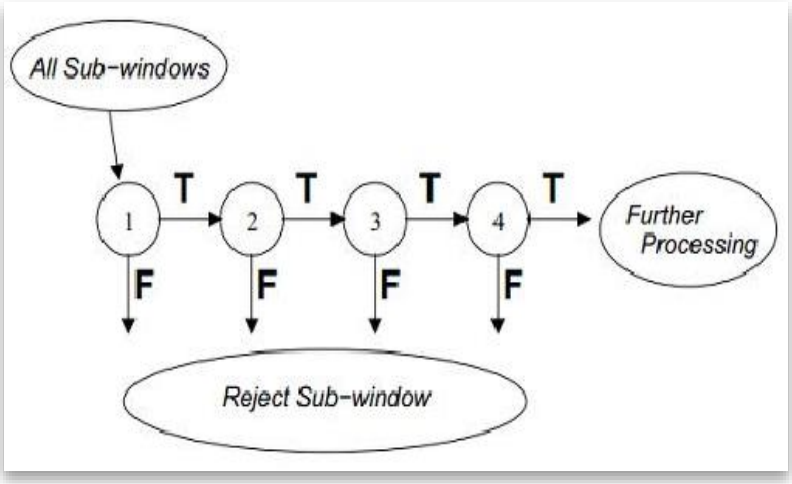
A Haar-like feature considers neighboring rectangular regions at a specific location in a detection window, sums up the pixel intensities in each region and calculates the difference between these sums. This difference is then used to categorize subsections of an image.
An example of this would be the detection of human faces. Commonly, the areas around the eyes are darker than the areas on the cheeks. One example of a Haar-like feature for face detection is therefore a set of two neighboring rectangular areas above the eye and cheek regions.

Cascade classifier:

The cascade classifier consists of a list of stages, where each stage consists of a list of weak learners. The system detects objects in question by moving a window over the image. Each stage of the classifier labels the specific region defined by the current location of the window as either positive or negative – positive meaning that an object was found or negative means that the specified object was not found in the image.

If the labelling yields a negative result, then the classification of this specific region is hereby complete and the location of the window is moved to the next location. If the labelling gives a positive result, then the region moves of to the next stage of classification. The classifier yields a final verdict of positive, when all the stages, including the last one, yield a result, saying that the object is found in the image.

In order to work well, each stage of the cascade must have a low false negative rate, because if the actual object is classified as a non-object, then the classification of that branch stops, with no way to correct the mistake made. However, each stage can have a relatively high false positive rate, because even if the n-th stage classifies the non-object as actually being the object, then this mistake can be fixed in n+1-th and subsequent stages of the classifier.

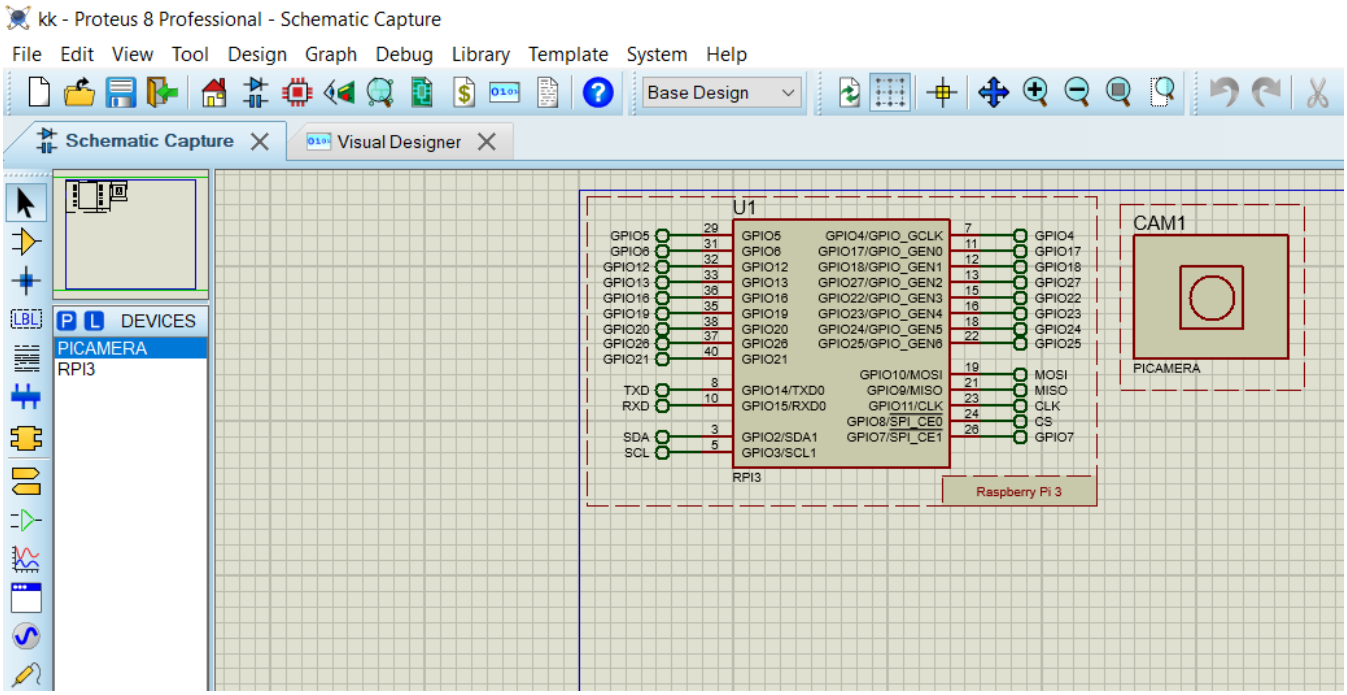


4. SOFTWARE AND TOOLS USED

4.1 Tools Used for Simulation

4.1.1 Proteus VSM

The Proteus VSM combines mixed mode SPICE circuit simulation, animated components and microcontroller models to facilitate co-simulation of complete microcontroller-based design. It is possible to develop and test such designs before a physical prototype is constructed. This is possible because interaction with the design is possible using circuit indicators like LED, display panels, actuators etc. It also provides extensive debugging facility by employing breakpoints, single stepping and variable display of both assembly code and high-level language source code.



4.2 Software used

4.2.1 PuTTY

PuTTY is a free and open-source terminal emulator, serial console and network file transfer application. It supports several network protocols, including SCP, SSH, Telnet, rlogin, and raw socket connection.

Some features of PuTTY are:

- The storing of hosts and preferences for later use.
- Control over the SSH encryption key and protocol version.
- Public key authentication support.
- Support local serial port connection.

4.2.2 Python (programming language)

Python is a widely used general-purpose high-level programming language which emphasizes program readability and reduces complexity in coding. Its syntax allows programmers to express concepts in fewer lines of code than would be possible in other languages. The language provides constructs intended to enable clear programs on both a small and large scale. It

supports multiple programming including object oriented, imperative and functional programming. It has feature like automatic memory management and has a large library.

4.2.3 OPEN-CV/MATLAB

MATLAB is a high-level technical computing language and interactive environment for algorithm development, data visualization, data analysis, and numeric computation. It can be used in a wide range of applications, including signal and image processing, communications, control design.

MATLAB was used to test the algorithms and then to model the system. MATLAB has a variety of toolboxes for different purposes. In this case Image Processing toolbox is used.

4.3 Raspberry pi

4.3.1 Hardware

It does not come with a real time clock so the operating system must use network time.

4.3.2 RAM

On the older boards 128 MB RAM was allocated by default leaving 128 MB for CPU. Later 256 MB RAM raspberry pi was released which was sufficient for 1080p decoding, or for simple 3D. 224 MB was for Linux only, with just a 1080p frame buffer, and was likely to fail for any video or 3D. 128 MB was for heavy 3D, possibly also with video decoding .For the new model B with 512 MB RAM initially there were new standard memory split files released(arm256_start.elf, arm384_start.elf, arm496_start.elf) for 256 MB, 384 MB and 496 MB CPU RAM (and 256 MB, 128 MB and 16 MB video RAM).

4.3.3 Processor

Broadcom SoC is used is raspberry pi. It operated at 700Mhz default which is equal to 0,041 GFLOPS. On a computer level it is similar to 700 MHz Pentium II computer. It does not require heat sink or some sort of cooling.

4.3.4 Why raspberry pi?

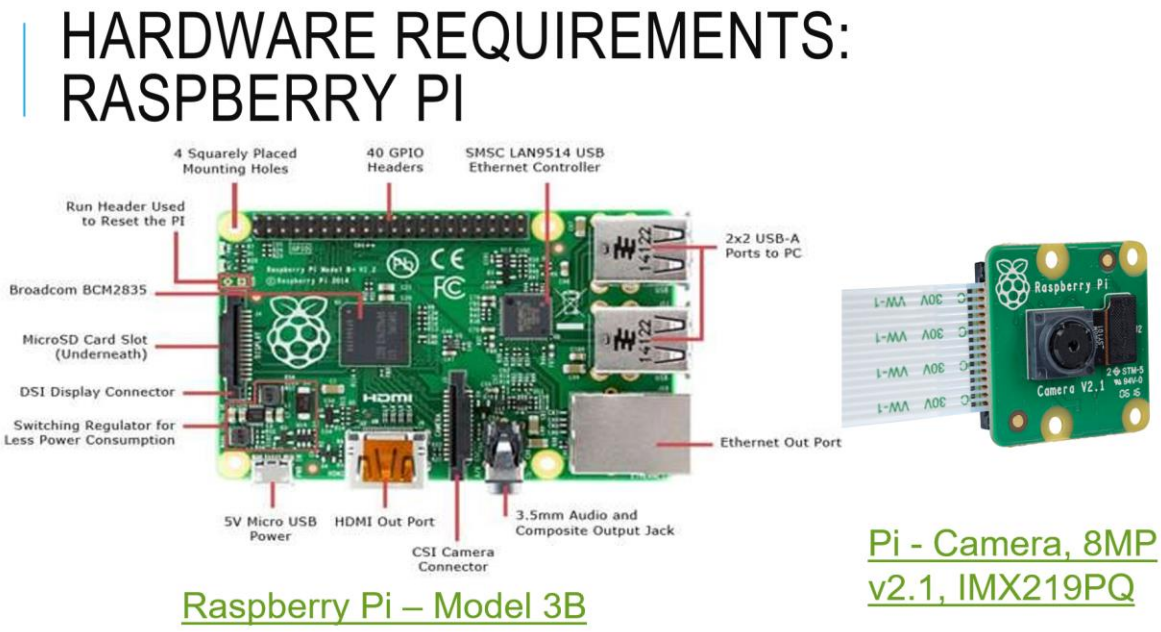
- The biggest advantage of raspberry pi is its small size as credit card. it works as if a normal computer at a relatively low price.
- One of other advantage of raspberry pi is usually speeding: problems can be solved in

'hardware' rather than in software, make use of parallelization.

- Lower power consumption. By replacing linear regulators with switching one's power consumption is reduced by between 0.5W and 1W.

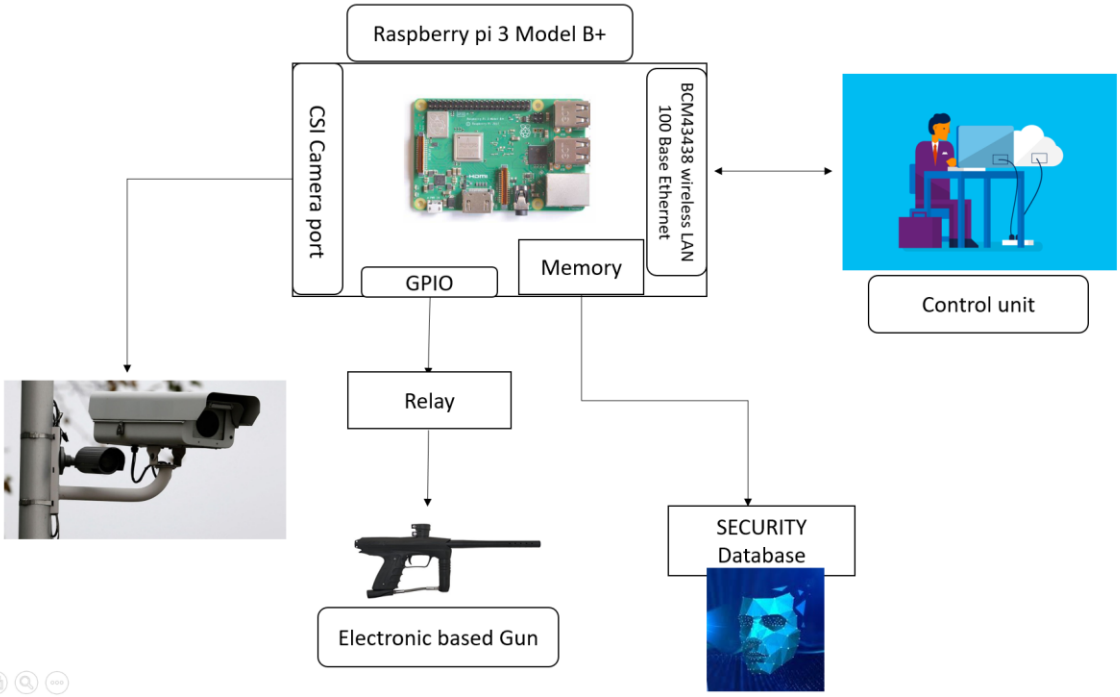
4.3.5 Raspberry pi Camera

RPI CAMERA BOARD plugs directly into the CSI connector on the Raspberry Pi. It's able to deliver a crystal clear 5MP resolution image or 1080p HD video recording at 30fps with latest v1.3. Board features a 5MP (2592 × 1944 pixels) Omni vision 5647 sensor in a fixed focus module. The module attaches to Raspberry Pi, by way of a 15 pin Ribbon Cable, to the dedicated 15 pin MIPI Camera Serial Interface (CSI), which was designed especially for interfacing to cameras. The CSI bus is capable of extremely high data rates, and it exclusively carries pixel data to the BCM2835 processor.



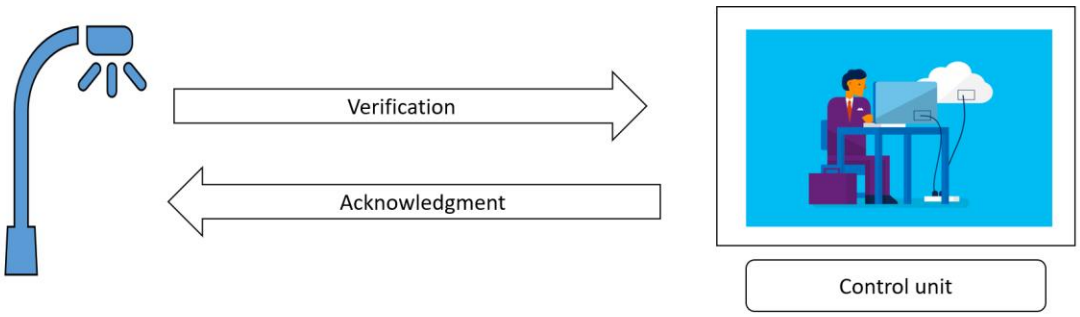
5.METHODOLOGY

5.1 System Block diagram

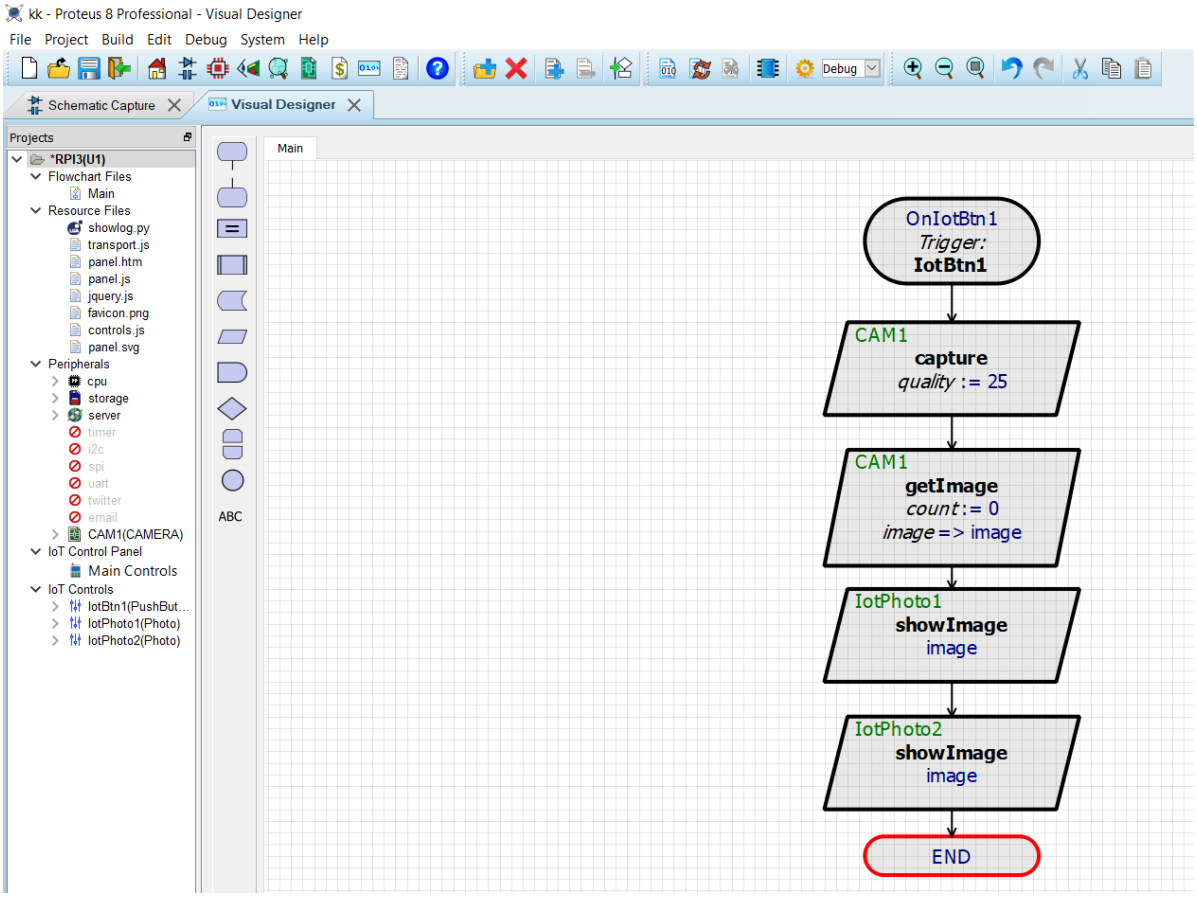


Algorithm:

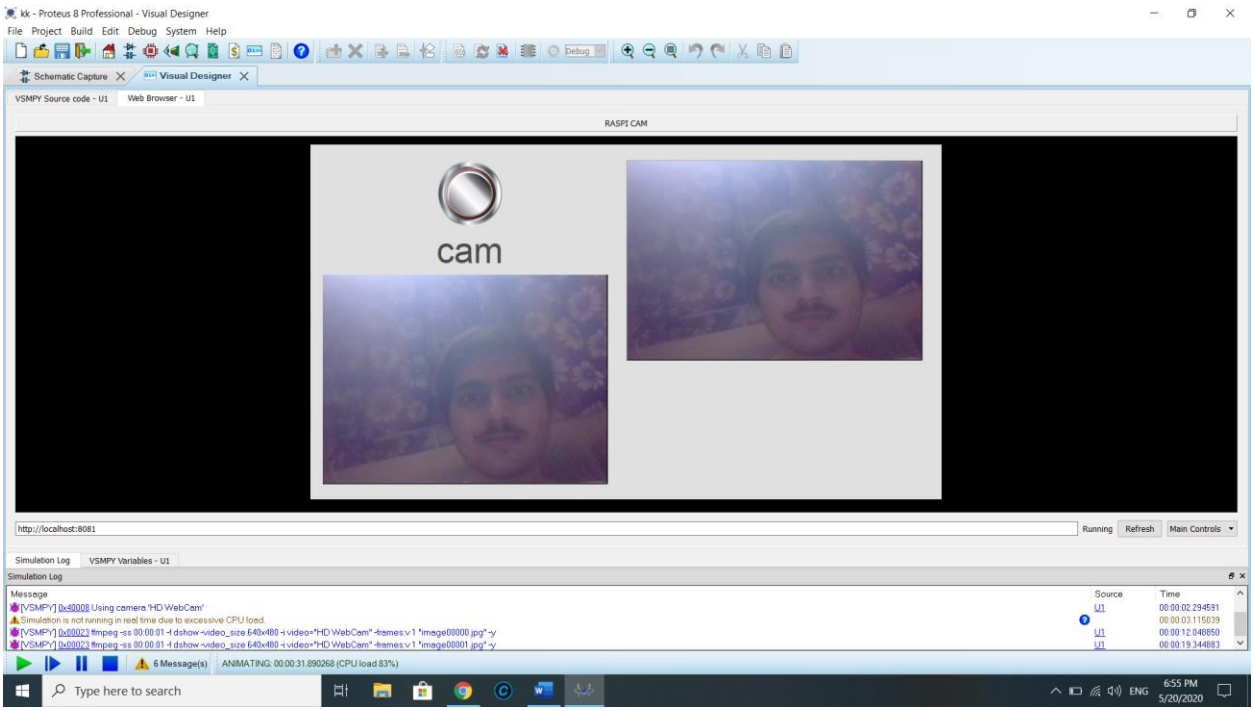
- Correlation of the input image with every image in the template for the best matching. Image correlation is an optical method that employs tracking and image registration techniques for accurate 2D and 3D measurements of changes in images.[12]
- Record the value of correlation for each template's character.
- Find the index which corresponds to the highest matched character.

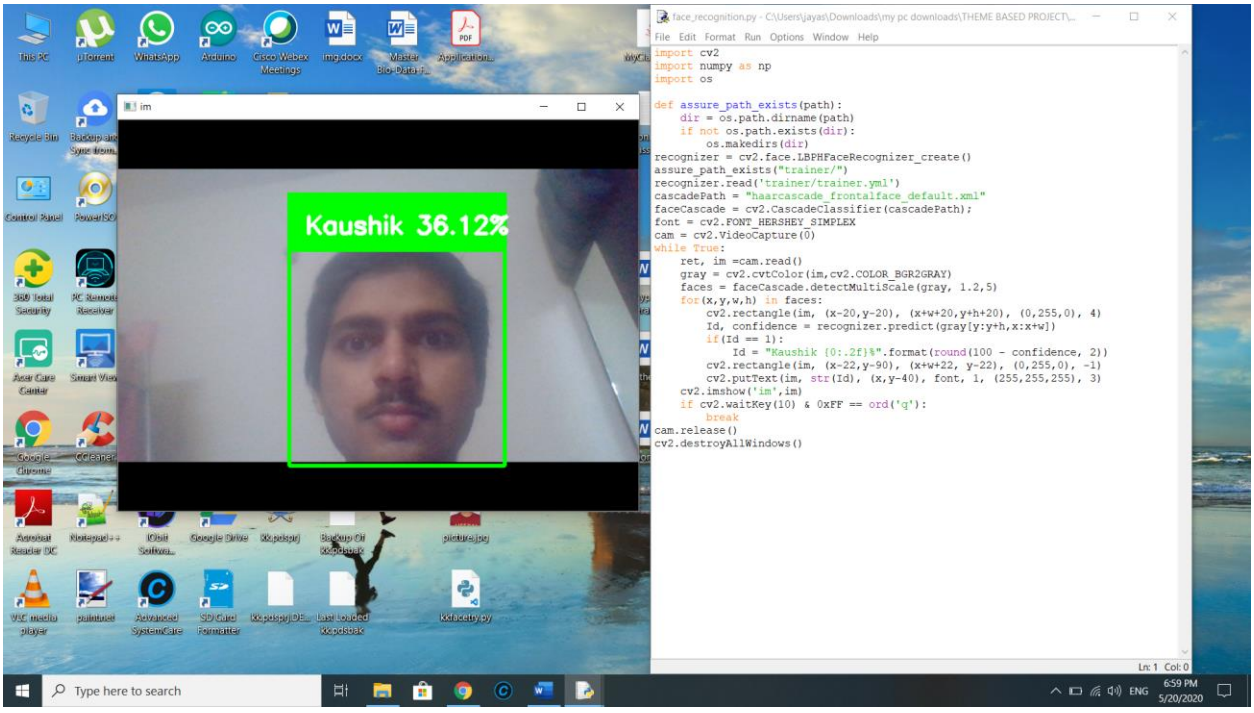


5.2 Flow chart



6. EXPERIMENTAL RESULTS





The accuracy/confidence of the model is displayed in the result and it can be increased by controlling the external conditions, such as:

- The external lighting conditions at the moment when the image is being observed and captured

- The resolution of the camera used
- Make-up also affects the recognition accuracy, since brightness intensity of face features are varied.

7. LIMITATION AND FUTURE ENHANCEMENT

Although automatic systems are advantageous regarding the simplicity of the task, the reliability won't be like that from human work. At such, our system has different limitations whose prime cause being the ones we discussed in problem Faced. Resolving these issues will help to enhance our system to a level where following objectives could be met:

- Accuracy can be increased using Neural Networks. Advanced image processing algorithms and libraries could be used so that the system can be used efficiently even during unfavorable lighting conditions and during the night time as well.
- The face can be sent to mobile of traffic police in the area using Android application.
- Adding more face detection wireless sensing networks and implementing a wireless sensor network will be another interesting application which will open up much more applications areas.
- Security of data during communication can be another important work for the future development of this project.

8. CONCLUSION

The designed face recognition system was capable of continuously monitoring the face of the approaching person. The output was more accurate with no other moving objects in the surrounding. The value of confidence of the model in the prediction of each passing person can be displayed in the LCD display. With each criminal passing by the sensor, the camera was triggered and the image was saved in the SD card. The image was also transferred to the server via internet where the image was processed for the extraction of the characters from the number plate. The Face Recognition system was not perfect and requires modification. It accurately identified few of the characters but not all. The character extraction also depended on the font and dimension of the character as well. The system was more accurate in identifying the characters that was written in the style similar to the one used in our template.