UPDATING ATTENDANCE USING DEEP LEARNING/COMPUTER VISION

A Project Report Submitted to

ShriRamdeobaba College of Engineering & Management, Nagpur

(An Autonomous Institute of Rashtrasant Tukdoji Maharaj Nagpur University)

in Partial fulfillment of VII semester of Bachelor Degree in

Industrial Engineering

Submitted by

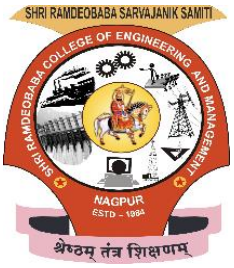
Ravindra Borade

Ashwin Ghagre

Varun Chopra

Under the Guidance of

Dr. Anupam Kher



Department of Industrial Engineering

Shri Ramdeobaba College of Engineering and Management

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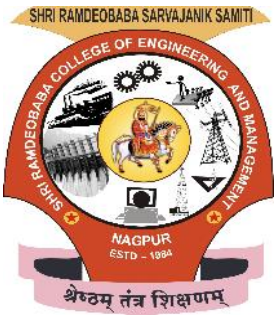

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CERTIFICATE

The project report titled, “Updating Attendance using Deep Learning and IOT” submitted by Ravindra Borade, Ashwin Ghagre,Varun Chopra of VII Semester in Industrial Engineering, is a record of original work carried out by them. This work has been carried out under my supervision at the Department of Industrial Engineering, Shri Ramdeobaba College of Engineering and Management, Nagpur during the academic session 2019-20. The work is comprehensive, complete and fit for evaluation, to the best of my knowledge.

Date:
Place:

Dr. Anupam Kher
Project Guide
Department of Industrial Engineering

Dr. I.P. Keswani
H.O.D.,
Department of Industrial Engineering

DECLARATION

We, hereby declare that the Project report titled “Updating Attendance using Deep Learning/Computer Vision” submitted herein for the partial fulfillment of VII semester in Industrial Engineering has been carried out by us in the Department of Industrial Engineering of Shri Ramdeobaba College of Engineering and Management, Nagpur. The work is original and has not been submitted earlier as a whole or in part for the award of any degree / diploma at this or any other Institution / University.

Date:

Ravindra Borade

Ashwin Ghagre

Varun Chopra

APPROVAL SHEET

This project report entitled **Updating attendance Using Deep learning and Computer Vision** by **Ravindra Borade, Ashwin Ghagre, Varun Chopra** is approved for the VII Sem of Bachelor of Industrial Engineering.

Name & signature of Supervisor(s)

Name & signature of External. Examiner(s)

Name & signature of HOD

Date:

Place:

ACKNOWLEDGEMENTS

With immense pleasure and great respect we take this opportunity to express deep sense of gratitude to our project guide Dr Anupam Kher, Department of Industrial Engineering, RCOEM, Nagpur, for his invaluable guidance, inspiration, constant encouragement and motivation throughout the project work.

We also express our sincere gratitude towards Dr. I. P. Keswani, Head of Department of Industrial Engineering, RCOEM, Nagpur, for his invaluable guidance and motivation to do this project work.

We are indebted to the faculty members of Department of Industrial Engineering, RCOEM, Nagpur, for giving us valuable time and helping us to get through the difficulties came across at each stage of project work.

We would like to express our special gratitude and thanks to Dr. Rajesh Pande, Principal, RCOEM, Nagpur, for his cooperation and encouragement.

Last but not least, we are very much thankful to our parents and friends who directly or indirectly supported us at every stage to bring this project towards successful completion.

Projectee

Ravindra Borade

Ashwin Ghagre

Varun Chopra

ABSTRACT

The face is the identity of a person. The methods to exploit this physical feature have seen a great change since the advent of image processing techniques. The attendance is taken in every schools, colleges and library.

Traditional approach for attendance is professor calls student name & record attendance. The system described in this paper aims to deviate from such traditional systems and introduce a new approach for taking an attendance using Computer Vision. This paper describes the working of An Automatic Attendance System in a classroom environment. Initially video clip of classroom is taken and is stored in the database, and these video is converted to frames/images, then these images acts as input data for the CNN classifier. Once the network is trained i.e when the weights are learned ,then in every class ,when a request will be triggered from Admin of the respective department and a image of whole class will be taken and feeded to the object detection model i.e. mobilenet. The model then will first detect objects i.e.

the students present in the image. The detected objects will be feeded to the classifier which will classify the class of the detected object . So index of the array corresponding to each student will be updated based on whether the student is present or not. Thus ,finally the attendance will be updated in the database and the students can see their updated attendance.

Check List for Project Report (Write Yes/No in the box)

SN	Item to Check	Yes/No
1	Followed the Correct template of Thesis sent on email for current semester	Yes
2	Read all the instructions for Thesis writing, How to write References	Yes
3	Thesis cover page as per the format(Font Size, logo, Session, etc.)	Yes
4	Title of Thesis Correctly written as per the font on the Cover Page	Yes
5	Same Title of thesis at all places in the thesis(Certificate, Declaration, etc.)	Yes
6	Certificate as per the format and correct title as on first page.	Yes
7	Industry Certificate attached in the thesis(If project is industry based)	No
8	Declaration as per the format and signed by all projectee	Yes
9	Acknowledgements page as per format	Yes
10	Table of Contents as per format with correct page numbering	Yes
11	Table Number and caption above the table.	Yes
12	List of Tables as per format	Yes
13	Figure Number and caption below the Fig.	Yes
14	List of Figures as per format	Yes
15	No page number on the outside and inside cover page	Yes
16	Page number in Chapter 1 and onwards given as 1,2,3……	Yes
17	Chapter Number, Chapter Title properly written as per the standard	Yes
18	Chapter Separator page included in the thesis	Yes
19	**REFERENCES** written as per the correct style and as per the instructions	Yes
20	Sequence of pages as per the instructions	Yes
21	Font and Font Size as per the instructions and uniform in the entire thesis	Yes
22	Grammar and Spelling checked in the entire thesis	Yes
23	Thesis binding & Project Details on the side binding as per the format	Yes
24	Project Group members address and contact details Page included in the Thesis.	Yes
25	**APPROVAL SHEET attached in the Thesis as per the instructions**	Yes

Name and Signature of Students

Roll. No.	Name	Signature
61	Ravindra Borade	
41	Ashwin Ghagre	
74	Varun Chopra	

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Dr. Anupam Kher

Date:

PROJECT DETAILS

Title of Project: Updating Attendence Using Deep Learning and Computer Vision

Academic Session:2019-2020

Name of Guide: Dr. Anupam Kher

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CHAPTER 1

INTRODUCTION

For humans and many other animals, visual perception is one of the most Important senses. We heavily depend on vision whenever we interact with our Environment: When we pick up an object and move through our environment and Avoid bumping into everything on the way or when we recognize our friends by Their faces. In order to pick up a glass, we need to first determine which part of our visual Impression corresponds to the glass before we can find out where we have to Move our hands in order to grasp it. And if we want to recognize another human, we first have to find out which part of The image we see represents him or her and where in this part the face is.Of course, we never think about these basic processing steps actively. The thing Which seems so effortless for our brain still poses a major challenge for artificial Systems like robots that need to process image content. Existing algorithms most

Often only tackle a small subset of the different tasks necessary for understanding An image and are very demanding in terms of computational resources .

Computer vision is an interdisciplinary scientific field that deals with how computers can be made to gain high-level understanding from digital images or videos. From the perspective of engineering, it seeks to automate tasks that the human visual system can do Computer vision tasks include methods for acquiring, processing, analyzing and understanding digital images, and extraction of high-dimensional data from the real world in order to produce numerical or symbolic information, e.g. in the forms of decision. Understanding in this context means the transformation of visual images (the input of the retina) into descriptions of the world that can interface with other thought processes and elicit appropriate action. This image understanding can be seen as the disentangling of symbolic information from image data using models constructed with the aid of geometry, physics, statistics, and learning theory

The scientific discipline of computer vision is concerned with the theory behind artificial systems that extract information from images. The image data can take many forms, such as video sequences, views from multiple cameras, or multi-dimensional data from a medical scanner. The technological discipline of computer vision seeks to apply its theories and models to the construction of computer vision systems. Sub-domains of computer vision include scene reconstruction, event detection, video tracking, object recognition, 3D pose estimation, learning, indexing, motion estimation, and image restoration.

CHAPTER 2

LITERATURE REVIEW

2.1 Artificial Neural Network

Artificial neural networks are enhanced computing systems that are inspired by the biological neural networks that comprises of animal brains. Such systems progressively improve their performance on various tasks by considering.

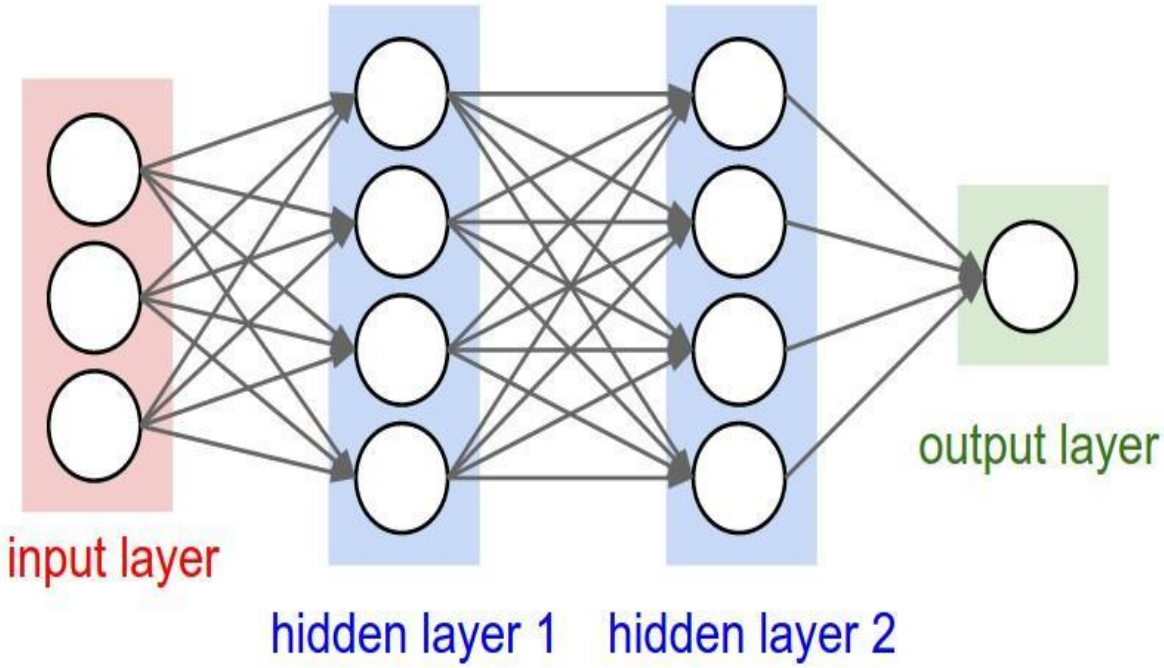


Fig 2.1 Artificial Neural Network

2.2 Convolution Neural Network:

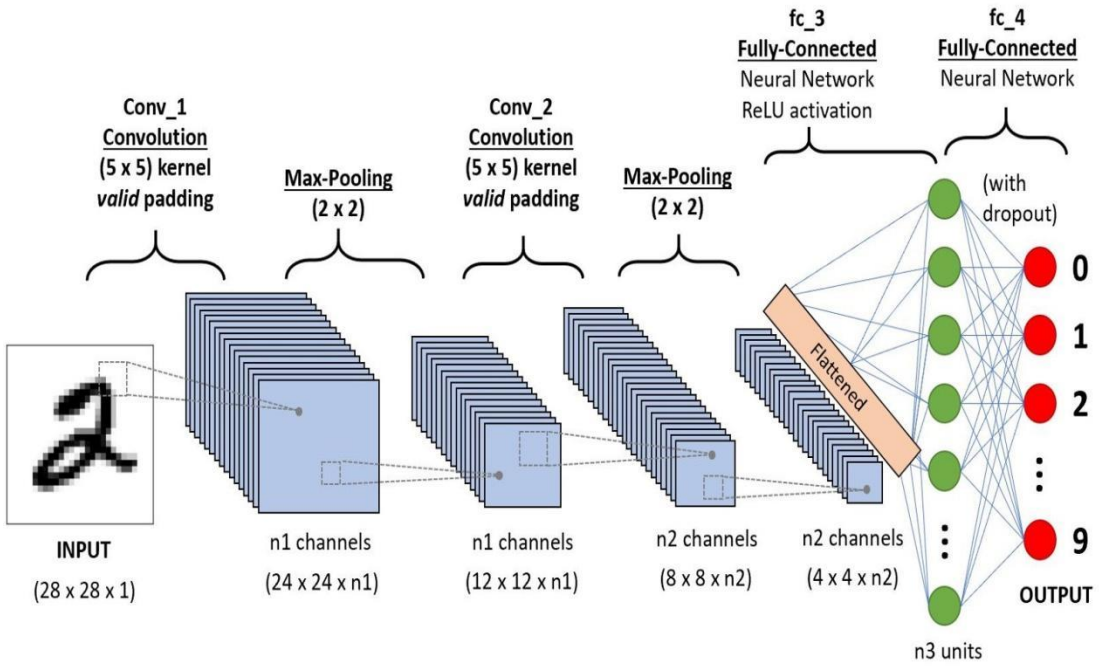


Fig 2.2 Convolutional Neural Network

convolution neuronal network (with the acronyms CNNs or Convents) is a concrete case of Deep Learning neural networks, which were already used at the end of the 90s but which in recent years have become enormously popular when achieving very impressive results in the recognition of image, deeply impacting the area of computer vision.

The convolution neural networks are very similar to the neural networks of the previous posts in the series: they are formed by neurons that have parameters in the form of weights and biases that can be learned. But a differential feature of the CNN is that they make the explicit assumption that the entries are images, which allows us to encode certain properties in the architecture to recognize specific elements in the images.

To get an intuitive idea of how these neural networks work, let's think about how we recognize things. For example, if we see a face, we recognize it because it has ears, eyes, a nose, hair, etc. Then, to decide if something is a face, we do it as if we had some mental boxes of verification of the characteristics that we are marking. Sometimes a face may not have an ear because it is covered by hair, but we also classify it with a certain probability as face because we see the eyes, nose and mouth. Actually, we can see it as a classifier equivalent to the one presented in

the post “Basic concepts of neural networks”, which predicts a probability that the input image is a face or no face.

But in reality, we must first know what an ear or a nose is like to know if they are in an image; that is, we must previously identify lines, edges, textures or shapes that are similar to those containing the ears or noses we have seen before. And this is what the layers of a convolution neural network are entrusted to do.

But identifying these elements is not enough to be able to say that something is a face. We also must be able to identify how the parts of a face meet each other, relative sizes, etc.; otherwise, the face would not resemble what we are used to. Visually, an intuitive idea of what layers learn is often presented with this example from an article by Andrew Ng’s group.

2.2.1 Layers of Convolutional neural network

2.2.1.1 Convolutional layer

Convolutional layer is the building block of a Convolutional Network that does most of the computational activity. The convolutional layer’s parameters consist of a set of learnable filters or weight matrices.

2.2.1.2 Pooling Layer:

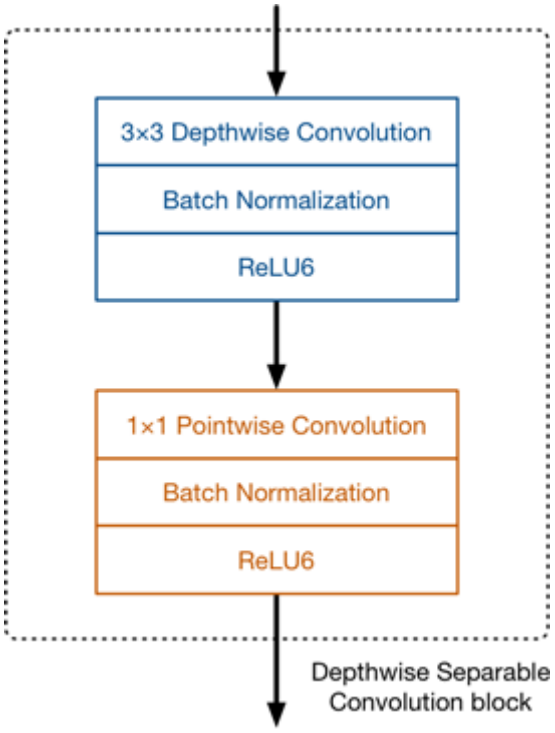
It is common to often insert a Pooling layer between successive Convolutional layers in a Convolutional Neural Network architecture. The aim of this layer is to progressively reduce the spatial size of the representation to reduce the amount of parameters and computation in the network, and hence to also control the problem of over fitting. The Pooling Layer operates independently on every depth slice of the input and resizes it spatially, using the MAX operation. The most common form is a pooling layer with filters of size 2x2 applied with a stride of 2 down samples every depth slice in the input by 2 along both width and height, discarding 75% of the activations. Every MAX operation would in this case be taking a max over 4 numbers (little 2x2 region in some depth slice). The depth dimension remains unchanged.

2.2.1.3 Fully Connected Layers:

Neurons in a fully connected layer have full connections to all activations in the previous layer, as seen in regular Neural Networks. Their activations can thereby be computed with a matrix multiplication followed by a bias offset. See the Neural Network section of the notes for more information

2.3 What is Mobile Net?

The big idea behind Mobile Net V1 is that convolutional layers, which are essential to computer vision tasks but are quite expensive to compute, can be replaced by so-called depth wise separable convolutions .The job of the convolution layer is split into two subtasks: first there is a depth wise convolution layer that filters the input, followed by a 1×1 (or point wise) convolution layer that combines these filtered values to create new features:



Together, the depth wise and point wise convolutions form a “depth wise separable” convolution block. It does approximately the same thing as traditional convolution but is much faster. The full architecture of Mobile Net V1 consists of a regular 3×3 convolution as the very first layer, followed by 13 times the above building block.

2.4 Prediction given by MobileNet

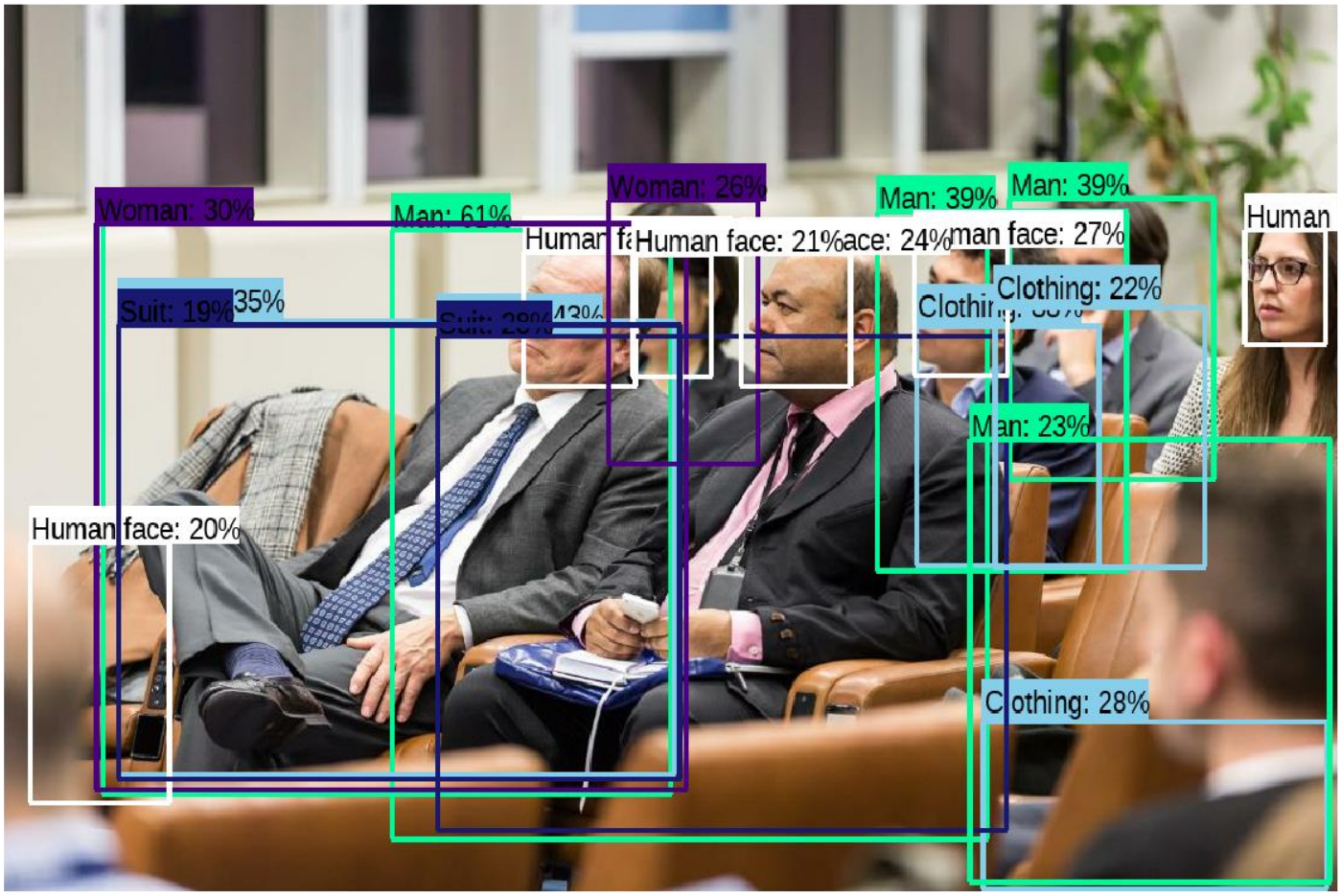


Fig 2.4 Objects Predicted by pretrained MobileNet model trained on imagenet dataset.

CHAPTER 3

METHODOLOGY

3.1 Architecture of web application: -

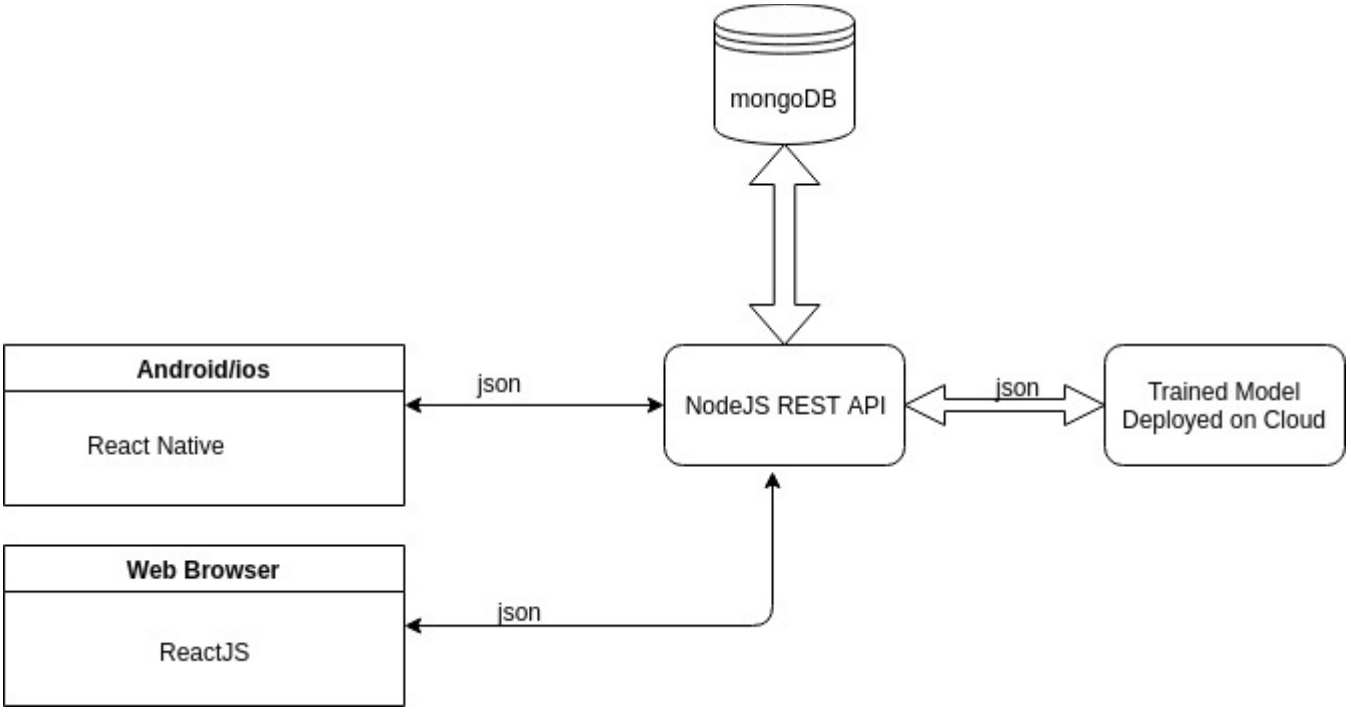
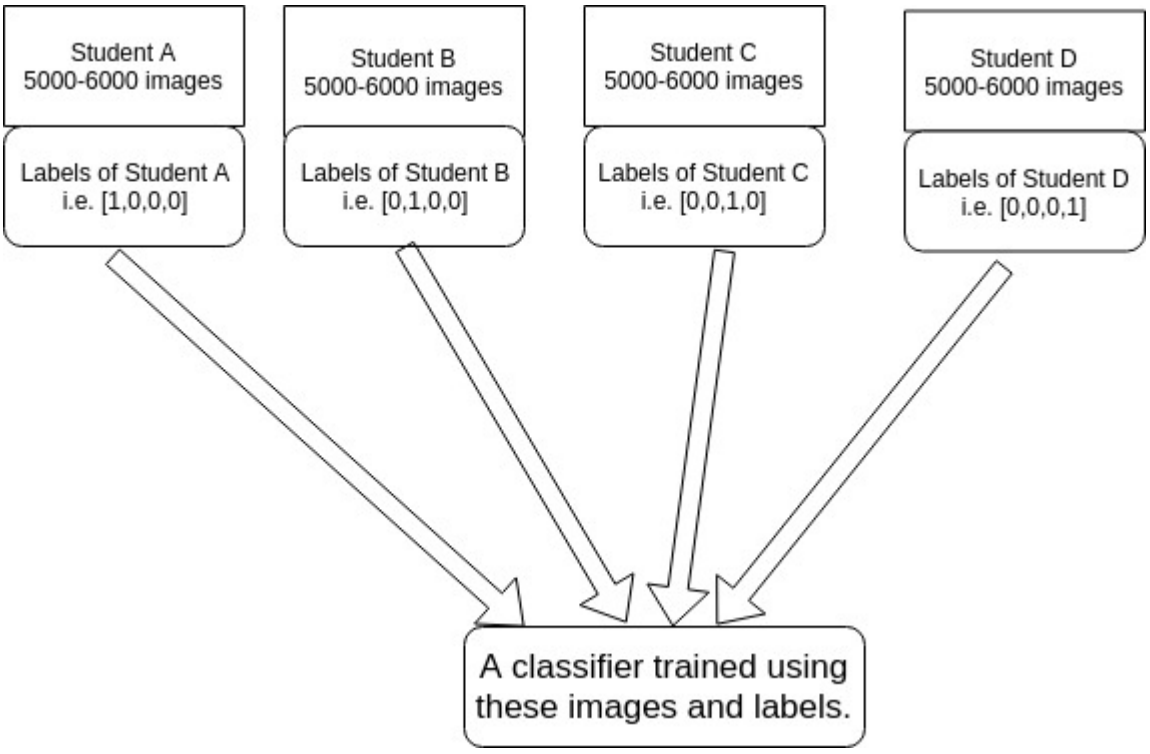


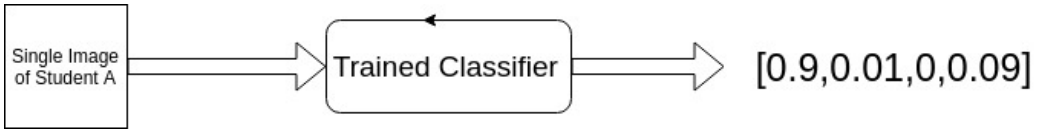
Fig 3.1 Architecture of the web application

3.2 Steps involved in building deep learning model:

1. Training the classifier using the images of students taken independently :



2. Getting the predictions from the trained classifier:



3. **Building the object detection model (mobilenet) in this case and getting the coordinates of the objects present in the image.**

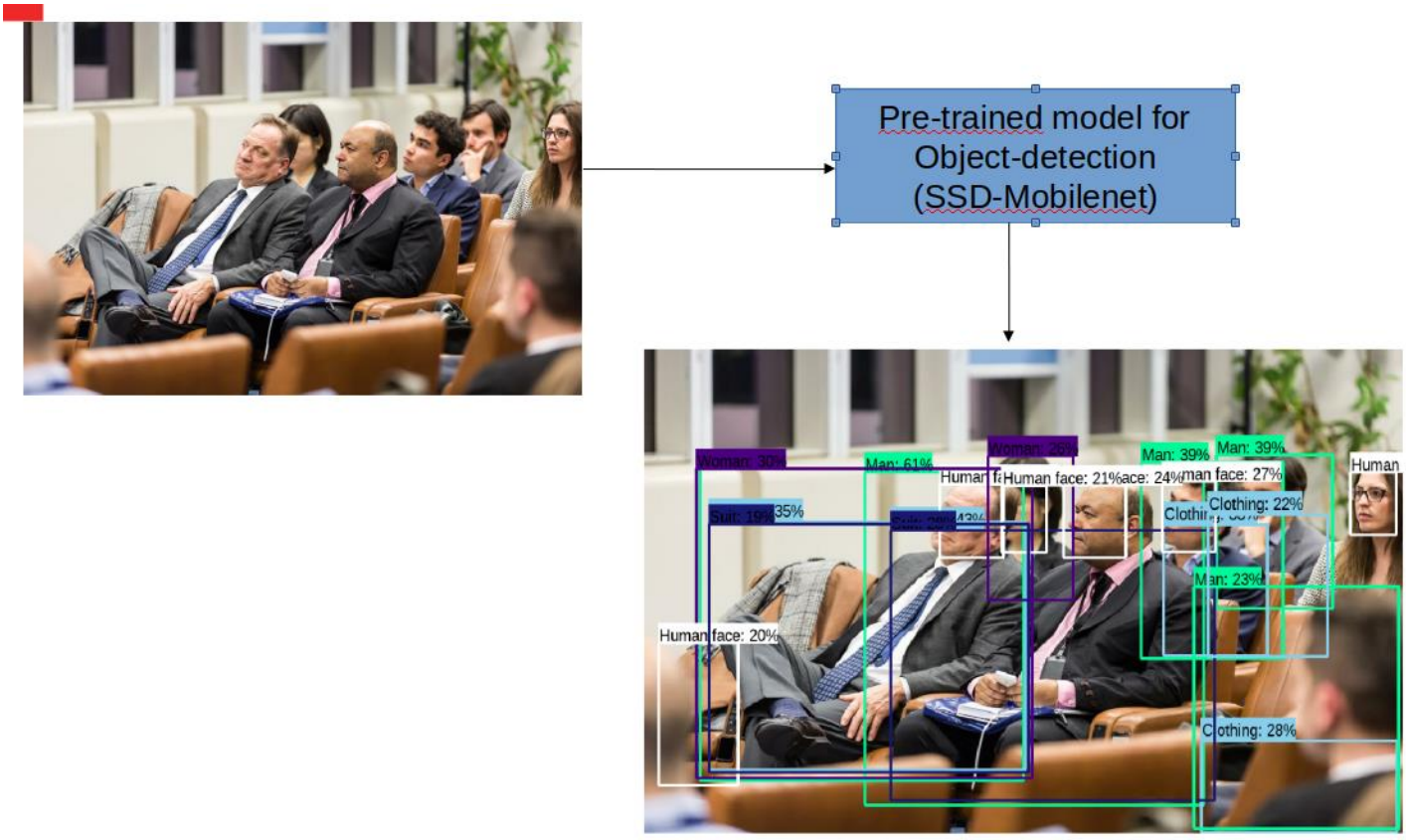


Fig. Building the Object detection model for getting the coordinates corresponding to each object/human face in the image.

3.3 Details of the Mobile Net model:

- The output of object detection contains two output, class labels and coordinates associated with those class labels.

  Ex. class labels=[‘Human face’,’clothing’,’Human face’,’Man’]
  Coordinates = [[5,5,35,46],[34,37,89,90],[30,30,90,90],[45,45,78,79]]

- The format of the coordinates are (Ymin,Xmin,Ymax,Xmax)
- Using these coordinates every patch corresponding to each class can be located.

- Using these coordinates associated with all the ‘Human faces’ class a four dimensional matrix can be formed which contains all the human faces present in the image.

I.e. [n,h,w,3]
n: humans present
h : height of image
w :width of image
3 : channels

- This four dimensional matrix is feed to the previously trained classifier which gives as output an array .

ex. [1,1,1,0,0,1,1,1]
where 1 represent present and 0 represent absent.
This array can then be used to update the attendance in the database.

3.2 Steps involved:

Step1: A video stream of a class is taken and saved in the mongoDb database and the video stream is converted into the different frames/images. The images acts as the input data for CNN classifier to built.

Step2: Once the CNN classifier is trained on the images of the students ,it can be used to classify the objects detected from an image by the MobileNet model.

Step3: Then in every class as the request is triggered from the Department-Admin the image of the class is taken and feed to the MobileNet model . Since the MobileNet model is already trained on the imagenet dataset , it will give as output all the objects detected in the image along with their coordinates.

Step4:- The model then detects the number of objects present in the image i.e. the students present in the image by filtering out all classes such as 'clothing' ,'bicycle',' book',etc . Then the detected objects are passed through the classifier which classify the image into the desired class.

Step5:- Alongside and array is maintained and the indices of the array represents the students present in the particular class. Based on the prediction given by the YOLO network the indices in the array are updated. Now the array contains information of the students which are present or not .

Step6:- Since the trained model is deployed on the Django REST API , the array is now sent to the nodejs REST API through a POST request . Then the mongoDB database is updated which is connected to the nodejs REST API.

Step7: - Once the database is updated , any student can login in the application and see their updated attendance.

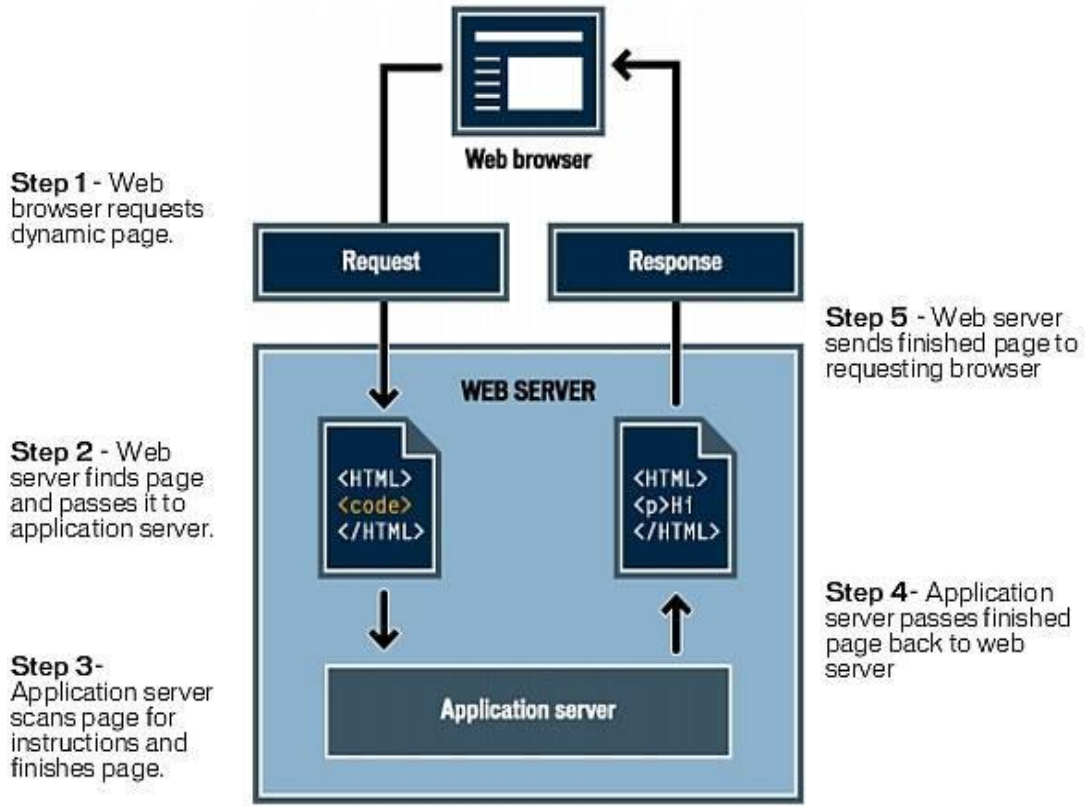


Fig 3.2 REST api and Client interaction

3.3 Facsimile of application:

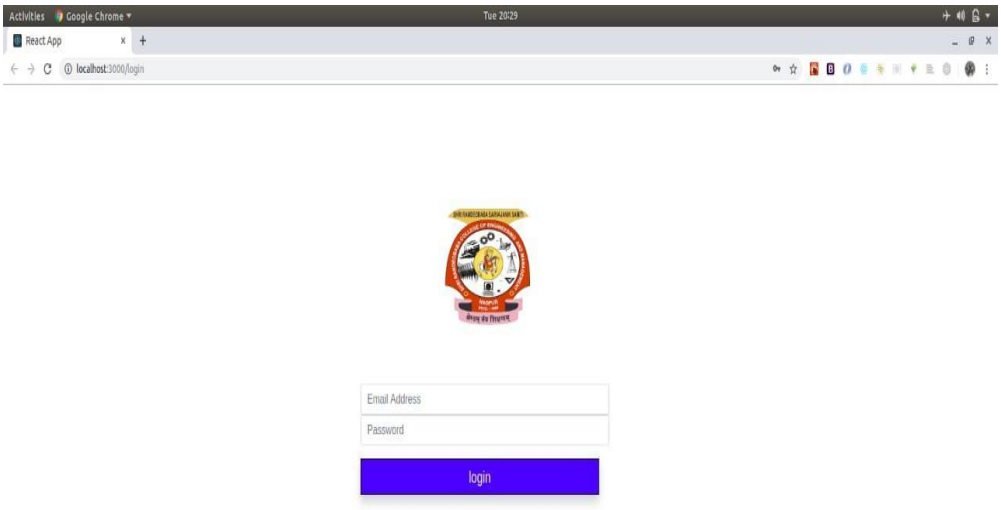


Fig 3.3 Login page of the Application

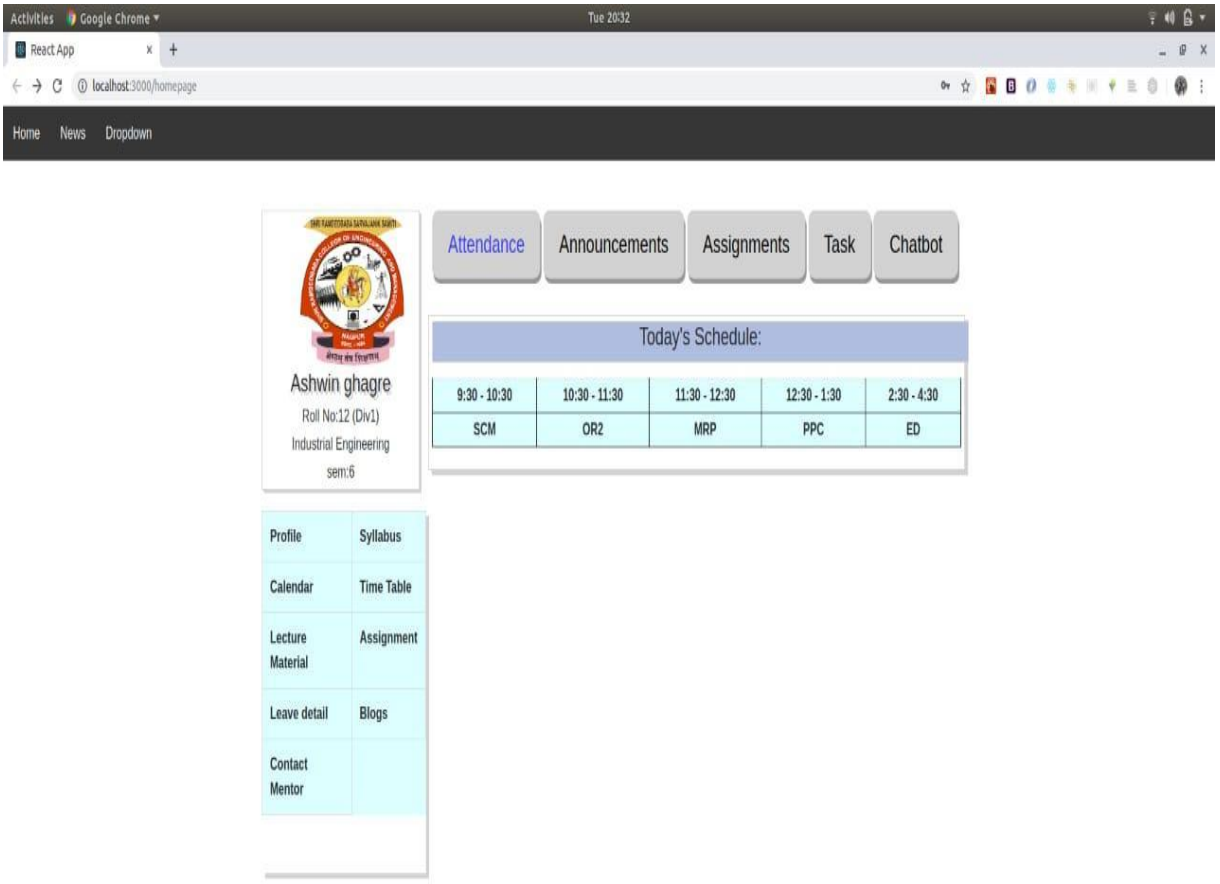
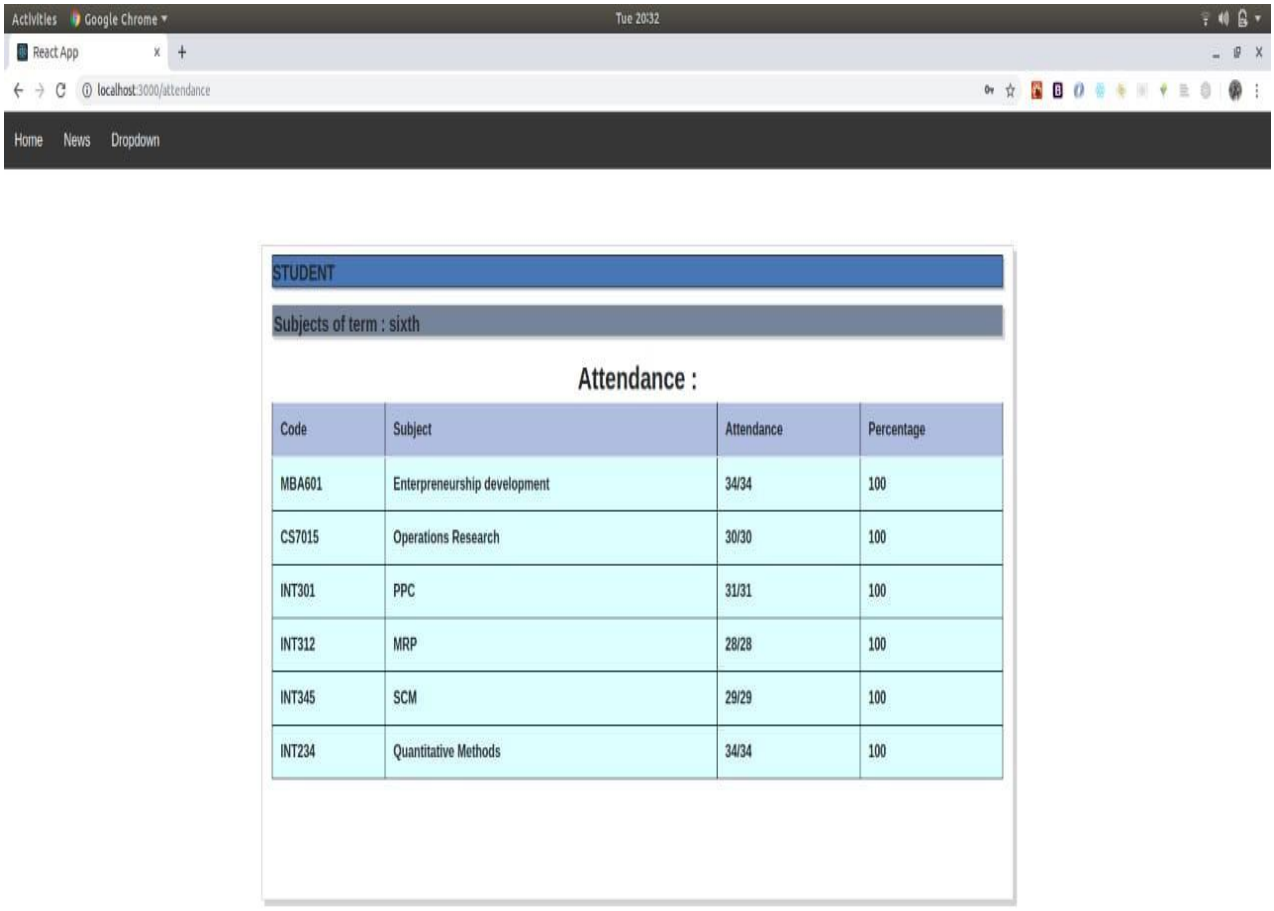


Fig 3.4 Homepage of application

Fig 3.5 Attendance page of the application



CHAPTER 4

TOOLS AND TECHNOLOGY USED

4.1 Tools and Technologies used for Application

4.1.1 Python

Python is an interpreted, high-level, general-purpose programming language. Created by Guido van Rossum and first released in 1991, Python has a design philosophy that emphasizes code readability, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales.

Python features a dynamic system and automatic memory management. It supports multiple programming paradigms, including object-oriented, imperative, functional and procedural, and has a large and comprehensive standard library.

Python interpreters are available for many operating systems. CPython, the reference implementation of Python, is open source software and has a community-based development model, as do nearly all of Python's other implementations. Python and CPython are managed by the non-profit Python Software Foundation.

4.1.2 React js

React (also known as **React.js** or **ReactJS**) is a JavaScript library for building user interfaces. It is maintained by Facebook and a community of individual developers and companies.

React can be used as a base in the development of single-page or mobile applications. Complex React applications usually require the use of additional libraries for state management, routing, and interaction with an API.

React was created by Jordan Walke, a software engineer at Facebook. He was influenced by XHP, an HTML component framework for PHP. It was first deployed on Facebook's newsfeed in 2011 and later on Instagram.com in 2012. It was open-sourced at JSConf US in May 2013.

React Native, which enables native Android, iOS, and UWP development with React, was announced at Facebook's React.js Conf in February 2015 and open-sourced in March 2015.

On April 18, 2017, Facebook announced React Fiber, a new core algorithm of React framework library for building user interfaces. React Fiber was to become the foundation of any future improvements and feature development of the React framework

4.1.3 MongoDB

MongoDB is a cross-platform document-oriented database program. Classified as a No SQLdatabase program, Mongo DB uses JSON-like documents with schemata. Mongo DB is developed by Mongo DB Inc. and licensed under the Server Side Public License (SSPL). Using object document mapper(ODM) like mongoose mongoDB can be used in very flexible way.

4.1.4 Nodejs / Expressjs

Node.js is an open-source, cross-platform JavaScript run-time environment that executes JavaScript code outside of a browser. JavaScript is used primarily for client-side scripting, in which scripts written in JavaScript are embedded in a webpage's HTML and run client-side by a JavaScript engine in the user's web browser. Node.js lets developers use JavaScript to write command line tools and for server-side scripting—running scripts server-side to produce dynamic web page content before the page is sent to the user's web browser. Consequently, Node.js represents a "JavaScript everywhere" paradigm, unifying web application development around a single programming language, rather than different languages for server side and client side scripts.

4.1.5 Operating system used

Ubuntu is an open source operating system for computers. It is a Linux distribution which is based on the Debian architecture. It is usually run on personal computers, and is also in demand and popular on network servers, usually running the Ubuntu Server variant, with enterprise-class features. Ubuntu runs on the most popular architectures, including Intel, AMD, and ARM-based machines. Ubuntu is also available for tablets and smartphones, with the Ubuntu Touch edition. Ubuntu is the most popular operating system running in hosted environments, socalled "clouds", as it is the most popular server Linux distribution.

Ubuntu provides the base for installation of Hadoop framework for performing distributed operations. Since, Ubuntu is popular for its distributed system environment, Hadoop works in it better for the distributed operations and working on cloud.

4.2 Libraries /API's used

4.2.1 Tensorflow

A free and open source software library for dataflow and differentiable programming range of tasks. It is a symbolic math library, and is also used for learning applications such as neural networks. It is used for both research and production at Google
GPUs, TPUs), and from desktops to clusters of servers to mobile and edge devices.
Tensor Flow computations are expressed as state full dataflow graphs. The name Tensor Flow derives from the operations that such neural networks perform on multidimensional data arrays, which are referred to as tensors. During the Google I/O Conference in June 2016, Jeff Dean stated that 1,500 repositories on Github mentioned Tensor Flow, of which only 5 were from Google

4.2.2 Numpy

NumPy is a library for the Python programming language, adding support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays. The ancestor of NumPy, Numeric, was originally created by Jim Hugunin with contributions from several other developers. In 2005, Travis Oliphant created NumPy by incorporating features of the competing Num array into Numeric, with extensive modifications. NumPy is open-source software and has many contributors.

4.2.3 OpenCV

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for business purpose to utilize and modify the code. The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. The algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc. It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS. OpenCV leans mostly towards real-time vision applications and takes advantage of MMX and SSE instructions when available.

CHAPTER 5

PROBLEM IDENTIFICATION

5.1 Problem Definition

Recognizing faces in computer vision is a challenging problem. The illumination problem, the pose problem, scale variability, low quality image acquisition, partially occluded faces are some examples of the issues to deal with. Thus face recognition algorithms must exhibit robustness to variations in the above parameters. The existing techniques do not perform well in cases of different illumination, background or rotation. Thus there is a need to address the above mentioned disadvantages. The project aims to design and implement a system which is less sensitive to Illumination, is rotation invariant, scale invariant and robust enough to be implemented in practical applications.

5.2 Statement of problem

5.2.1 General problem

Based on studies we found that taking attendance manually consumes a lot of time

5.2.2 Specific Problem

The following are the specific details identified in the problem:

• Time consuming in checking the attendance

• Administrator might loss the attendance sheet

• Erasures/Tampered

5.2.3 General Objectives

We analyzed the problems when it comes to attendance. They planned and proposed a system that can solve the problems of the school.

5.2.4 Specific Objectives

•To reduce the time for taking and updating attendance

• To avoid risk of losing the attendance sheet

• To avoid erasures and tempering

5.3 Significance of the Study

The proposed system will benefit the following:

5.3.1 Faculty's- It will help to organize the record and monitor the faculty member's attendance.

5.3.2 Department Admin- this web application will help the department admin to monitor the attendance of the students of entire department

5.3.3 Proponents - It can help the proponents to learn more and enhance their skills in programming.

5.3.4 Future Proponents- The study enhances the knowledge of users in the advancement of technology this study will provide contribution for educational purposes.

5.4 Scope and Limitation

5.4.1 Scope

The study will benefit the faculties by updating the attendance of the whole class. Since the faculties will not have to mark the attendance of the students one by one on the attendance sheet and update it on the the College management system. This will avoid the risk of losing the attendance of the students if they failed to give it in the class.

5.4.2 Limitation

The proposed system has limitations like other programs. Computer hardware damage and problem caused by power interruption are not controlled by the said system. If the department admin failed to trigger a request to the Django REST API while the class is going on the attendance of all the students of that particular department will not be updated.

5. 5 Collage survey

Total Teaching in RCOEM=1160 hrs per day

Most Every Lecturer Takes = 5 min to take an attendance manually

That is 8.33 % of the Whole 1hr class and 4.156% if its 2hr class

So,

Whole RCOEM waste 8.33 % 1160hrs i.e its 96.628 hr a Day (considering all classes of one hr)

CHAPTER 6

CONCLUSION

The purpose of reducing the errors that occur in the traditional attendance taking system has been achieved by implementing this automated attendance system. This system has been presented using deep learning which exhibits robustness towards recognition of the users.

The result shows the capability of the system to cope with the change in posing and projection of faces. From face recognition with deep learning, it has been determined that during face detection, the problem of illumination is solved as the original image is turned into a representation that captures the major features of the image regardless of image brightness. In the face recognition method, local facial landmarks are considered for further processing. After which faces are encoded which generates 128 measurements of the captured face and the optimal face recognition is done by finding the person's name from the encoding. The result is then used to generate on our web application, and that data sent to the students and professors on weekly interval. This system is convenient to the user and it gives better security.

CHAPTER 7

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