CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The present railway systems in India are not automated which are fully manmade. In railway stations normally we use bridges. It is very difficult for the elderly persons or handicapped persons to use the bridge. The current review from the social examination was said that the most burdens in Indian railroad are moving up the overhead strides for the physically tested individuals. These bridges over the railroads are expensive, especially when elevators or long ramps for wheelchair users are required. Without elevators or ramps, people with mobility handicaps will not be able to use the structure. Extensive ramping accommodates wheelchairs but results in long crossing distance and steep slope discourages its use. The exchanging of physically challenged people starting with one Platform then onto the next Platform is troublesome by utilizing fly over.

On other hand we have level crossing at various urban and sub urban areas of India which faces drastic tragedies resulting in life loss of human and animals in large scale. This is because of the poor maintenance and manual systems used at level crossing, cities have the manmade system for level crossing which is literally handled by an in charge to make operation of gates happen at dynamic timings and weather. Sub-urban sometime lack in manpower to handle the in charge position and makes the system even more dangerous to lives.

This project finds a good solution. Mainly, the tracking of a train is sensed by sensor and the camera unit, this is used for automatically close/open the mobile platform. Sensors and camera units are placed on two sides of track to sense the motion of train. The micro-controller will sense the presence of trains by using proximity sensors. So on sensing the train on one path, it triggers the camera unit to capture the image. Once the image is captured it is compared with the predefined images using convolution neural network algorithm and concludes whether the captured image is of train or not using the haar cascade classifier. Once the captured image is of train, the yield of Raspberry pi is given to DC motor to close the mobile platform automatically to indicate the arrival of train and stop pedestrians from crossing. When sensing the train on another path, i.e., while train has successfully left the track and platform, the controller will give pulses to the DC motor to

open the mobile platform automatically to indicate the successful crossing of train and provide pedestrians with secure crossing.

An automatic close/open mobile bridge is used between the train tracks. Normally the mobile bridge connects the two platforms, through which the passengers can walk on the bridge to reach the next platform. It will also be very easy to transport goods from one platform to other if a more direct route is available. A direct route will overcome the difficulties over construction of long ramps on either sides of the overpass.

1.2 PROBLEM IDENTIFICATION

- The Indian railway system have limitations in providing facilities to the handicapped and elderly aged people for crossing the platforms in the Railway stations.
- The aged and disabled commuters feel difficult to take the foot over bridge and reach the other platform as shown in Figure 1.1.
- Many commuters are getting died with this scenario, this motivates us to come out with this project.

Figure 1.1: Handicapped person taking help of others to cross the platform(left- side) and people moving on the track irrespective of train arrival(right-side).

1.3 OBJECTIVES

The main objectives are as follows,

- To help the physically challenged people to cross the intersection of platforms.
- To innovate a smart and an automatic pedestrian crossing bridge
- To minimize the chances of accidents in railway stations.
- To alert the passengers by using the alert signals on the railway platforms.
- To reduce the distance between the two platforms.
- To reduce the time consumption by using the smart platforms.

CHAPTER 2

LITERATURE SURVEY

2.1 SCOPE OF LITERATURE

Now- a- days India is moving in a smarter direction by promoting the smart cities and smart railway stations, in this aspect we have taken a small initiative by adding an innovation in domestic railway platform in the Indian railway structure. The motivation for this innovation is to address few problems faced by physically challenged people and senior nationals in crossing of foot over bridge between the two railway Platforms. To overcome this issue, a modified smart platform is proposed in this paper. The smart Platform is participated amidst the railway tracks in the side of the crossing point Platform. At the moment that there is no train arriving in the station, the smart Platform will be opened. The physically challenged individuals will use the smart Platform to cross between the Platforms. Proximity sensors are set on the two sides of track. If the train reaches one sensor the smart Platform will consequently close and enables the trains to o through the tracks and when the train leaves the second sensor the smart Platform will automatically open between the Platforms. The train approaching the railway stations will be proclaimed in a voice system and illustrated by LED signals. The proposed structure gives the best response for the movement of physically challenged individuals from one platform to another Platform without using foot over bridge. The present railway systems in india are not automated which are fully manmade. In railway stations normally we use bridges. It is very difficult for the elderly persons or handicapped persons to use the bridge. This paper finds a good solution. Mainly the tracking of a train is sensed by sensor, this is used for automatically close/open the mobile platform. Sensors are placed on two sides of track to sense the motion of train. The microcontroller will sense the presence of trains by using proximity sensors. So on sensing the train on one path, the controller will give pulses to the dc motor to close the mobile platform automatically.

2.2 LITERATURE REVIEW

In the Indian railway framework physically challenged individuals and senior nationals are use trams and flyovers to cross the railway Platforms, so they feel troublesome. To defeat this issue, a programmed mobile platform is proposed by Dr.P.Gomathi Dinesh [1]. The versatile Platform is joined in the middle of the railway tracks in the side of the

intersection Platform. At the point when there is no train landing in the station, the versatile Platform will be opened and consequently moving like lift. The physically challenged people will utilize the moving Platform to pass the intersection Platforms. At the point when the train is arriving, moving Platforms will be shut. The train entry sign will be declared in a voice framework and demonstrated by LED signal. The proposed framework gives a superior answer for exchanging of physically challenged people in one Platform to another Platform without utilizing fly over and metros.

The paper proposed by Prashantha.P *et.al* [2], deals with automatic railway gate opening at a level crossing without human intervention. In the present work, it is used to substitute fully automated railway gate opening feature and as well as automated platform bridge facility in the station which helps peoples to move from flat form to flat form. Now a day all over the world accidents are common because of lack of technology, human carelessness at right time. And these accidental barriers cannot be completely avoidable but some fruitful steps definitely reduced to some extent, in account of this the initiative steps is required to avoid many humans death at any place and time by introducing new technologies, this effort has been taken in this work by adopting automatic railway gate opening without gate keeper near level crossing and automated platform bridge. The above said system works on microcontroller based technique and rack and pinion mechanism which is employed to operate Platform Bridge.

The main aim of the project proposed by Akhila Mohan *et.al* [3] is to automate railway track pedestrian crossing without using staircase & announce the status of the arrival for platform users. Normally the mobile platform connects the two platforms through which the passenger can walk on the platform to reach on the next platform. Sensors are placed on the two sides of track. If the train reaches one sensor the mobile platform will automatically close and allows the train to go through the tracks and then when the train leaves the second sensor the mobile platform will automatically open the bridging platforms. The microcontroller will sense the presence of train by using infrared sensor. So on sensing the train on one path controller will give pulses to the dc motor to close the mobile platform automatically. This is used to avoid the train collision, thus saves the valuable human lives and losses. So this is useful for railway departments.

The idea proposed by Sudarsan.P *et.al* [4] is to avoid train collision problems. Now a day's train accidents are occurring frequently in India. The one of the main reason for train accident is the traveling of two trains in same track in opposite direction. In order to avoid the

accidents due to the above reason they have designed this system. This proposed sytem identifies the status of each train using IR transceivers and informs it to microcontroller. If the sensor unit identifies both trains in same track means microcontroller automatically trip the supply of the trains, which is more than sufficient to avoid this kind of accident. This is used to avoid the train collusion, thus we save the valuable human lives and losses.

The Primary objective of Automatic Railway Bridge System proposed by Vidhya.K *et.al* [5] is to help the physically Challenged Passenger to move from one Platform to another. Crossing the railway track inside the railway station is very difficult. But it is quite difficult to the handicapped and aged persons to cross the railway track without the help of other. The proposed system uses the train time for opening and closing of bridges. This is done by wireless communication. Each train is connected with RF transceiver, which will send a data of arrival before it reaches the station platform. If the train leaves the platform, the automatically the mobile platform will be bridged between two platforms to build a path between them. This project is designed with arduino microcontroller. The arduino microcontrollers gives the input to the RSSI and give command to the motor to run in order to change in the position of open and close the mobility rostrum.

The project proposed by G,Prabhavathi *et.al* [6] is used to automatically close or opens the mobile platforms in between the track trains. Normally the mobile platform connects the two platforms through which the passenger can walk on the platform to reach on the next platform Sensors are placed on the two sides of track. if the train reaches one sensor the mobile platform will automatically close and allows the train to go through the tracks and then when the train leaves the second sensor the mobile platform will automatically open the bridging platforms. The microcontroller will sense the presence of train by using infrared sensor, so on sensing the train on one path controller will give pulses to the stepper motor to close the mobile platform automatically.

The Android Smart phone or a tablet is proposed by Er.Nafisa Shaikh M.Imran *et.al* [7]. When the train is nearby the level crossing the command of closing the level crossing gate is given from the android device. This command will be given to the microcontroller, which gives output signal to the motor and it is switched on to close the gate. Then for gate opening, other command is given to motor through microcontroller with help of motor driver IC. Here Microcontroller of family 8051 is used where the command from android application acts as an input to it. The gate operation is performed based on the output

received from microcontroller. The status of gate operation i.e. open or closed is known through a LCD display which is connected to microcontroller.

CHAPTER 3

METHODOLOGY

3.1 METHODOLOGY

3.1.1 AUTOMATED SMART RAILWAY PLATFORM CONTROL

The flowchart shown in below Figure 3.1, demonstrates the essential format of mentioned smart platform system. Here the overall control is controlled by the Raspberry pi based on the various inputs from the sensors and camera unit.

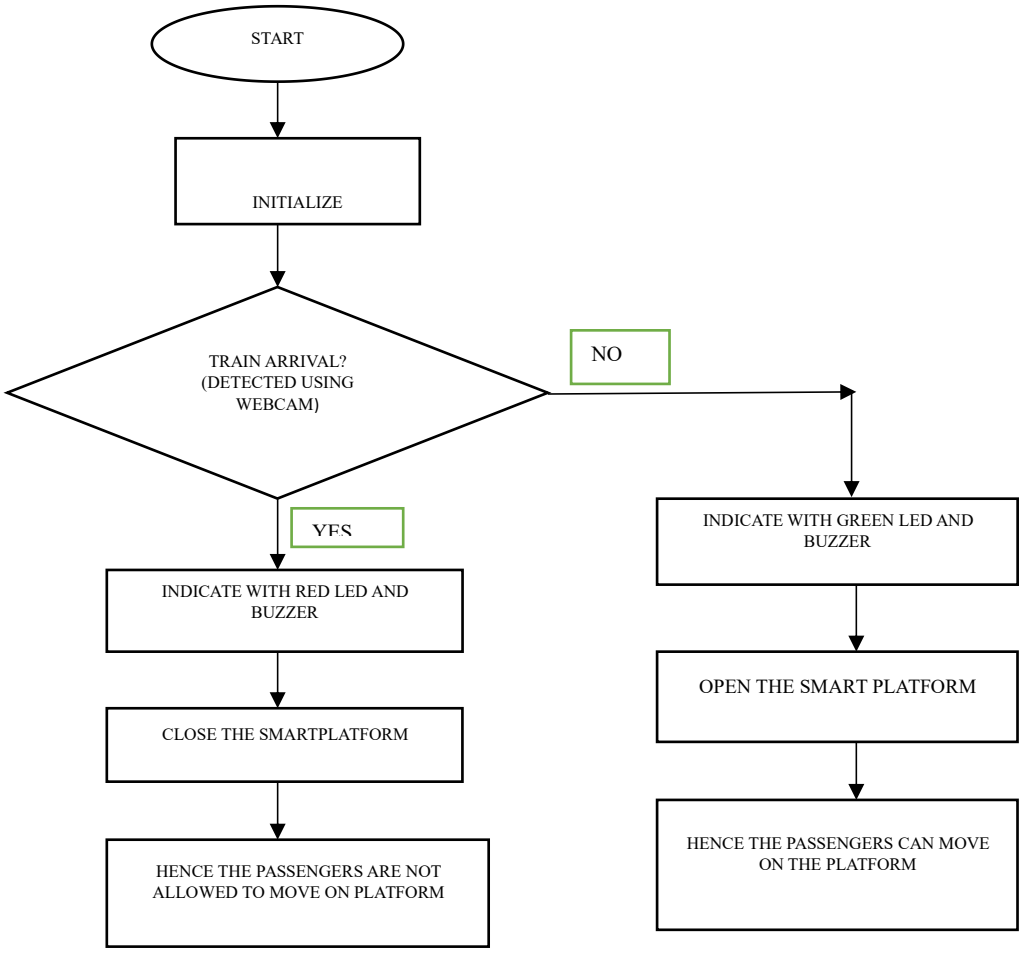

Figure 3.1: Flowchart of automated smart railway platform control

Proximity sensor used to detect the metal product. In our task we utilize this sensor to distinguish the position of the train. We utilize two sensors for security reason to maintain a strategic distance from mechanical issue. The sensor gives two outputs. On the other chance when that train is close to platform, else far from platform. In the event that train draws close to smart platform, the proximity sensor senses the train position and gives its yield to camera

unit. Micro-controller works on the supply of oscillator. It has as of now have a modified structure in it which executes. The yield of Micro-controller is given to LED and Buzzer to give an alarm to the general population move rapidly. After that smart platform begins to open well-ordered and offers approach to train to remain in platform. On the off chance that the train is far from the keen stage then the sensor sends the signal to Micro-controller and that Micro-controllers yield is given to buzzer. What's more, smart platform stays shut.

3.1.2 FLOW CHART OF TRAIN DETECTION

The Figure 3.2., depicts the flow of train detection using CNN algorithm.

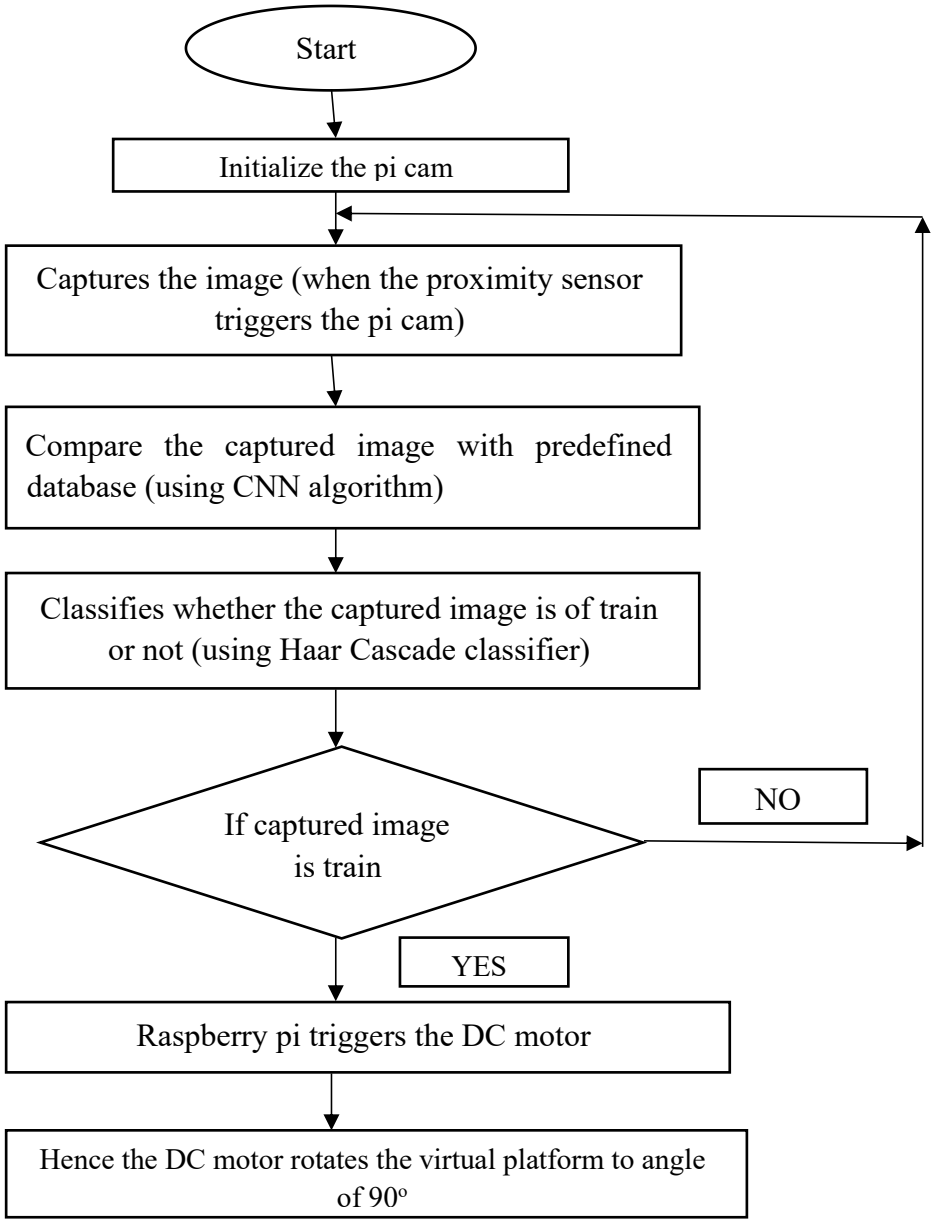

Figure 3.2: Flow diagram of the train detection

Firstly, initialize the pi cam. When the proximity sensor detects any object nearby it, it sends the signal to the camera unit to capture the image. The captured image will be compared with the pre-defined images which is available in the database. The comparison of images is done using convolution neural network algorithm. Further, it verifies whether the captured image is similar to the pre-defined images or not. Using the haar cascade classifier it concludes that, the captured image is of train or not. Based on this output the controller will trigger the DC motor which performs the angle of rotation of the virtual smart platform. If the captured image is train, the DC motor rotates the smart platform to an angle of 90^{o}, that is the smart platform is closed. If the captured image is not train, the DC motor helps the platform to remains in 0^{o}, that is the smart platform remains open providing a path for general population to move on.

3.1.3 ALGORITHM OF THE PROPOSED SYSTEM

1. Firstly, we must turn ON the complete framework.
2. Initialize the raspberry pi, pi cam and proximity sensor.
3. Read the proximity sensor and send the sensor output to pi cam.
4. Pi cam captures the image.
5. Captured image is compared with pre-defined image using CNN.
6. Haar cascade classifier conclude whether the captured image is train or not.
7. Based on the pi cam output, the controller triggers the DC motor.
8. If the captured image is the train, then the smart platform will be closed and if it is not train image, then the smart platform remains open.

3.2 SYSTEM OVERVIEW

Our project mainly deals for the public safety and public convenience. At present, the Indian railway system have limitations in providing facilities to the handicapped and the elderly aged people for crossing the platforms in the railway stations. The aged and disabled commuters feel difficult to take the foot over bridge and reach the other platform. Many commuters are getting died with this scenario, this motivates us top come out with this project.In this proposed work instead of IR sensor, proximity sensor is used as it has high sensitivity and obtains more stable output. This sensor helps in detecting the nearby objects without any physical contact. Further for more security purpose camera unit is also included. Based on these two inputs the virtual platform functions. The proposed structure gives the best response for the movement of physically challenged individuals from one platform to another Platform without using foot over bridge.

CHAPTER 4

PROPOSED SYSTEM

4.1 PURPOSE OF DESIGN

Indian railways are in operation for more than 160 years and it covers the whole of India. The entire network cover 64,000 km of rail route. Safety and reliability are very important features of Indian railways. When people are passing a railway track, an accident may occur and it is impossible to make a prediction given all the possibilities. If train drivers rely solely on their own eyes or warning signals given off by detecting devices, they usually do not have enough time to react when an obstacle appears at a platform crossing, giving rise to an accident.So, more efforts are required for railway platform crossing safety. In India over thousands of trains are running on tracks everyday.

Building smart platforms which acts as virtual platforms to help the physically challenged or aged persons to cross from one platform to other, without using the traditional foot over bridge to cross, which usually becomes the barrier and making it difficult to cross. The other alternative way of installing elevators to reach the foot over bridge and to climb down is not a complete solution to cross one platform to other by a physically challenged or aged person. This alternative way turns out to be costly to operate and maintain. It also helps transport goods from various locations of platform to the destination easily.

4.2 DESIGN FEATURES

The components used for the automated smart railway platform control is as follows, The Hardware Components used for the project is as follows,

1. Raspberry pi
2. Proximity Sensors
3. Camera unit
4. LEDs
5. DC Motor

Software Components used for the project is as follows,

1. Raspbian

4.1.1. RASPBERRY PI:

The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside its target market for uses such as robotics. It now is widely used even in research projects, such as for weather monitoring because of its low cost and portability. It does not include peripherals (such as keyboards and mice) or cases. However, some accessories have been included in several official and unofficial bundles. The Figure 4.1 shows the Raspberry pi.

The Raspberry Pi 3 Model B is the earliest model of the third-generation Raspberry Pi. It replaced the Raspberry Pi 2 Model B in February 2016. See also the Raspberry Pi 3 Model B+, the latest product in the Raspberry Pi 3 range.

The technical specifications are:

- Quad Core 1.2GHz Broadcom BCM2837 64bit CPU
- 1GB RAM
- BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board
- 100 Base Ethernet
- 40-pin extended GPIO
- 4 USB 2 ports
- 4 Pole stereo output and composite video port

- Full size HDMI
- CSI camera port for connecting a Raspberry Pi camera
- DSI display port for connecting a Raspberry Pi touchscreen display
- Micro SD port for loading your operating system and storing data
- Upgraded switched Micro USB power source up to 2.5A

*FIGURE 4.1: RASPBERRY PI(Courtesy:*https://www.raspberrypi.org/*)*

4.1.2. PROXIMITY SENSOR:

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors. For example, a capacitive proximity sensor or photoelectric sensor might be suitable for a plastic target; an inductive proximity sensor

always requires a metal target. The maximum distance that this sensor can detect is defined "nominal range". Some sensors have adjustments of the nominal range or means to report a graduated detection distance. Some know these processes as "thermo sensation". Proximity sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between the sensor and the sensed object.

The detection coil located at the front end of the sensor produces a high-frequency magnetic field as shown in the figure below. When an object (metallic) approaches this magnetic field, induced currents flow in the metal, causing thermal loss and resulting in the reduction or stopping of oscillations. This change in state is detected by an oscillation state sensing circuit which then operates the output circuit.

When the target is within nominal range, the device lock screen user interface will appear, thus emerging from what is known as sleep mode. Once the device has awoken from sleep mode, if the proximity sensor's target is still for an extended period of time, the sensor will then ignore it, and the device will eventually revert into sleep mode. For example, during a telephone call, proximity sensors play a role in detecting (and skipping) accidental touchscreen taps when mobiles are held to the ear. The internal block diagram of proximity sensor is shown in Figure 4.2.

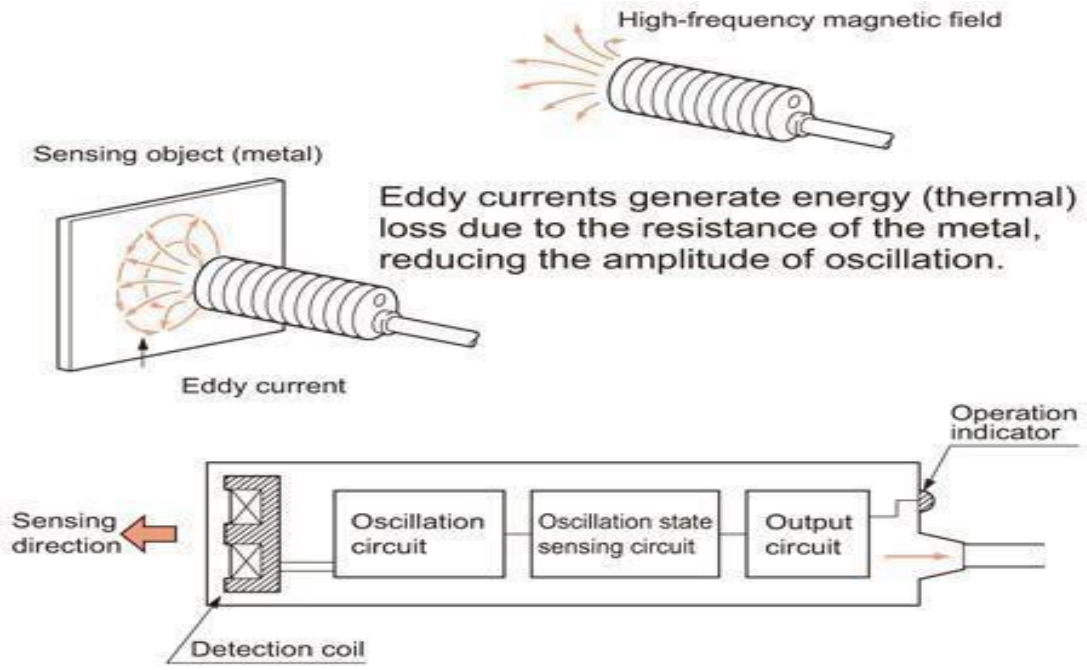

*FIGURE 4.2: INTERNAL BLOCK DIAGRAM OF PROXIMITY SENSOR(Courtesy:*https://www3.panasonic.biz/ac*)*

4.1.3 CAMERA UNIT:

A digital camera takes photos electronically and converts into digital data. This captured images are sent to the processor unit for comparison. It does not use the film found in a traditional camera, instead it has a special light sensitive silicon chip. The digital camera is shown in Figure 4.3.

*FIGURE 4.3: DIGITAL CAMERA(Courtesy:*https://www.kenyt.com/*)*

4.1.4 LED:

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. The internal view of LED is shown in Figure 4.4. LEDs are typically small (less than 1 mm^2) and integrated optical components may be used to shape the radiation pattern.

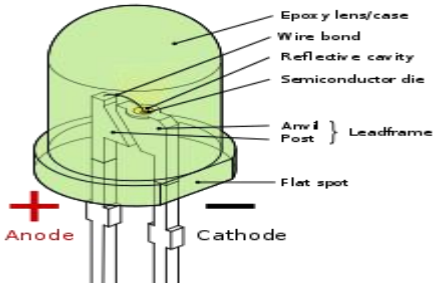

*FIGURE 4.4. INTERNAL VIEW OF LED(Courtesy:*https://www.envirovaluation.org/*)*

A P-N junction can convert absorbed light energy into a proportional electric current. The same process is reversed here (i.e. the P-N junction emits light when electrical energy is applied to it). This phenomenon is generally called electroluminescence, which can be defined as the emission of light from a semiconductor under the influence of an electric field. The charge carriers recombine in a forward-biased P-N junction as the electrons cross from the N-region and recombine with the holes existing in the P-region. Free electrons are in the conduction band of energy levels, while holes are in the valence energy band. Thus the energy level of the holes is less than the energy levels of the electrons. Some portion of the energy must be dissipated to recombine the electrons and the holes. This energy is emitted in the form of heat and light. The electrons dissipate energy in the form of heat for silicon and germanium diodes but in gallium arsenide phosphide (GaAsP) and gallium phosphide (GaP) semiconductors, the electrons dissipate energy by emitting photons. If the semiconductor is translucent, the junction becomes the source of light as it is emitted, thus becoming a light emitting diode. However, when the junction is reverse biased, the LED produces no light and—if the potential is great enough, the device is damaged.

4.1.5 DC MOTOR:

A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current.

A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications. The DC motor is shown in Figure 4.5.

*FIGURE 4.5: DC MOTOR(Courtesy:*https://www.amazon.in/*)*

A simple DC motor has a stationary set of magnets in the stator and an armature with one or more windings of insulated wire wrapped around a soft iron core that concentrates the magnetic field. The windings usually have multiple turns around the core, and in large motors there can be several parallel current paths. The ends of the wire winding are connected to a commutator. The commutator allows each armature coil to be energized in turn and connects the rotating coils with the external power supply through brushes. (Brushless DC motors have electronics that switch the DC current to each coil on and off and have no brushes.)

The total amount of current sent to the coil, the coil's size and what it's wrapped around dictate the strength of the electromagnetic field created.

4.3 BLOCK DIAGRAM

4.3.1. AUTOMATED SMART RAILWAY PLATFORM CONTROL

The block diagram of automated smart platform is as shown in Figure 4.6.,

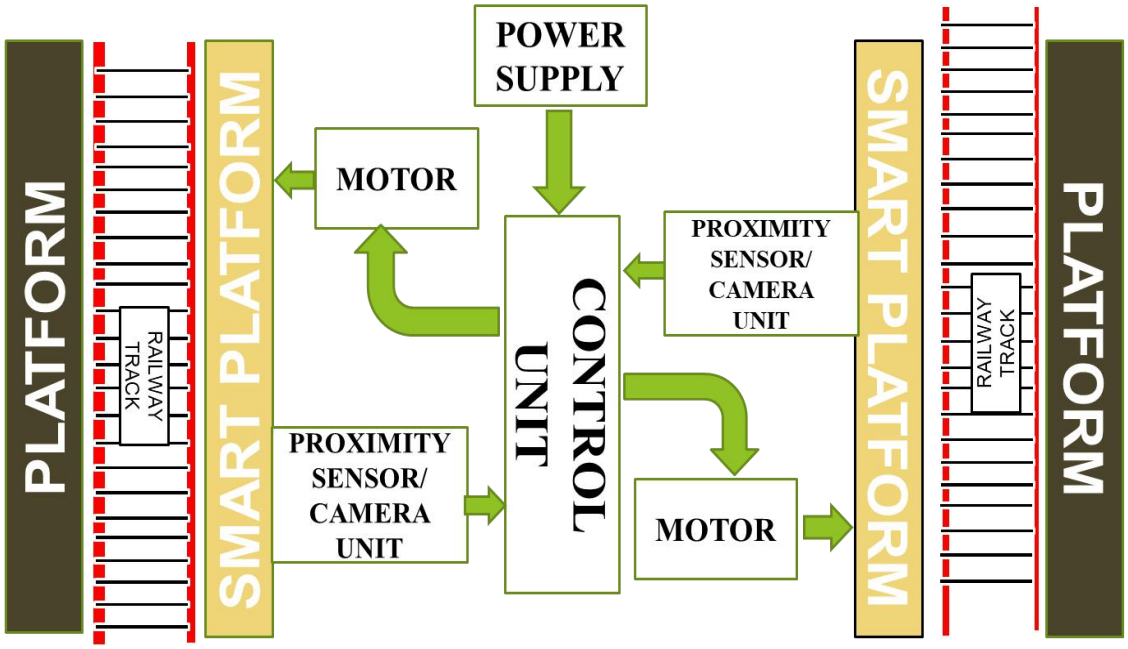

Figure 4.6: Block diagram of automated smart railway platform control

Building smart platforms which acts as virtual platforms to help the physically challenged or aged persons to cross from one platform to other, without using the traditional foot over bridge to cross, which usually becomes the barrier and making it difficult to cross. The other alternative way of installing elevators to reach the foot over bridge and to climb down is not a complete solution to cross one platform to other by a physically challenged or aged person.

The circuit is designed by interfacing the raspberry pi with the proximity sensor, camera unit and the DC motor which helps to control the overall virtual platform by sensing and detecting the arrival and departure of the train.

This work includes the following steps as follows,

Step 1: Initialization of the proximity sensor is done. Here this sensor is used to distinguish the position of the train arrival.

Step 2: Further the sensor triggers the camera unit to capture the image. Once the image is captured it is compared with the data base using CNN network algorithm.

Step 3: If the image captured is a train then the yield of raspberry pi is given to the LED and buzzer to give alarm to the general population to move rapidly

Step 4: Hence, the smart platform begins to close well-ordered and offers approach for the train to remain in the platform.

Step 5: Once the train leaves the platform the sensor triggers the raspberry pi to provide LED and alarm signals.

Step 6: Hence, the smart platform begins to open well-ordered and offers approach to general population to travel from one platform to the other.

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CHAPTER 5

TECHNICAL IMPLEMENTATION

5.1 CNN ALGORITHM

CNNs are a category of Neural Networks that have proven very effective in areas such as image recognition and classification. CNNs are a type of feed-forward neural networks made up of many layers. CNNs consist of filters or kernels or neurons that have learnable weights or parameters and biases. Each filter takes some inputs, performs convolution and optionally follows it with a non-linearity. A typical CNN architecture can be seen as shown in Figure 5.1.

The structure of CNN contains Convolutional, pooling, Rectified Linear Unit (ReLU), and Fully Connected layers.

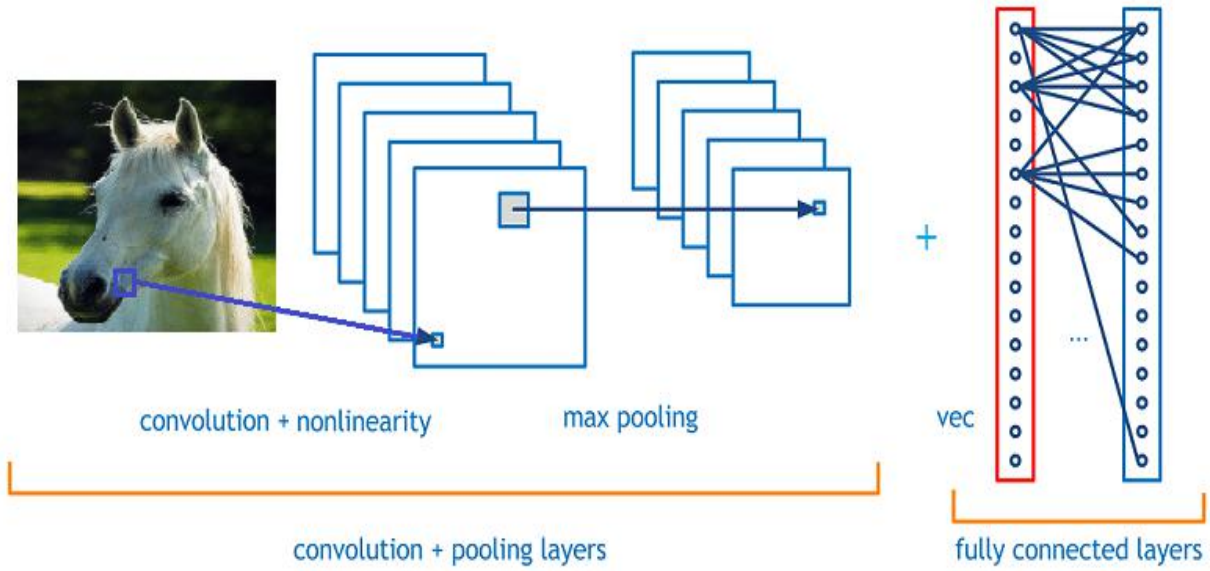

Figure 5.1: Convolution neural network design*(Courtesy:*https://www.researchgate.net/*)*

Convolutional Layer:

When programming a CNN, the input is a tensor with shape (number of images) x (image height) x (image width) x (image depth). Then after passing through a convolutional layer, the image becomes abstracted to a feature map, with shape (number of images) x (feature map height) x (feature map width) x (feature map channels). A convolutional layer within a neural network should have the following attributes:

- Convolutional kernels defined by a width and height (hyper-parameters).
- The number of input channels and output channels (hyper-parameter).

- The depth of the Convolution filter (the input channels) must be equal to the number channels (depth) of the input feature map.

Convolutional layers convolve the input and pass its result to the next layer. This is similar to the response of a neuron in the visual cortex to a specific stimulus.[12] Each convolutional neuron processes data only for its receptive field. Although fully connected feed forward neural networks can be used to learn features as well as classify data, it is not practical to apply this architecture to images. A very high number of neurons would be necessary, even in a shallow (opposite of deep) architecture, due to the very large input sizes associated with images, where each pixel is a relevant variable. For instance, a fully connected layer for a (small) image of size 100 x 100 has 10,000 weights for *each* neuron in the second layer. The convolution operation brings a solution to this problem as it reduces the number of free parameters, allowing the network to be deeper with fewer parameters.[13] For instance, regardless of image size, tiling regions of size 5 x 5, each with the same shared weights, requires only 25 learnable parameters. By using regularized weights over fewer parameters, the vanishing gradient and exploding gradient problems seen during back propagation in traditional neural networks are avoided.

Pooling Layer:

Another important concept of CNNs is pooling, which is a form of non-linear down-sampling. There are several non-linear functions to implement pooling among which max pooling is the most common. It partitions the input image into a set of non-overlapping rectangles and, for each such sub-region, outputs the maximum.

Intuitively, the exact location of a feature is less important than its rough location relative to other features. This is the idea behind the use of pooling in convolutional neural networks. The pooling layer serves to progressively reduce the spatial size of the representation, to reduce the number of parameters, memory footprint and amount of computation in the network, and hence to also control over fitting. It is common to periodically insert a pooling layer between successive convolutional layers in a CNN architecture. The pooling operation provides another form of translation invariance.

The pooling layer operates independently on every depth slice of the input and resizes it spatially. The most common form is a pooling layer with filters of size 2×2 applied with a stride of 2 down samples at every depth slice in the input by 2 along both width and height, discarding 75% of the activations:

In this case, every max operation is over 4 numbers. The depth dimension remains unchanged.

In addition to max pooling, pooling units can use other functions, such as average pooling or ℓ_2-norm pooling. Average pooling was often used historically but has recently fallen out of favor compared to max pooling, which performs better in practice.

Due to the aggressive reduction in the size of the representation, there is a recent trend towards using smaller filters or discarding pooling layers altogether.

Fully Connected Layer:

Finally, after several convolutional and max pooling layers, the high-level reasoning in the neural network is done via fully connected layers. Neurons in a fully connected layer have connections to all activations in the previous layer, as seen in regular (non-convolutional) artificial neural networks. Their activations can thus be computed as an affine transformation, with matrix multiplication followed by a bias offset (vector addition of a learned or fixed bias term.

ReLu Layer:

ReLu is a non-linear operation and includes units employing the rectifier. It is an element wise operation that means it is applied per pixel and reconstitutes all negative values in the feature map by zero.

Here, we assume that there is a neuron input given as x and from that the rectifier is defined as f(x) = max(0,x) in the literature for neural networks.

The loss layer specifies how training penalizes the deviation between the predicted (output) and true labels and is normally the final layer of a neural network. Various loss functions appropriate for different tasks may be used.

Softmax loss is used for predicting a single class of *K* mutually exclusive classes.

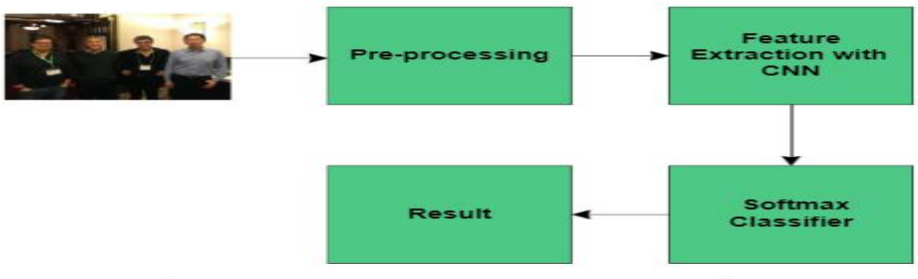

Figure.5.2: Block diagram of CNN algorithm*(Courtesy:*https://www.researchgate.net/*)*

The block diagram of the proposed CNN recognition algorithm is shown in Figure 5.2.

The algorithm is carried out in three main steps as follows:

1. Resize the input images as 16x16x1, 16x16x3, 32x32x1, 32x32x3, 64x64x1, and 64x64x1.
2. Build a CNN structure with eight layers made up of convolution, max pooling, convolution, max pooling, convolution, max pooling, convolution, and convolution layers respectively.
3. After extracting all features, use Softmax classifier for classification.

The structure of feature extraction block is as shown in Figure 5.3.

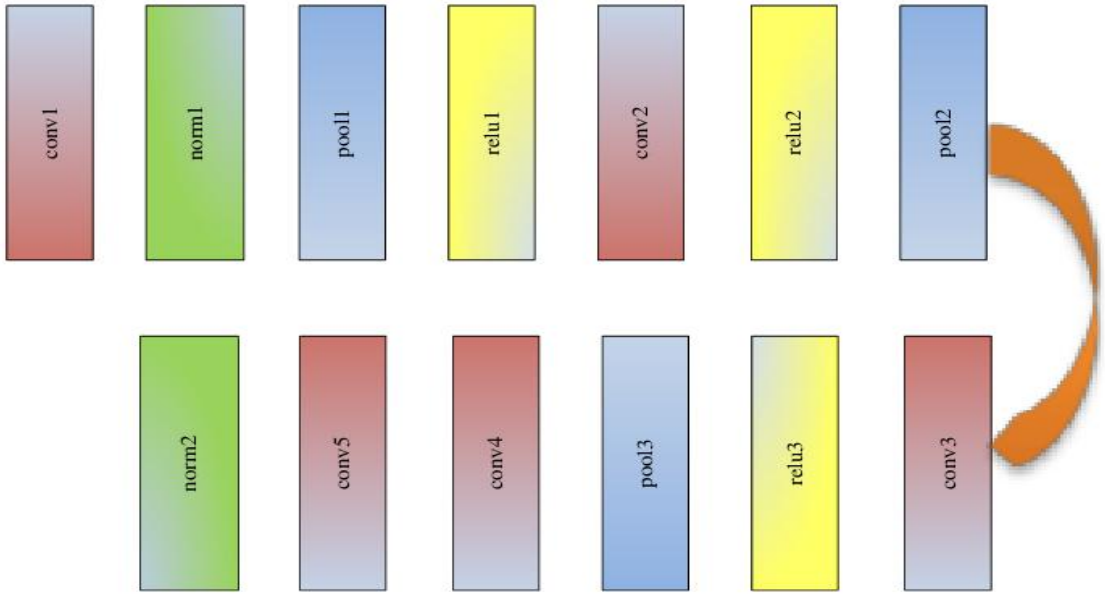

Figure 5.3: The structure of feature extraction of the CNN*(Courtesy:*https://www.researchgate.net/*)*

5.2 HAAR CASCADE CLASSIFIER:

A Haar Cascade is based on “Haar Wavelets”. Haar Cascades is a machine learning techniques in which a function is trained from a lot of positive and negative images. A sequence of rescaled “square-shaped” functions which together form a wavelet family or basis. It is based on the Haar wavelet technique to analyze pixels in the image into squares by function. The training procedure is shown in Figure 5.4.

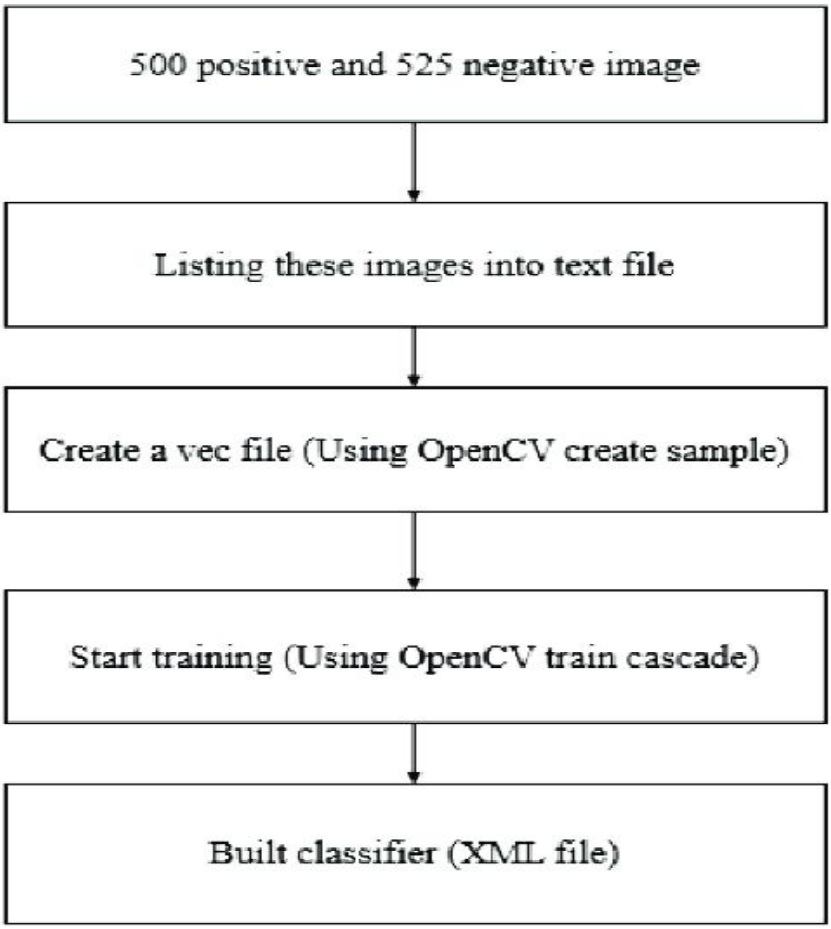

Figure 5.4: Training procedure of classifier*(Courtesy:*https://www.researchgate.net/*)*

Cascading is a particular case of ensemble learning based on the concatenation of several classifiers, using all information collected from the output from a given classifier as additional information for the next classifier in the cascade. Unlike voting or stacking ensembles, which are multi expert systems, cascading is a multistage one.

Cascading classifiers are trained with several hundred "positive" sample views of a particular object and arbitrary "negative" images of the same size. After the classifier is trained it can be applied to a region of an image and detect the object in question. To search for the object in

the entire frame, the search window can be moved across the image and check every location for the classifier. This process is most commonly used in image processing for object detection and tracking, primarily facial detection and recognition.

The first cascading classifier was the face detector of Viola and Jones (2001). The requirement for this classifier was to be fast in order to be implemented on low-power CPUs, such as cameras and phones.

Haar Cascade is a machine learning object detection algorithm used to identify objects in an image or video and based on the concept of features proposed by Paul Viola and Michael Jones in their paper "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001.

Now, all possible sizes and locations of each kernel are used to calculate lots of features. (Just imagine how much computation it needs? Even a 24x24 window results over 160000 features). For each feature calculation, we need to find the sum of the pixels under white and black rectangles. To solve this, they introduced the integral image. However large your image, it reduces the calculations for a given pixel to an operation involving just four pixels. It makes things super-fast.It is based on the Haar wavelet technique to analyze pixels in the image into squares by function.

The algorithm has four stages:

i. Haar feature selection.
ii. Creating integral images.
iii. Adaboost Training.
iv. Cascading Classfiers.

Haar feature selection: First step is to collect the Haar Features. A Haar feature considers adjacent 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. Figure 5.5 shows certain feature selection in the images.

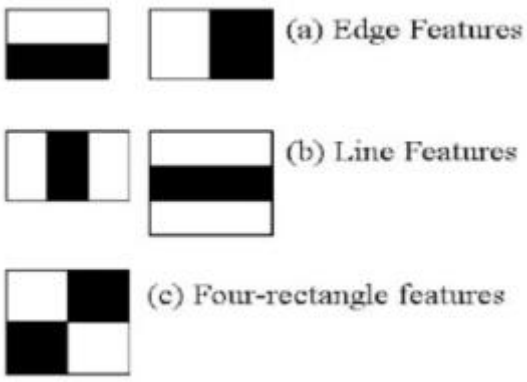

Figure 5.5: Feature selection*(Courtesy:*http://www.willberger.org/*)*

Integral Images: Are used to make this super-fast. But among all these features we calculated, most of them are irrelevant. For example, consider the image below. Top row shows two good features. The first feature selected seems to focus on the property that the region of the eyes is often darker than the region of the nose and cheeks as shown in Figure 5.6. The second feature selected relies on the property that the eyes are darker than the bridge of the nose. But the same windows applying on cheeks or any other place is irrelevant.

Figure 5.6: Integral images*(Courtesy:*http://www.willberger.org/*)*

Adaboost: This is accomplished using a concept called Adaboost which both selects the best features and trains the classifiers that use them. This algorithm constructs a "strong" classifier as a linear combination of weighted simple "weak" classifiers. The process is as follows.

During the detection phase, a window of the target size is moved over the input image, and for each subsection of the image and Haar features are calculated.

The difference is then compared to a learned threshold that separates non-objects from objects. Because each Haar feature is only a "weak classifier" (its detection quality is slightly better than random guessing) a large number of Haar features are necessary to describe an object with sufficient accuracy.

Cascade Classifier: The cascade classifier consists of a collection of stages, where each stage is an ensemble of weak learners. The weak learners are simple classifiers called decision stumps. Each stage is trained using a technique called boosting. Boosting provides the ability to train a highly accurate classifier by taking a weighted average of the decisions made by the weak learners.

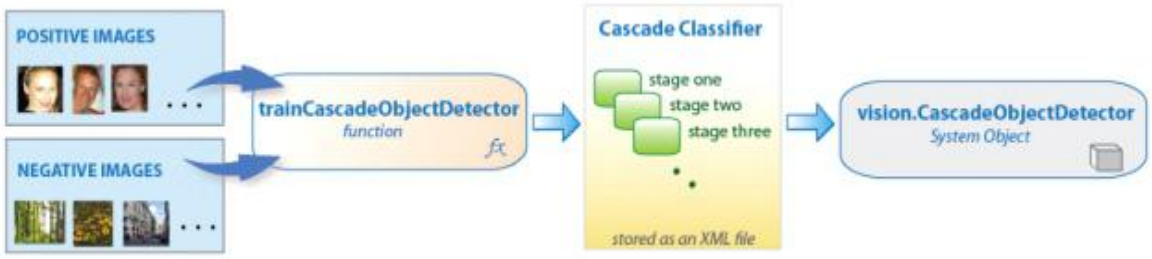

Figure 5.7: Cascade classifier technique*(Courtesy:*http://www.willberger.org/*)*

Each stage of the classifier labels the region defined by the current location of the sliding window as either positive or negative as shown in Figure 5.7. *Positive* indicates that an object was found and *negative* indicates no objects were found. If the label is negative, the classification of this region is complete, and the detector slides the window to the next location. If the label is positive, the classifier passes the region to the next stage. The detector reports an object found at the current window location when the final stage classifies the region as positive.

The stages are designed to reject negative samples as fast as possible. The assumption is that the vast majority of windows do not contain the object of interest. Conversely, true positives are rare and worth taking the time to verify.

A true positive occurs when a positive sample is correctly classified.

A false positive occurs when a negative sample is mistakenly classified as positive.

A false negative occurs when a positive sample is mistakenly classified as negative.

CHAPTER 6

RESULTS AND DISCUSSIONS

6.1 HARDWARE CONNECTIONS

Initially the pi camera and the raspberry pi are interfaced to check the working condition of the pi camera as shown in Figure 5.8, further the code is dumped into it to classify whether the captured image is of a train or not.

This indicates that the proposed model is ready to undergo the test to detect the moving train.

Figure 5.8: Pi camera interfaced with raspberry pi

The Figure 5.9., shown below represents the interfacing of DC motor with Raspberry pi. DC motor performs the action of controlling the angle of rotation of the virtual platform after the detection of the train arrival.

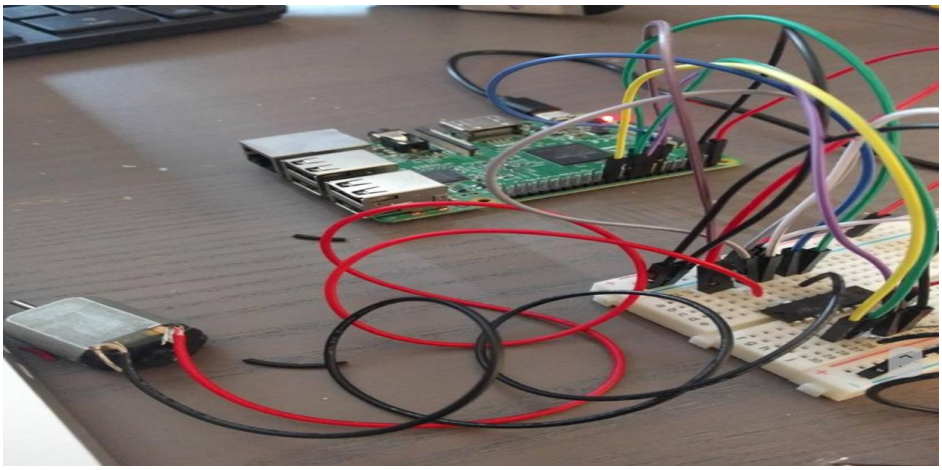

Figure 5.9: Raspberry pi interfaced with dc motor

6.2 RESULTS

MATLAB is a multi-paradigm numerical computing environment and proprietary programming language developed by MathWorks. It is heavily used in many technical fields for data analysis, problem solving, and algorithm development. Convolution neural network is a method that is used to describe characteristics of the image. Applying this method, the texture characteristic probability of an input image can be summarized into histogram. The Figure.6.1., shows the captured image which is obtained by MATLAB code.

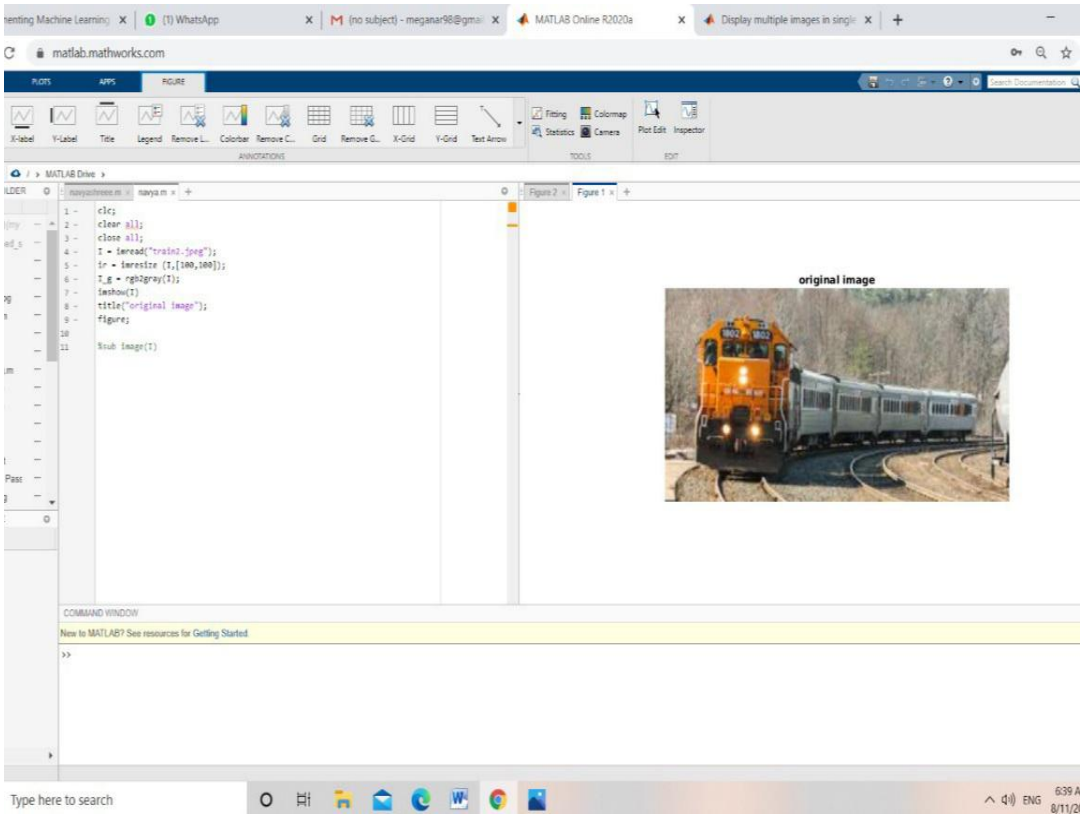

Figure 6.1: Output of original image

The Figure 6.2., depicts the texture characteristic probability, summarized histogram of the input colour image. Here, the histogram describes the characteristics of train image where, there is no sharp edge detection in case of color image. Hence, color image is not accurate for image classification.

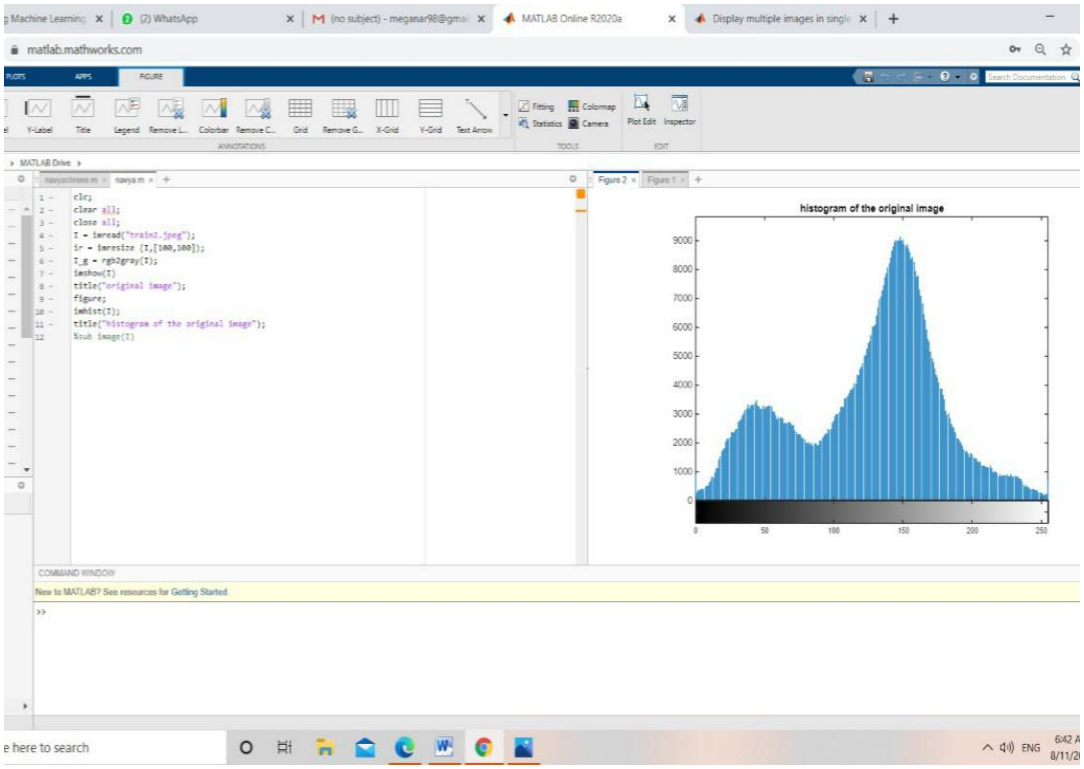

Figure 6.2: Histogram of original image

The Figure 6.3., shows the converted gray scale image of original color image using the MATLAB Code. The colour image of train is converted into the gray scale image using "rgbtogray' command and hence, the gray image of train is obtained.

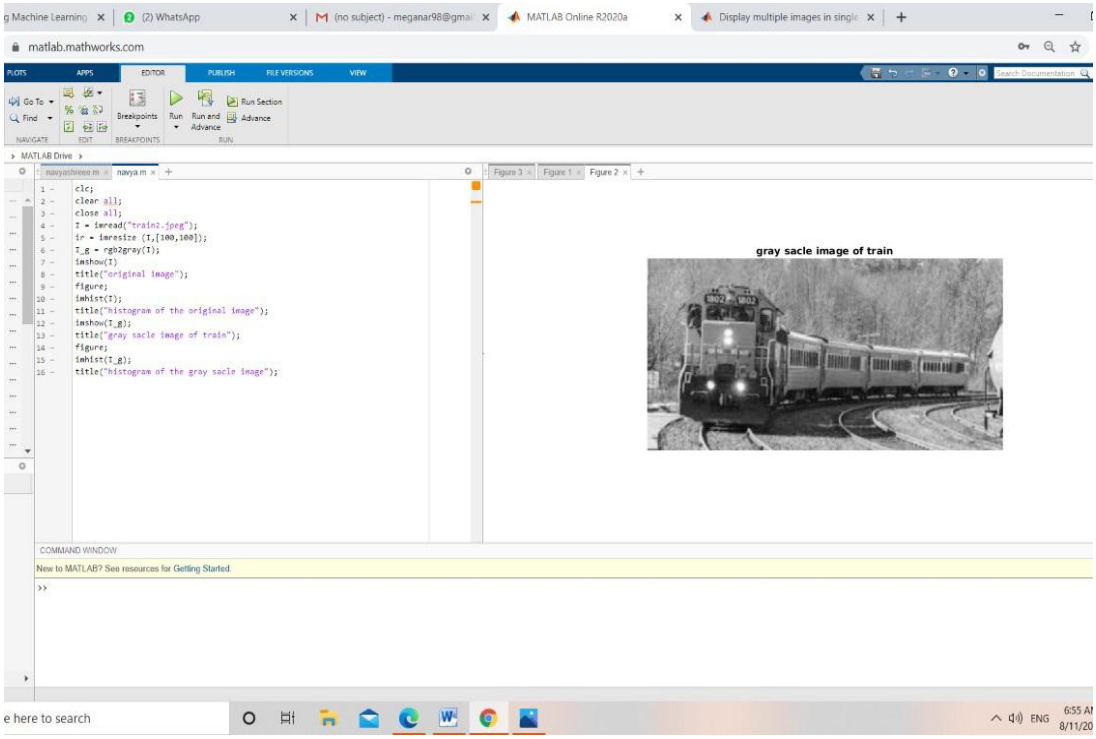

Figure 6.3: Output of gray scale image

The Figure 6.4., depicts the histogram of coverted gray scale image. Here, the graph shows sharp edge detection as compared to the color image histogram. Hence, gray scale image classification will be more accurate than the color image.

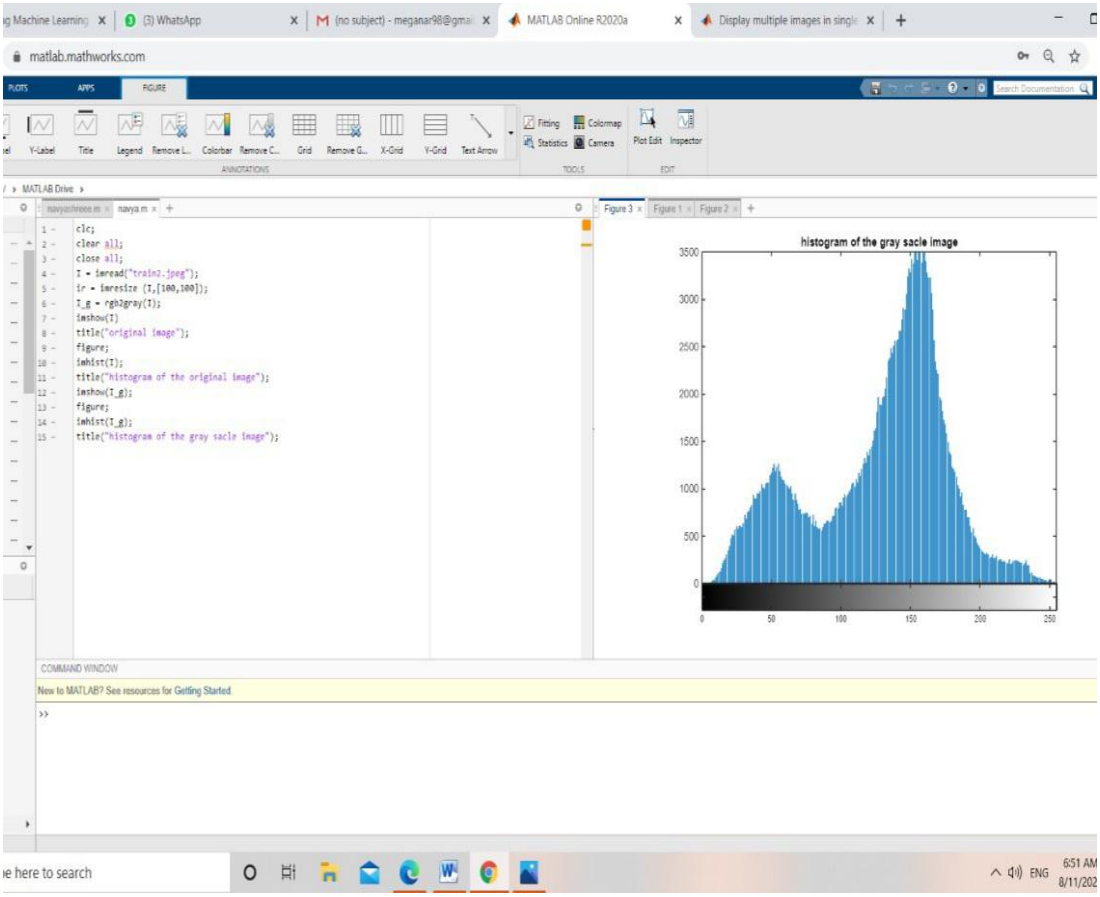

Figure 6.4: Histogram of gray scale image

The convolution neural network found the novel result and finally we compare the input detected train with the predefined dataset. This compares the input images with the database images and works on it, after extracting features from the images it is compared with the dataset and finally we can figure out the train images as favorably recognized, otherwise the train images would not be recognized. The captured images is shown in Figure 6.5, is been successfully detected and recognized. The rectangular box is obtained by the haar cascade classifier. Here in this image, the train is detected.

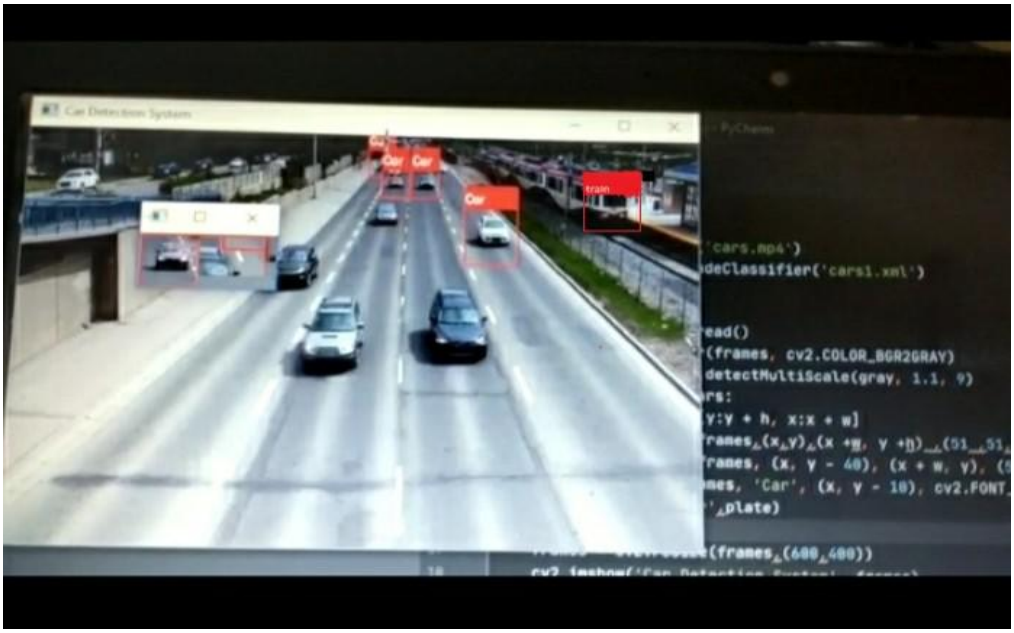

Figure 6.5: Final output of the proposed module.

The Figure 6.6., shows the output window of DC motor control. This helps in the angle of rotation of the virtual smart platform.

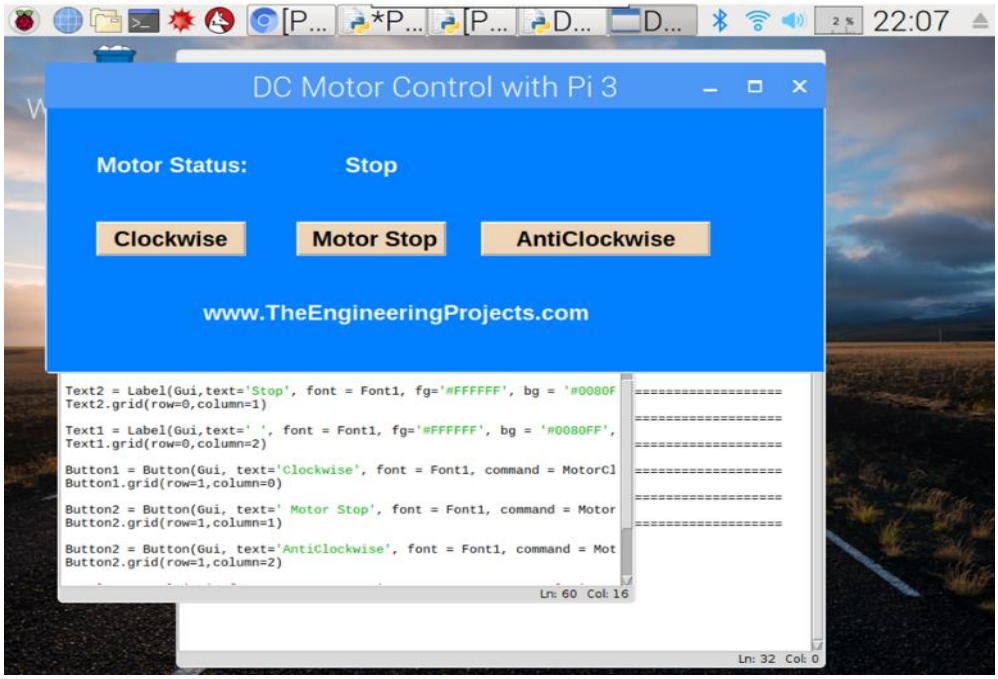

Figure 6.6: Output window of dc motor control

The Figure 6.7, shows the model accuracy for each epoch. Training data is the actual data set that we use to train the model. Validation data is the sample data that provide an unbiased evaluation of a model on the training data while tuning model hyper-parameters. A single appearance of entire data set is referred to as an "epochs". Each time the algorithm has seen all samples in the data set, an epoch is completed. 140 epochs took 3 minute 15 seconds, resulting the accuracy of 91.82%.

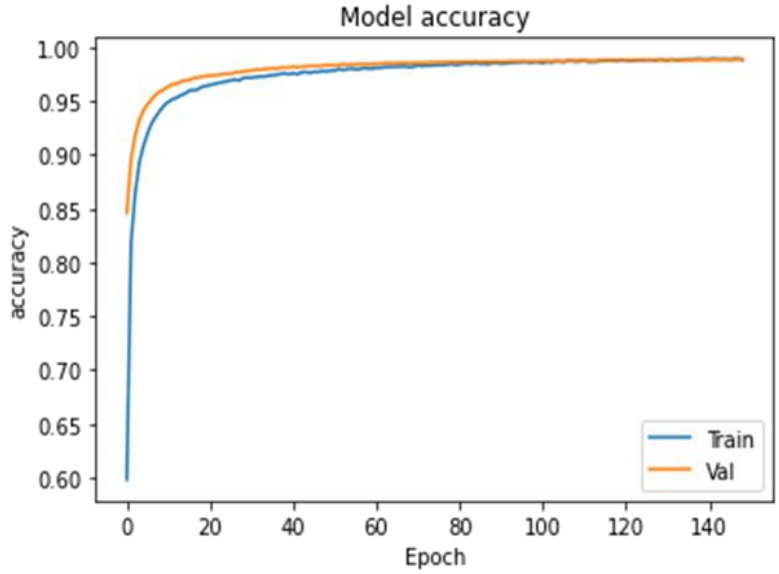

Figure 6.7: Plot of Model accuracy

The Figure 6.8, shows the training and validation loss for each epoch. During an epoch, the loss function is calculated across every data item and it is guaranteed to give loss measure at the given epoch and plotting curve across each iteration only gives the loss on a subset of the entire data set. 140 epochs took 3 minute 15 seconds, resulting the loss of 0.2702.

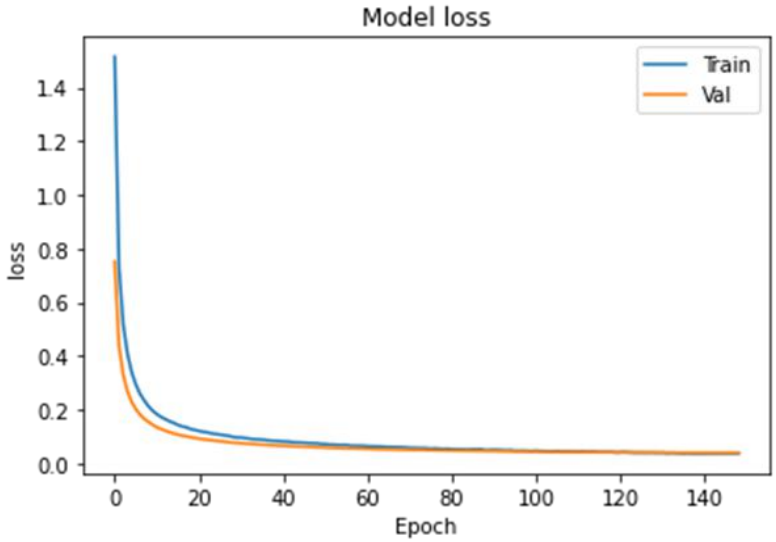

Figure 6.8: Plot of Model loss

Firstly, CNN is primarily used to obtain high-level features from raw images and the softmax is often used to classify and evaluate the accuracy. The graph shown in Figure 6.9 , suggests that the features extracted using CNN are more discriminative than those extracted using LBPH and Haar-WT.

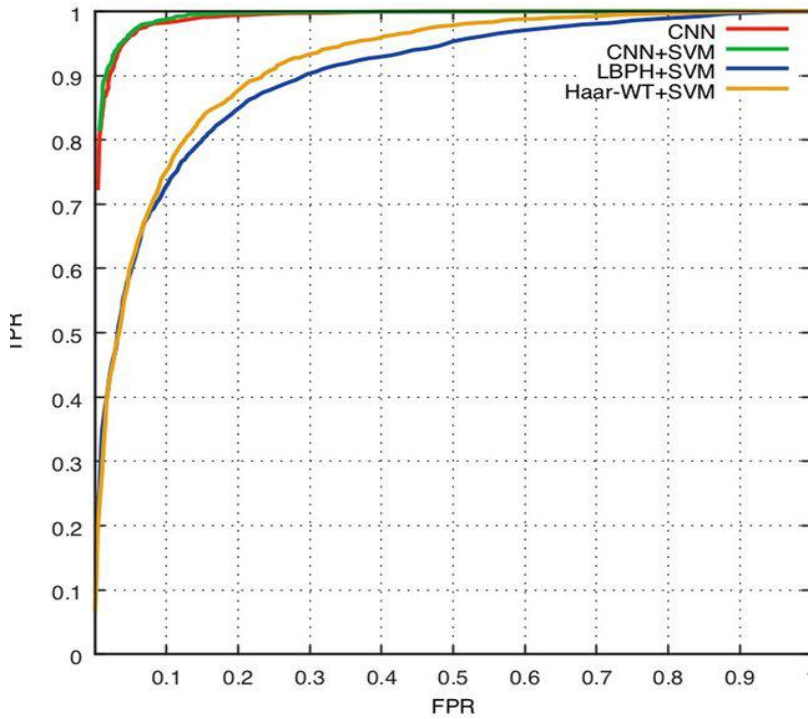

Figure 6.9: Plot of accuracy comparison among different algorithms.

6.2 SOCIETY AND ENVIRONMENTAL RELEVANCE

- Due to rapid increase in accidents happening at railways, there is a requirement for enhanced safety and security system.
- The system proposed here results in infrastructural development at railways. Its cost effective and also more efficient.
- This proposed system is not only limited to the infrastructural development at railways, but also results in secured virtual platform for physically challenged people.
- As the proposed system is built by using some of the machine learning paradigms this enhances the system performance and gives fast response.
- This system provides a better platform for old aged people and reduces the accidents taking place while crossing the platforms.

6.3 ADVANTAGES

- Artificial Platform gives a smart facility to the physically challenged individuals. The trading of physically challenged individuals from one Platform to the other platform is difficult by using the foot over bridge. Hence the artificial platform gives the smart facility.
- The led signal gives more security for the passengers for the usage of artificial platform.
- It reduces the chances of human error as there is no human source is involved in the controlling process.
- It minimizes the time for passengers to cross between the platforms. By using the foot over bridge, it takes more time to cross between the platforms. In case of emergencies this is the very effective method.

6.4 APPLICATIONS

- The proposed system can be applicable in railways to reduce the train accidents in the railway stations.
- Applicable and highly helpful to physically challenged people to cross the platform.
- The time consuming will be very less to cross the platforms.
- Our Proposed system reduces the chances of human error.

CONCLUSION

The customized Smart Platform gives the splendid office to the physically challenged individuals in railway convergence to cross the Platforms without using foot over bridge with enhanced safety and security upon sensing the train consistently with the help of proximity sensor and camera unit. This system gives an extraordinary change of Indian railway system. The structure gives totally customized control by using advanced technological paradigms that helps to consequently close and open the smart platform giving the exuberant experience to the current Indian railway system. The whole work took place in this proposed system heading towards trying to avoid accidents and reduce the number of fatalities in the field of railway transportation system.

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