SAVITRIBAI PHULE PUNE UNIVERSITY

A PROJECT REPORT ON

REAL-TIME AUTOMATIC HELMET DETECTION OF BIKE RIDERS

SUBMITTED TOWARDS THE
PARTIAL FULFILLMENT OF THE REQUIREMENTS OF

BACHELOR OF ENGINEERING (Computer Engineering)

BY

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CERTIFICATE

This is to certify that the Project Entitled

REAL-TIME AUTOMATIC HELMET DETECTION OF BIKE RIDERS

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is a bonafide work carried out by Students under the supervision of Prof. I. Priyadarshini and it is submitted towards the partial fulfillment of the requirement of Bachelor of Engineering (Computer Engineering) Project during academic year 2017-18.

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Abstract

Nowadays two-wheeler is the most popular modes of transport. However, because of less protection there is a high risk involved. As a solution to this, it is highly desirable for bike-riders to use helmet. Observing the usefulness of helmet, Governments have made it punishable offense to ride a bike without helmet and have adopted manual strategies to catch the violators which has limitations of speed. Using video surveillance of the street, the proposed approach detects if the bike rider is wearing a helmet automatically without manual help. If a bike rider is detected not wearing a helmet, the license plate of the vehicle read and noted. A database will be generated with records to identify every offender accurately. The system implements pure machine learning in order to identify every type of helmet that it comes across with minimum computation cost.

Acknowledgments

*It gives us great pleasure in presenting the project report on **'Real-Time Automatic Helmet Detection of Bike Riders'**.*

*We would like to take this opportunity to thank our internal guide **Prof. I. Priyadarshini** for giving us all the help and guidance we needed. We are really grateful to her for the extended kind support. Her valuable suggestions were very helpful.*

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CHAPTER 1

SYNOPSIS

1.1 PROJECT TITLE

REAL-TIME AUTOMATIC HELMET DETECTION OF BIKE RIDERS

1.2 PROJECT OPTION

Internal project.

1.3 INTERNAL GUIDE

Prof. I. Priyadarshini

1.4 TECHNICAL KEYWORDS (AS PER ACM KEYWORDS)

1. C. Computing methodologies
   (a) C.3 ARTIFICIAL INTELLIGENCE
      i. C.3.4 Vision and Scene Understanding
         A. Image Processing and Computer Vision
         B. C.3.4 Scene Analysis
   (b) C.4 Machine Learning
      i. C.4.1 Supervised Learning
         A. Feature evaluation and selection
         B. Vehicle Classification
         C. Optical Character Recognition

1.5 PROBLEM STATEMENT

To develop and implement a system which performs real time helmet detection of bike riders using video surveillance of the street and hence generates a database of the license plates where a driver without helmet is found. Hence a database will be available for analysis for the police authority.

1.6 ABSTRACT

- Nowadays two-wheeler is the most popular modes of transport. However, because of less protection there is a high risk involved. As a solution to this, it is highly desirable for bike-riders to use helmet. Observing the usefulness of helmet, Governments have made it punishable offense to ride a bike without helmet and have adopted manual strategies to catch the violators which has limitations of speed. Using video surveillance of the street, the proposed approach detects if the bike rider is wearing a helmet automatically without manual help. If a bike rider is detected not wearing a helmet, the license plate of the vehicle read and noted. A database will be generated with records to identify every offender accurately. The system implements pure machine learning in order to identify every type of helmet that it comes across with minimum computation cost.

1.7 GOALS AND OBJECTIVES

The goal of this system is to implement a fast and accurate real time helmet detection system.

- The main objective is to ensure that an awareness is spread in the public about the importance of safety among bike riders by active reporting of people not abiding by this rule.
- Provide a human free automatic traffic monitoring system.
- To generate a database of license plates corresponding to the bikes where helmet is not detected.

1.8 RELEVANT MATHEMATICS ASSOCIATED WITH THE PROJECT

System Description:

- Input: Video feed, Latitude-Longitude of location
- Output: license plate, Time of offence, Date of offence, Location of offence, Image/Frame of proof
- Functions: Background Subtraction, Object detection, ROI Identification, Optical character recognition, Database operations.
- Success Conditions: license plate of every rider without helmet is detected
- Failure Conditions: No bike detected in the image, No license plate associated with the bike detected, Fancy license plate, Poor lighting condition.

1.9 NAMES OF CONFERENCES / JOURNALS WHERE PAPERS CAN BE PUBLISHED

- IEEE/ACM Conference/Journal 1
- Conferences/workshops in IITs
- Central Universities or SPPU Conferences
- IEEE/ACM Conference/Journal 2

1.10 REVIEW OF CONFERENCE/JOURNAL PAPERS SUPPORTING PROJECT IDEA

- **Helmet Detection on Motorcyclists Using Image Descriptors and Classifiers :**
  This paper aims a system for detection of motorcyclist without helmet is proposed. It is achieved by application of the circular Hough transform and the Histogram of Oriented Gradients descriptor to extract the image attributes. The Multilayer Perceptron classifier was then used and the obtained results

were compared with others algorithms. Traffic images were captured by cameras from public roads and constitute a database of 255 images. This system for helmet detection accomplished an accuracy rate of 91.37 while consuming a lot of computation resource. [6]

- **Automatic detection of motorcyclists without helmet :**
  The specialty of this system is to illustrate an automatic method for motorcycles detection and classification on public roads and a system for automatic detection of motorcyclists without helmet. For this, a hybrid descriptor for features extraction is proposed based in Local Binary Pattern, Histograms of Oriented Gradients and the Hough Transform descriptors. Traffic images captured by cameras were used. The best result obtained from classification was an accuracy rate of 0.9767, and the best result obtained from helmet detection was an accuracy rate of 0.9423. [2]

- **Automatic Detection of Bike-riders without Helmet using Surveillance Videos in Real-time :**
  The approach proposed in this paper first detects bike riders from surveillance video using background subtraction and object segmentation. Using visual features and binary classifier it then determines whether bike-rider is using a helmet or not . Also, a consolidation approach for violation reporting is presented which helps in improving reliability of the proposed approach. For evaluation, a performance comparison of three widely used feature representations was provided namely histogram of oriented gradients (HOG), scale-invariant feature transform (SIFT), and local binary patterns (LBP) for classification. The experimental results show detection accuracy of 93.80. [8]

1.11 PLAN OF PROJECT EXECUTION

Month	Schedule	Project Task
July	1st week	Idea about project topic
	3rd week	Project topic discussion
	5th week	Project topic finalization
August	1st week	Abstract submission
	2nd week	Discussion of synopsis content with project guide
	3rd and 4th week	Synopsis submission
September	1st week	Feasibility assessment using mathematical modeling
	3rd week	Discussion of UML diagram
	4th week	Project presentation
October	1st week	Submission of project report
	2nd week	Documentation of project paper
	3rd week	Coding various modules
November	1st week	Integration of various modules
December	1st week	Testing of modules
	2nd week	Fixing errors and bugs
January	1st week	Coding various modules
	3rd week	Integration of various modules
	4th week	Testing modules
February	1st week	Fixing errors and bugs
	1st week	System testing
	1st week	Trial of product
	2nd week	Delivery of product

CHAPTER 2

TECHNICAL KEYWORDS

2.1 AREAS OF PROJECT

Machine Learning

Computer Vision

2.2 TECHNICAL KEYWORDS

1. C. Computing methodologies
    (a) C.3 ARTIFICIAL INTELLIGENCE
        i. C.3.4 Vision and Scene Understanding
            A. Image Processing and Computer Vision
            B. C.3.4 Scene Analysis
    (b) C.4 Machine Learning
        i. C.4.1 Supervised Learning
            A. Feature evaluation and selection
            B. Vehicle Classification
            C. Optical Character Recognition

CHAPTER 3

INTRODUCTION

3.1 PROJECT IDEA

- The idea is to develop an entirely human free Helmet detection system. Since the number of two wheeler drivers on the road is large, it is difficult to identify every rider driving without helmet, this problem is solved by implementing an automated helmet detecting system where every detected bike rider is assessed and a database of offenders is generated

3.2 MOTIVATION OF THE PROJECT

- The motivation for doing this project was primarily an interest in undertaking a challenging project in an interesting area of research. In today's world the need for introducing technology for accelerating the day to day jobs is vital. Especially in the area of enforcement of law on the streets where the number of vehicles is increasing everyday. In this case safety is a major concern. Hence the opportunity to do something in this area by spreading awareness of wearing helmet was motivating. Moreover, the idea of developing something that would help the traffic police and hence the general public is appealing.

3.3 LITERATURE SURVEY

- Review of the papers, Description.
- **The safety helmet detection technology and its application to the surveillance system :**
  The Automatic Teller Machine (ATM) plays an important role in the modern economy. But it provides a convenient way for criminals to get illegal money or use stolen ATM cards to extract money from their victims accounts.For safety reasons, each ATM has a surveillance system to record customers face information. However, when criminals use an ATM to withdraw money illegally, they usually hide their faces with something to avoid the surveillance system recording their face information, which decreases the efficiency of the surveillance system. In this paper, a circle/circular arc detection method was

proposed based upon the modified Hough transform, and it was applied to the detection of safety helmets for the surveillance system of ATMs. Since the safety helmet location is within the set of the obtainable circles/circular arcs(if any exist), geometric features was used to verify if any safety helmet exists in the set. The proposed method helped the surveillance systems to record a customers face information more precisely. If customers wear safety helmets to block their faces, the system sends a message to remind them to take off their helmets. [11]Besides this, the method can be applied to the surveillance systems of banks by providing an early warning safeguard when any customer or intruder uses a safety helmet to avoid his/her face information from being recorded by the surveillance system. Real images were used to analyze the performance of the proposed method. [11]

- **Extraction and Segmentation of Helmets in Motor Cycles :**
  The motive of this paper is to detect whether the motorcycle riders have worn helmets. Even though motorcycles are convenient means of transportation, it is not so safer. Here, a traffic video was given as input. To this input,[3] background extraction algorithm is applied so as to extract the foreground objects in the video which is then extracted as frames. In the next stage, the SIFT (Scale Invariant Feature Transform) algorithm is used to detect a motion object motorcycle. Using the Region of Interest (ROI), [3] it chooses the location where the helmet can be found. This area is extracted and the helmet is detected.[3]

- **Motorcyclists Helmet Wearing Detection Using Image Processing:**
  This approach applies the circular Hough transform and the Histogram of Oriented Gradients descriptor to extract the image attributes. [10] Then, the Multilevel Perception classifier were used and the obtained results were compared with others algorithms. Traffic images were captured by cameras from public roads and constitute a database of 255 images.[10] The algorithm step regarding the helmet detection accomplished an accuracy rate of 91.37 %

- **A Fast and Robust 3D Feature Extraction Algorithm for Structured Environment Reconstruction:**

  This paper describes an algorithm for generating compact feature-based 3D models of indoor environments with a mobile robot. The emphasis lies on the high performance of the algorithm, [12] its possible incremental use, as well as its wide applicability to a variety of sensors as it does not assume any structure in the raw data at all. It recovers planar surfaces of physical environments based on a set of unorganized points and generates a compact, real-time render able 3D model.[12]

- **Moving object segmentation by background subtraction and temporal analysis :**

  This system propose a reliable foreground segmentation algorithm that combines temporal image analysis with a reference background image. Special care is taken of the core problem arising in the analysis of outdoor daylight scenes: continuous variations of lighting conditions that cause unexpected changes in in densities on the background reference image.[13] In this paper, a new approach for background adaptation to changes in illumination is presented. All the pixels in the image, even those covered by foreground objects, are continuously updated in the background model. The experimental results demonstrate the effectiveness of the proposed algorithm when applied in different outdoor and indoor environments. [13]

- **Segmenting foreground objects from a dynamic textured background via a robust Kalman filter :**

  The algorithm presented aims to segment the foreground objects in video (e.g., people) given time-varying, textured backgrounds. Examples of time-varying backgrounds include waves on water, clouds moving, trees waving in the wind, automobile traffic, moving crowds, escalators, etc.[14] We have developed a novel foreground-background segmentation algorithm that explicitly accounts for the non stationary nature and clutter-like appearance of many dynamic textures. The dynamic texture is modeled by an auto regressive moving average model (ARMA). A robust Kalman filter algorithm iterative estimates the intrinsic appearance of the dynamic texture, as well as the regions of the foreground objects. Preliminary experiments with this method have demonstrated promising results. [14]

- **Automatic Detection of Bike-riders without Helmet using Surveillance Videos in Real-time:**
  This paper [4] revolves around automatic detection of bike-riders without helmet using surveillance videos in real time. The proposed approach first detects bike riders from surveillance video using background subtraction and object segmentation. Then it determines whether bike-rider is using a helmet or not using visual features and binary classifier. Also, it presents a consolidation approach for violation reporting which helps in improving reliability of the proposed approach. In order to evaluate this approach, [4] a performance comparison of three widely used feature representations namely histogram of oriented gradients (HOG), scale-invariant feature transform (SIFT), and local binary patterns (LBP) for classification was provided. [4]The experimental results show detection accuracy of 93.80% on the real world surveillance data. It has also been shown that proposed approach is computationally less expensive and performs in real-time with a processing time of 11.58 ms per frame.

  - **Description:** Variable number of Gaussian components enables the background model to easily adjust its parameters according to situation. However, some errors may still occur due to presence of highly occluded objects and merged shadows. Let us consider $I^1, I^2, ...I^t$ be the intensity of a pixel for past t, consecutive frames. Then at time t probability of observing intensity value for a pixel is given by:

    $$P(I^t) = \sum_{j=1}^{K} w_j^t \times \eta(I^t, \mu m_j^t, \sigma_j^t) \tag{3.1}$$

    where, w_j^t is weight and $\eta(,,)$ is j^{th} Gaussian probability density function with mean μm_j^t and σ_j^t as variance at time t. For each pixel, the Gaussian components with low variance and high weight correspond to background class and others with high variance correspond to foreground class.

Background subtraction method retrieves only moving objects and ignore non-useful details such as static objects. The moving objects which are not of interest are filtered based on their area.Let B_j be the j^{th} object with area a_j then B_j will be selected if $T_l < a_j < T_h$. Here T_l and T_h are threshold for minimum and maximum area, respectively. The objective behind this is to only consider objects which are more likely to fall in bike-riders category. It helps in reducing the complexity of further steps.

CHAPTER 4

PROBLEM DEFINITION AND SCOPE

4.1 PROBLEM STATEMENT

To implement a system which performs real time helmet detection of bike riders using video surveillance of the street and hence generates a database of the license plates where the a driver without helmet is found.

4.1.1 Goals and objectives

Goal and Objectives:

- The main objective is to ensure that an awareness is spread in the public about the importance of safety among bike riders by active reporting of people not abiding by this rule.
- The goal of this system is to provide with a fast and accurate real time helmet detection system.
- Provide a human free automatic traffic monitoring system.
- To generate a database of license plates corresponding to the bikes where helmet is not detected.

4.1.2 Statement of scope

- This system will identify bike riders driving without helmet at real time. This system will take live video feed of the traffic as input from a video camera. The inputs will strictly be monitored for moving bikes and everything else will be subtracted from the frames. Using a feature extraction algorithm, It will be detected if rider is wearing a helmet or not. The time, date and location at the moment of detection is also noted. The output from the system will be an entry in the database which will include the license plate of the bike where driver is not wearing a helmet, the time, date and location when it is detected and a screen shot of the frame as a proof of offence

4.2 MAJOR CONSTRAINTS

- Darkness is one of the major constraint of system, Lighting condition where video feed is shot must be decent.
- The clarity of the video frame can be a major concern for the system for feature extraction.
- Multiprocessing ability of the device where the system is implemented has to be high.
- The data set by which the system has been trained must be updated with the new designs of helmets as and when found.

4.3 METHODOLOGIES OF PROBLEM SOLVING AND EFFICIENCY ISSUES

- Background subtraction is the first step after which only motorcycle will be selected for feature extraction. It will the be used for detection of bike rider without helmet and further for license plate recognition.
- The lighting condition affects the video clarity hence affects the efficiency of the system. So an filtering approach is also used to improve efficiency in case of low lighting.
- Since the number of vehicles and objects on the road is huge, the processing of per frame requires system to have good processing speed to avoid delay.

4.4 OUTCOME

- Database of licence number of the bike rider without helmet along with the detailed information of time, location and a snapshot is stored. This information is accessible to the traffic authorities for taking actions against the offenders. Also, this data can be mined for generation of impact reports of different areas.

4.4.1 Accuracy

Accuracy of the proposed system is up to 90% depending upon the availability of number of images in the data set

4.5 APPLICATIONS

- Traffic Surveillance System on the road

4.6 HARDWARE RESOURCES REQUIRED

Sr. No.	Parameter	Minimum Requirement
1	CPU Speed	2 GHz
2	RAM	4 GB
3	Processor	Intel Core i3 (5th Gen) and Above
4	Storage Space	1GB for 1000 Images
5	IP Camera	24FPS, 2 Megapixels or above

Table 4.1: Hardware Requirements

4.7 SOFTWARE RESOURCES REQUIRED

Platform :

1. Operating System: Windows, Linux, MacOS
2. IDE: PyCharm
3. Programming Language: Python

CHAPTER 5

PROJECT PLAN

5.1 PROJECT ESTIMATES

5.1.1 Reconciled Estimates

5.1.1.1 Cost and Time Estimate

Cost = Rs.300/KLOC

The basic COCOMO equations take the form

Effort Applied (E) = ab (KLOC)bb [person-months]

Development Time (D) = cb (Effort Applied)db [months]

People required (P) = Effort Applied / Development Time [count]

For this project, ab = 3:0bb = 1:12cb = 2:5db = 0:35 and people=4

LOC = 4KLOC (approx)

Thus Development Time=6.32 months

5.1.2 Project Resources

- People: 5 Students, 1 Internal Guide
- Hardware: Intel i3 or above, 4 GB memory (min.), 10 GB Hard Drive Space, 24 FPS, 2 MP IP Camera
- Software: Python IDE with installed open CV

5.2 RISK MANAGEMENT

This section discusses Project risks and the approach to managing them.

5.2.1 Risk Identification

For risks identification, review of scope document, requirements specifications and schedule is done. Answers to questionnaire revealed some risks. Each risk is categorized as per the categories mentioned in [15]. Please refer table 5.1 for all the risks. Risk identification questionnaire can be referred following.

1. Are end-users enthusiastically committed to the project and the system/product to be built?

   A: Yes, the end-users are the traffic police. They will enthusiastically accept the product as it will improve the efficiency of the traffic system.

2. Are requirements fully understood by the software engineering team and its customers?

   A: Yes, most of the requirements are understood by the development team

3. Have customers been involved fully in the definition of requirements?

   A: Customers have been involved in definition requirement.

4. Do end-users have realistic expectations?

   A: All the conditions cannot be satisfied completely.

5. Are project requirements stable?

   A: Projects requirements may change depending upon how the implementation actually goes.

6. Is the number of people on the project team adequate to do the job?

   A: 5 people on a project may prove to be inadequate under certain scenarios.

7. Do all customer/user constituencies agree on the importance of the project and on the requirements for the system/product to be built?

   A: Yes, all user/customer agree that this new system is important/necessary.

5.2.2 Risk Analysis

The risks for the Project can be analyzed within the constraints of time and quality

ID	Risk Description	Probability	Impact		
			Schedule	Quality	Overall
1	Damage to Video Camera	Low	Low	Low	Low
2	Defunct Power Source	Low	Medium	Low	Medium
3	Unrealistic Expectation	Low	Medium	Medium	Medium
4	New Helmet Type	Medium	High	Medium	High
5	Man Power	Low	Medium	Low	Medium

Table 5.1: Risk Table

Probability	Value	Description
High	Probability of occurrence is	$> 75\%$
Medium	Probability of occurrence is	$26 - 75\%$
Low	Probability of occurrence is	$< 25\%$

Table 5.2: Risk Probability definitions

Impact	Value	Description
Very high	$> 10\%$	Schedule impact or Unacceptable quality
High	$5 - 10\%$	Schedule impact or Some parts of the project have low quality
Medium	$< 5\%$	Schedule impact or Barely noticeable degradation in quality Low Impact on schedule or Quality can be incorporated

Table 5.3: Risk Impact definitions

5.2.3 Overview of Risk Mitigation, Monitoring, Management

Following are the details for each risk.

Risk ID	1
Risk Description	Damage to Video Camera
Category	Quality Control.
Source	Software requirement Specification document.
Probability	Low
Impact	Low
Response	Mitigate
Strategy	Regular Quality checks
Risk Status	Identified

Risk ID	2
Risk Description	Defunct Power Source
Category	Requirements
Source	System Deployment.
Probability	Low
Impact	Medium
Response	Mitigate
Strategy	Better planning will resolve this issue.
Risk Status	Identified

Risk ID	3
Risk Description	Unrealistic Expectation
Category	Requirement
Source	This was identified during early development.
Probability	Low
Impact	Medium
Response	Accept
Strategy	Users need to consider the impact of external factors.
Risk Status	Identified

Risk ID	4
Risk Description	New Helmet Type
Category	Requirement
Source	This was identified during early development.
Probability	Medium
Impact	High
Response	Mitigate
Strategy	Regular dataset update will solve this issue
Risk Status	Identified

Risk ID	5
Risk Description	Man Power
Category	Development Environment
Source	This was identified during early development.
Probability	Low
Impact	Medium
Response	Mitigate
Strategy	Better Planning can solve the problem
Risk Status	Occurred

5.3 PROJECT SCHEDULE

5.3.1 Project task set

Major Tasks in the Project stages are:

- Task 1: Data set Collection and Generation
- Task 2: Data set Interpretation
- Task 3: Feature Extraction
- Task 4: Feature Selection
- Task 5: Classification Score Generation, Analysis and Results

5.3.2 Time-line Chart

Please refer Annexure C for the planner

5.4 TEAM ORGANIZATION

There is a team of 5 students, and an internal guide

5.4.1 Team structure

The team structure (students) for the project is as follows :

- Shubhankar Deshpande
- Kavyashree Devadiga
- Yash Gujarathi
- Shreya Joshi
- Pratik Khanapurkar

Various Tasks are divided as follows:

- Designing and coding of Front end GUI:
  Shreya Joshi, Shubhankar Deshpande
- Data-set Generation and Collection:
  Shreya Joshi, Shubhankar Deshpande
- Data set Interpretation:
  Kavyashree Devadiga, Yash Gujarathi
- Feature Extraction Module:
  Prtik Khanapurkar, Yash Gujarathi
- Feature Selection Module:
  Kavyashree Devadiga, Pratik Khanapurkar,Shreya Joshi

- Classification Module:

  Pratik Khanapurkar,Yash Gujarathi

- Testing of Modules:

  Shubhankar Deshpande, Kavyashree Devadiga

- Documentation:

  Divided equally between the team members

- Communication:

  Yash Gujarathi,Kavyashree Devadiga

5.4.2 Management reporting and communication

Mechanisms for progress reporting and inter module team communication are identified as per assessment sheet and lab time table.

CHAPTER 6

SOFTWARE REQUIREMENT SPECIFICATION

6.1 INTRODUCTION

6.1.1 Purpose and Scope of Document

The purpose of this document is to outline the requirements which the Real time Automatic Helmet detector must meet.

6.1.2 Overview of responsibilities of Developer

Responsibilities of Developers include:

1. Monitoring the functioning of the algorithms applied and the data set formed so as to generate a precise classification score output
2. Modules are executed in real time so the data must stay relevant and must not get out of date

6.2 USAGE SCENARIO

This section provides various usage scenarios for the system to be developed.

6.2.1 User profiles

The categories of objects detected are described here.

Class Name	Frequency of Use	Characteristics
Unwanted region	Low	Bike riders wearing Helmet
Region of interest	High	Bike riders not wearing a Helmet

Table 6.1: User Profiles

6.2.2 Use-cases

All use-cases for the software are presented. Description of all main Use cases using use case template is provided.

Sr No.	Use Case	Description	Actors	Assumptions
1	Record Video	Using Video Camera, the video of bike riders is recorded	User	Quality of recording is fair with good lighting condition
2	Background Subtraction	The inanimate objects are removed	None	All the subjects of interest are moving objects
3	Feature Extraction	The features that identify an object are extracted	Classification Algorithm, Trained Model	Frames are processed so as to detect edges and other features incorrectly
4	Result Collection	The extracted license plate is stored in database	Database, Algorithm	Connectivity to database is intact

Table 6.2: Use Cases

6.2.3 Use Case View

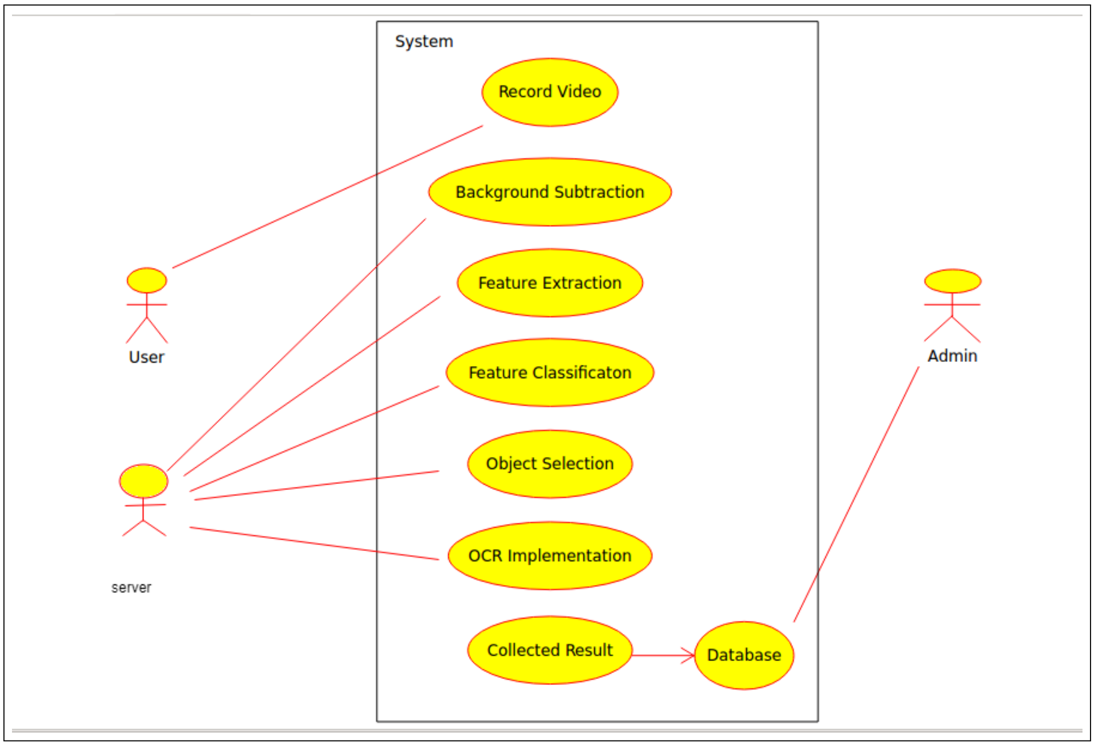

Figure 6.1: Use case diagram

6.3 DATA MODEL AND DESCRIPTION

6.3.1 Data Description

- Input is in the form of Video feed.
- Data set is structured as a data set.
- Multiple data sets of images of objects to be identified are maintained in the training model.

6.4 FUNCTIONAL MODEL AND DESCRIPTION

6.4.1 Description of functions

A description of each software function and a processing narrative for the functions is presented in the activity diagram (Refer fig. 6.2)

6.4.2 Activity Diagram:

The given Activity diagram shows the dynamic aspects as well as control flow of the system. It describes the various activity flow and sequence flow of the system. In this proposed system, the activity starts from taking input from the video feed followed by the necessary feature extraction and feature selection of bike is done. If detected, feature extraction and feature selection of helmet is done. If a bike rider without helmet is found, OCR is implemented and the license plate is extracted. In other cases, the system reaches the end state.

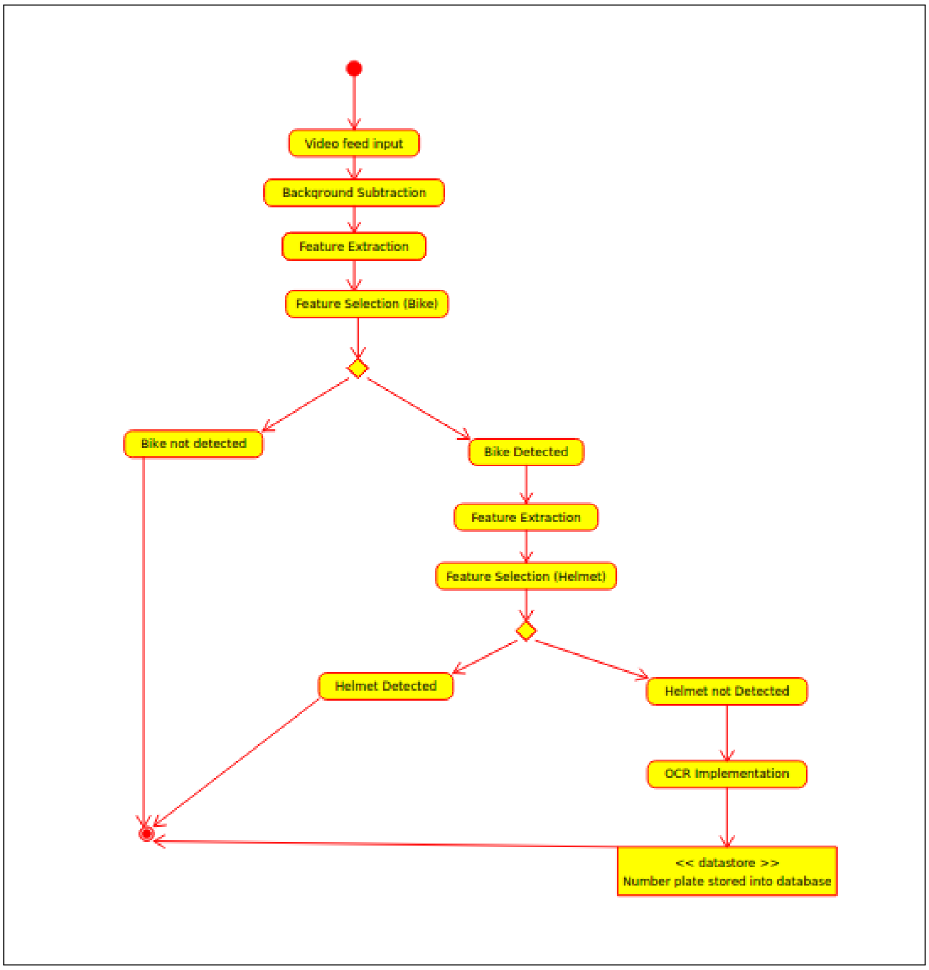

Figure 6.2: Activity diagram

6.4.3 Non Functional Requirements:

- Reliability
- Performance Requirements - System must process video without any time delay.
- Scalablity - to hold the large amount of data that will be generated where the system is deployed and provide resources and also security of the data.
- Privacy - the data should be accessed only by the concerned authorities.
- The geographical location of server should not affect the availability of the system.

6.4.4 State Diagram:

The following diagram shows the state transition diagram of the system. The states are represented in ovals and state of system gets changed when certain events occur. The transitions from one state to the other are represented by arrows.

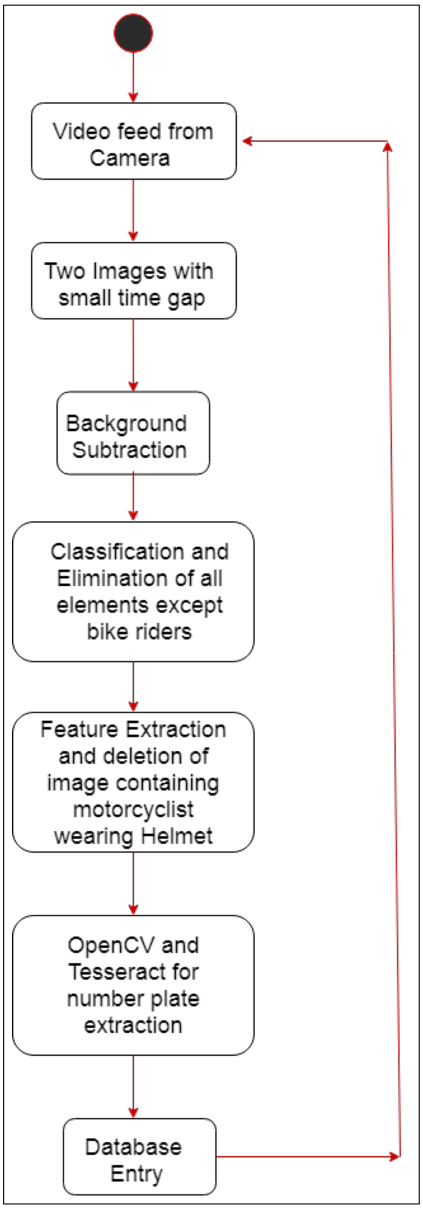

Figure 6.3: State transition diagram

CHAPTER 7

DETAILED DESIGN DOCUMENT USING APPENDIX A AND B

7.1 ARCHITECTURAL DESIGN

A description of the system architecture is present in below fig.7.1

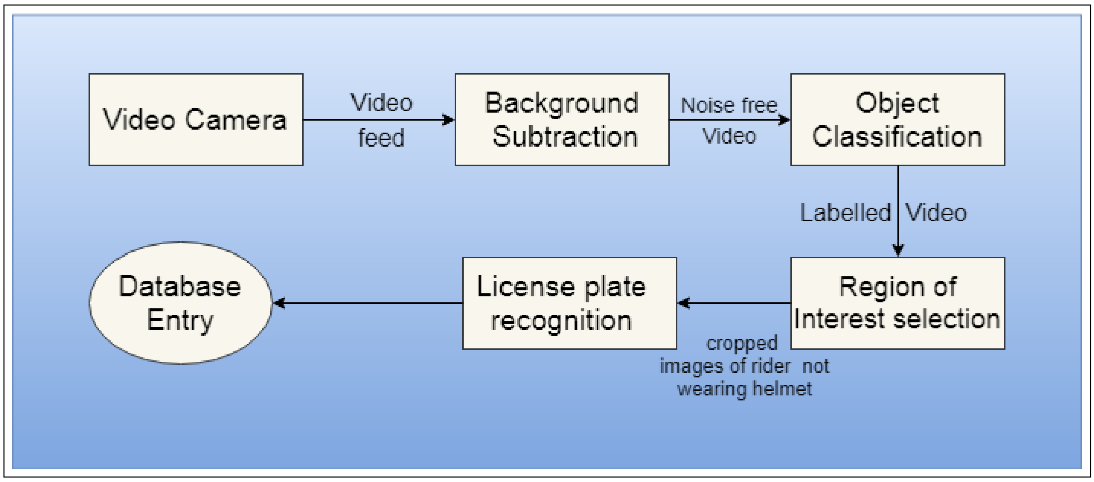

Figure 7.1: Architecture diagram

The Video Camera records traffic road and provides input to the system. This video feed undergoes number of processes. All the inanimate objects are firstly eliminated so as to obtain a video with moving objects. Using the classification models, the objects are then labelled. The regions of interest that is the part containing a bike rider without helmet are extracted. The next module runs Optical character recognition on the region of interest. The last module is the database where the output data is deployed.

7.2 PHASES OF SYSTEM

7.2.1 Training Phase

Training phase mainly involves of seven steps:

- Gathering data: Quantity and Quality of data will determine the predictability of the model. In this project, using web scraping and manually clicking pictures in different scenarios, 500 images related to helmet and bike riders were collected

  - Preparing that data: Loading of data at suitable place for its use in machine learning process. The Images are labelled and stored in an XML file.
  - Choosing a model: There are many models developed for various data sets, hence a suitable model according to our data set is chosen.
  - Training: Data is incrementally improved for the improvement of the model.
  - Evaluation: This phase help us to test the model against untrained data set.
  - Tuning: To make changes or improvement in our model tuning is done.
  - Prediction: where we get the answer of our questions using trained data .
- The graphs generated during the training phases are shown in figures 10.1. They indicate the total loss incurred in the training process.

7.2.2 Testing Phase

In this phase the generated model is tested. Various video frames are given as input and the objects classified by the model are checked for correctness.

7.3 DATA DESIGN (USING APPENDICES A AND B)

7.3.1 Internal software data structure

- File
- vector
- Set

7.3.2 Global data structure

Object array is the data structure used throughout the process over every module. It is used to store various parameters which pertain different characteristics of the image in the data set.

7.3.3 Temporary data structure

Data Structures like Vector, Hash Maps, ArrayList, etc. are used for storing the data in intermediate form as it passes through different modules in the process of the object classification and identification to check whether helmet is present or not.

7.3.4 Database description

MySQL Community server 8.0.11 The fields included in the database are: License Plate, Location, Time and Date of offence and a Frame/Screen shot of bike rider for proof

7.4 COMPONENT DESIGN

7.4.1 Class Diagram

The given static structure diagram describes us the structure of system by showing systems classes and there attributes, functions and functional dependency between the modules.Proposed system revolves around seven classes and various functions included in the instance of class. These classes describes the modules included in the system like feature identification, background reduction ,bike identification with there attributes and functions used by those modules.

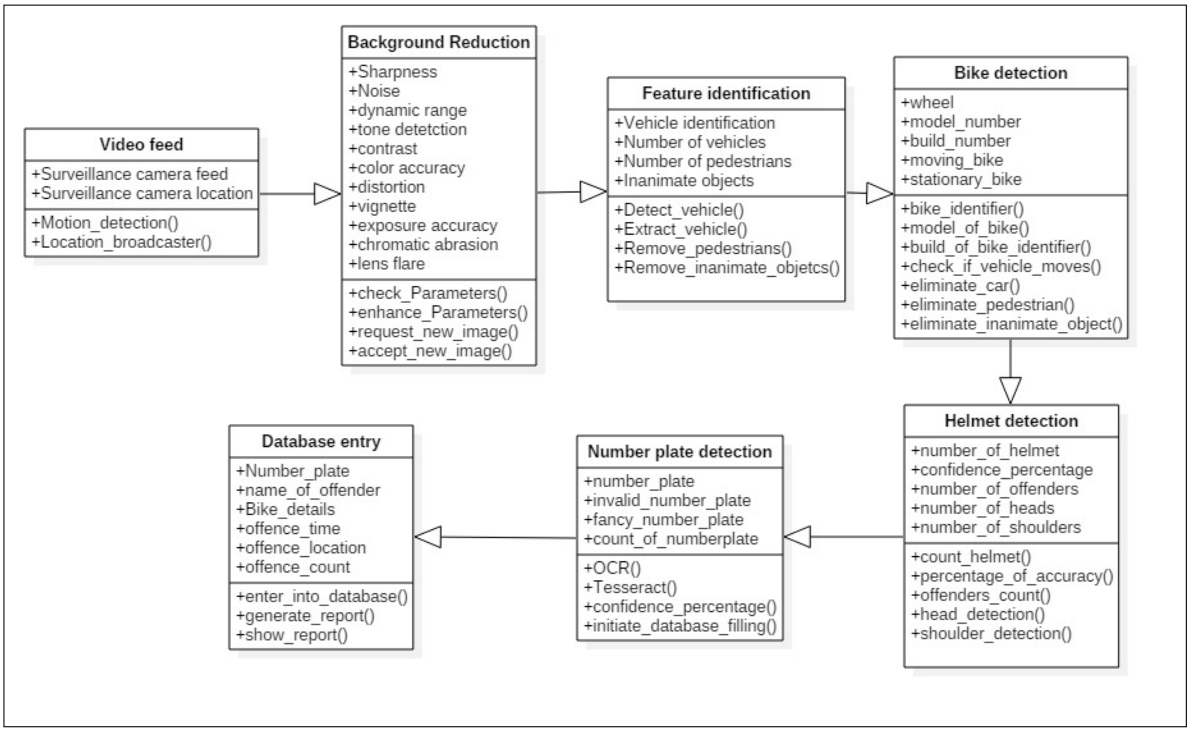

Figure 7.2: Class Diagram

CHAPTER 8

PROJECT IMPLEMENTATION

8.1 INTRODUCTION

According to the statistics given by transport ministry about 28 two-wheeler riders die daily on Indian roads in 2016 because of not wearing helmets. In the year 2017, 31 out of 100 people died in road accidents which shows increased rate from 21.6 deaths per 100 accidents in 2005. Also, it is proved that one of every five bike riders who died on roads were not wearing helmet. A study has estimated that not wearing helmet improves chances of deaths in accidents by 42%. The number of deaths might be even more than the data which could not be collected. The deadliest fact is that out of the total deaths the average age was between 18 to 45 years which is a very productive age group. There are existing methods which uses specialized sensors in the ergonomics of the motorbike to check the presence of helmet. But it is impossible to convince every user for installation of sensors on the already existing bikes. Also, the accuracy and integrity of these sensors is questionable. Apart from this, systems that use video processing have very high computational costs. The technologies that were used to build the system very expensive hence making it an economically non viable choice. The proposed system tries to mitigate the aforementioned problems by proposing a potential solution using continuous real time video processing of the traffic video feed. The proposed solution will provide a completely free of cost system once installed. Also, the software was build using free and open source technologies hence it has an overall software cost equal to zero. Every vehicle on the street will be evaluated and a database of the offenders will be generated real time. Hence given that every rider not wearing helmet is prosecuted, there will be an increased awareness in the public.

The tasks that are currently being performed by Digital Image processing are classification feature extraction Multi-scale signal analysis Pattern recognition and projection. In this project we use feature extraction and classification of digital images to achieve our goal. Also machine learning has been used extensively in this project. Machine learning is the ability that a computer acquires to learn via gathering statistical data processing it and drawing conclusion from it. In this project we have used supervised machine learning to train our model to identify the elements on the street classify them and then perform feature extraction over them to catch the riders of motorcycles not wearing helmet.

8.2 TOOLS AND TECHNOLOGIES USED

1. Platform : Linux & Mac
2. Operating System : Mac High Sierra
3. IDE : Pycharm
4. Technologies : Tensorflow, OpenCV, Tesseract.

8.3 METHODOLOGIES/ALGORITHM DETAILS

The flow of solution in algorithmic format can be given as,

1. Capture Video and feed it to the system.
2. Background Subtraction of video frames
3. Creation of bounding boxes and the search area reduction.
4. Classification and determination of region of interest
5. Detection of helmet in region of interest.
6. If helmet is not present goto step 7 else goto step 1.
7. license plate extraction from video frame and database entry.
8. Goto step 1.

The detailed flow of the solution is as follows.

8.3.1 Background subtraction

All the moving objects must be detected first. These objects include pedestrians(p), cars (c), buses(b), trucks(t), and motorcycles(m). This can be done by capturing two frames within a very short time gap. Then the two images are simply converted to grey scale and subtracted. All the points with nonzero values are coloured as white and the rest are coloured as black. A box is drawn on the extreme four corners encompassing the white regions. These 4 co-ordinates are then stored. This forms the bounding box of the Images in concern. We are interested in motorcycles only.

8.3.2 Classification of bounding box images

The co-ordinates of moving objects are stored, and can be retrieved. Then the images are cropped according to the bounding box. Threads are created, one for each bounding box. Here the classification of images takes place. Buses Cars Trucks pedestrians are all eliminated. Only motorcycle are considered. The co-ordinates of all the boxes not containing the motorcycles are erased. Now system only contains images with motorcyclist present. This extraction or segregation is done using the pre-trained model of Googles tensor flow machine learning library.

8.3.3 Feature extraction

The next task in our program is detection of helmet. Once the images with motorcyclist are cropped and present in the system, these images are stored in our local data set. The images in which the motorcyclist is driving the motorcycle with a helmet on is deleted from the database. If not these images are kept as it is. The feature extraction is done via a trained neural network of images of helmet which were acquired by web scrapping. The images were individually labelled using the labelling tool LabelImg. The model was trained for individual features of helmet and a new trained neural network was created. This was feed as a model and image classification was done again. The images where helmet is detected by the bike rider are deleted from the database.

8.3.4 License plate detection

Of the images that are left in the database, these are the images of bike riders without their helmet on. The license plate has been extracted using OpenCV, Tesseract and python. The number- plates are boxed and the number of the license plate has been stored in a database. The database also contains the location of the offence the time the date and flags the rider.

8.4 VERIFICATION AND VALIDATION FOR ACCEPTANCE

Verification is done to evaluate the mediator products of software to check whether the products satisfy the conditions imposed during the beginning of the phase.These include the documents which are produced during the development phases like, requirements specification, design documents, data base table design, ER diagrams, test cases, trace-ability matrix etc. We sometimes tend to neglect the importance of reviewing these documents but we should understand that reviewing itself can find out many hidden anomalies when if found or fixed in the later phase of development cycle, can be very costly. Validation is the process of evaluating the final product to check whether the software meets the business needs. In simple words the test execution which we do in our day to day life are actually the validation activity which includes smoke testing, functional testing, regression testing, systems testing etc.

CHAPTER 9

SOFTWARE TESTING

9.1 TYPE OF TESTING USED

9.1.1 Unit Testing

In this, each module is tested individually. Criteria selected for identifying unit test module is that identity modules that has core functionality implementation. Module could be an individual function or procedure. Each function is tested separately. Components for unit testing are solving the task, detecting failure, assigning task to a node in case another is failed, combining result at the master. The criteria selected for unit test module is identity functions that have core functionality implemented and its execution is independent of other modules.

9.1.2 Integrated Testing

Integration testing integrates individual modules and tests them as a group. Integration testing takes as its input modules that have been unit tested, groups them in larger aggregates, applies tests defined in an integration test plan to those aggregates, and delivers as its output the integrated system ready for testing. The purpose for integration testing is to verify functional, performance and reliability requirements. In integration testing, the modules which are unit tested are combined and testing is performed to see if the correct information is passed between the modules as per the algorithms.

9.1.3 Validation Testing

This is the process of evaluating software during or at the end of the development process to determine whether it achieves the required goals ie. all the entries in the database are of the bike riders without helmet.

9.1.4 GUI Testing

The Database GUI showing output of the system was tested to determine usability and accuracy of the system

9.2 TEST SCHEDULE

March	1^{st} Week	Unit Testing
	2^{nd} Week	Integration Testing
	3^{rd} Week	Validation Testing
	4^{th} Week	GUI Testing

Table 9.1: Use Cases

9.3 TEST CASES AND TEST RESULTS

9.3.1 Testing Procedure

Test Case	Purpose of Test	Expected Result
Background elimination	To check if the module successfully removes all the unwanted inanimate objects from video	Video consisting only of moving objects generated
Object Classification	To check if all the objects are labelled accurately, special focus is on objects appearing similar to helmet (Scarves, other head gears etc)	A bounding box around the required objects with label showing their names will be seen
License Plate recognition	To check if most variety of license plates are identified	The text on every standard license plate is recognized by the system

Table 9.2: Unit Testing

Test Case	Purpose of Test	Expected Result
Integration of all modules	To check whether license plate of bike rider without helmet is detected or not.	Successfully detected license plate of bike rider without helmet.

Table 9.3: Integration Testing

Test Case	Purpose of Test	Expected Result
Correct Output Generation	To check whether correct output is generated or not	Correct output must be generated (All Bike riders without helmet identified and no helmet must go undetected)

Table 9.4: Validation Testing

CHAPTER 10

RESULTS

10.1 LOSS GRAPH

The following figures sre of the graphs that were generated while training the object detection module. It indicates the loss that occurred in the training process during different phases. Loss is penalty for wrong prediction during training. The goal of training a model is to find a set of weights and biases that have low loss. In our model we stopped training when loss was less than 1.

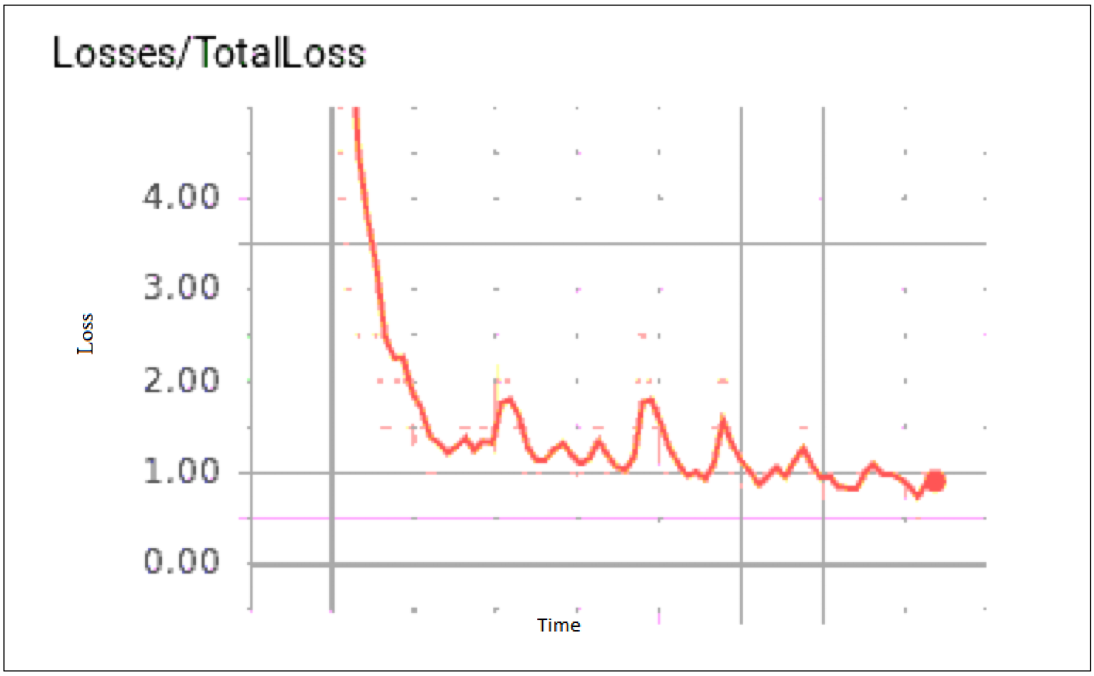

Figure 10.1: Training graph

10.2 SCREEN SHOTS & OUTPUT

Fig.10.2 shows the fame of the video where the bike rider not wearing helmet is identified and labelled. It can be seen that all other boxes are dropped

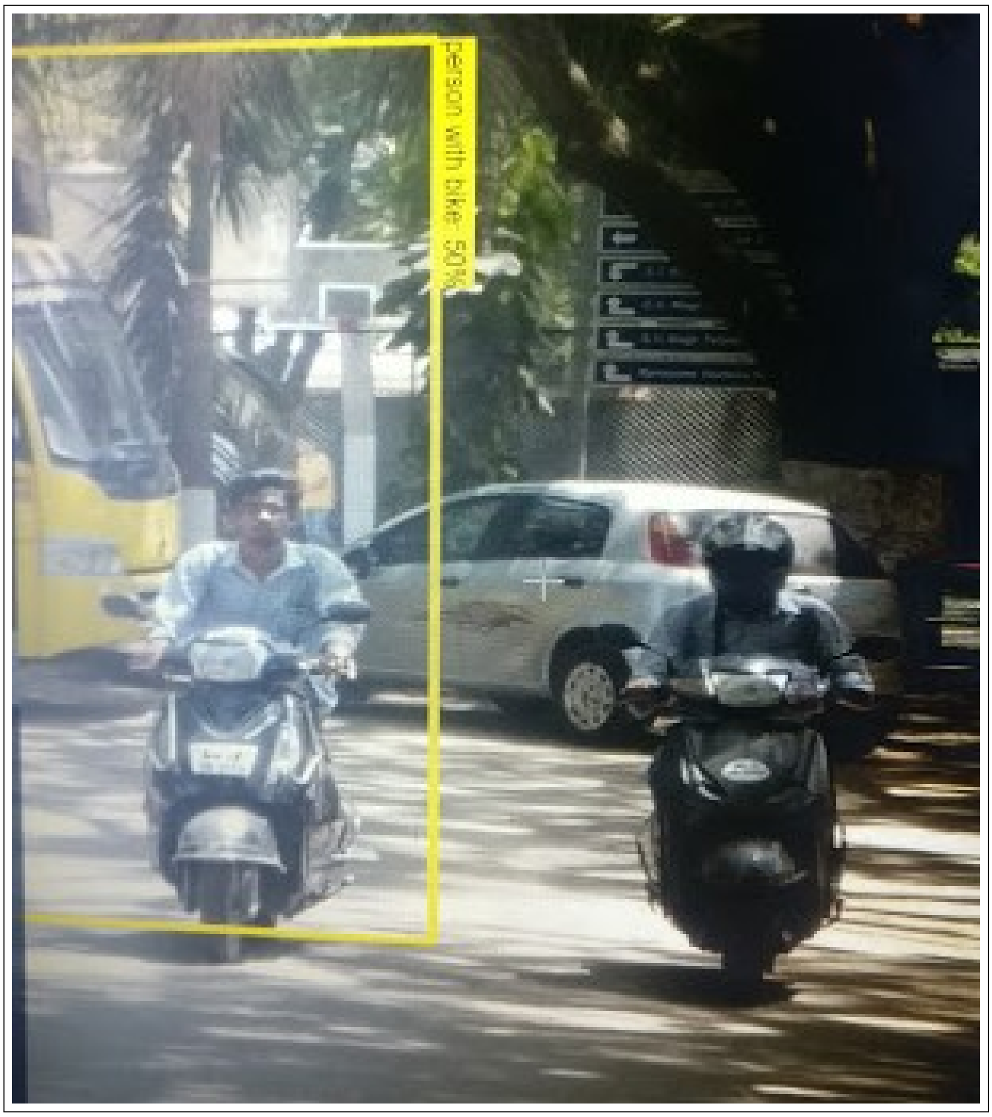

Figure 10.2: A bike rider without helmet identified

Fig.10.3 shows the identification of the license plate. The first and second row are recognized separately which can be combined and stored in the database

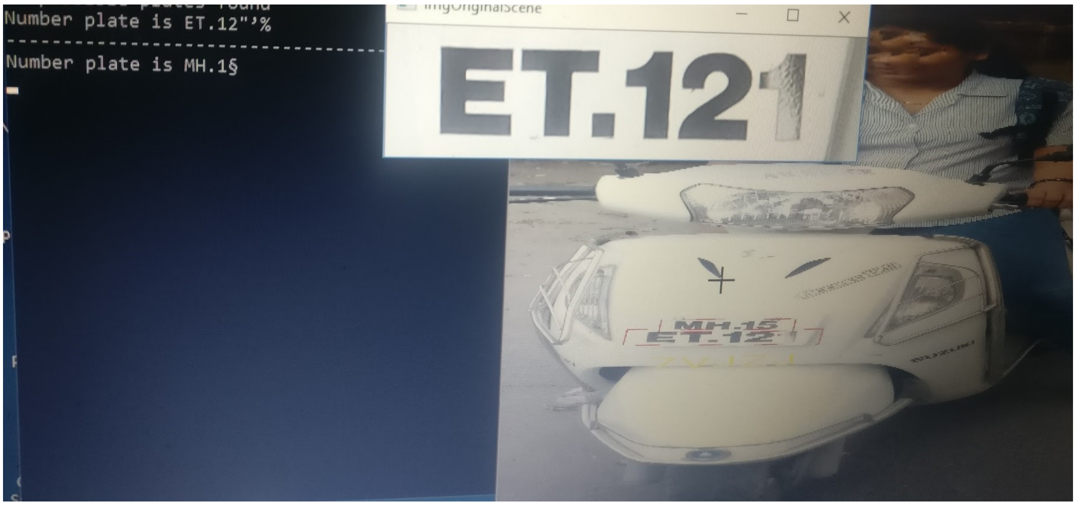

Figure 10.3: License plate recognition

10.2.1 Observation Table

There will be different scenarios where the system is implemented. Table 10.1 gives the success and failure conditions in each case.

Scenario	**Observation**
Rider with head gear/ scarves	Not Detected as helmet by the model
Fancy, non-standard License Plates	failure condition - cannot classify license number
Video feed in good lighting condition	Best case scenario - Maximum Accuracy
Video feed in dim/dark/bad lighting condition	Reduced Accuracy, many cases of undetected bike riders

Table 10.1: Observation table

CHAPTER 11

DEPLOYMENT AND MAINTENANCE

11.1 INSTALLATION AND UN-INSTALLATION

The most crucial part of implementation of the solution is video feed from surveillance camera. This will go into our system which should ideally be 64-bit but can work on selective 32-bit machines. The machine must have Tensorflow installed on them. Presence of GPU on the machine will accelerate the processing of the solution. Python 2.7.+ Is the minimum requirement of the system.

Cameras need to be installed on the streets, signals preferably at a height of 10 meters. The cameras must have ample lighting. The cameras must be digital. Analogue cameras will add unnecessary computations for conversion of Analogue to digital. Cameras with high resolution will be beneficial to the system for License plate recognition. They streets should be well lit and if not the camera must be able to capture the license plate at night.

IP Cameras must be used to broadcast the feed to the main head office. The system in head office must be of server grade to accommodate this high flow of incoming data. Parallel systems will be more efficient in this solution. Parallel systems with commodity hardware will speed up the execution.

Hardware requirement at head office systems will be 8GB DDR4 RAM machines with a good NVIDIA GPU. The database must be robust for capturing the images of offenders and store them till the fine for offence is collected. The preservation of these images as proof is must. Also the linkage of license plate to owner is a crucial linkage to this project.

11.2 MAINTENANCE

Regular checking of the security of the system installed on the streets must be done to ensure no tampering of the video feed. Also Cleanliness must be maintained to obtain clear smudge-free video feed. The database must be kept at secure servers so that no one can attack it and the integrity of the records is maintained

CHAPTER 12

CONCLUSION AND FUTURE SCOPE

12.1 CONCLUSION

The access of the database which is generated by the system is given to appropriate authorities will result in increasing awareness of wearing helmet and authorities may take required action. Implementation of the system could result into increase in bike rider wearing helmets. The traffic monitoring system of the street is improved. At the end reducing fatality in accidents. Data gathered while monitoring traffic can be used for further analysis.

12.2 FUTURE SCOPE

12.2.1 E-Wallet Linking

If the License number of the registered vehicle is linked to rider's bank account, auto deduction of the fine and SMS delivery system can be implemented. This will make the system completely automatic hence there will be no scope of corruption or unfair fine collection. But, for this to be implemented it is important that helmet and license number detection is 100% accurate

12.2.2 A complete traffic check system

This helmet check system can be expanded to check if other rules are followed. Modules can be designed for speed tracking, zebra crossing, traffic signal check etc. Also, using video surveillance it can be checked if vehicle drivers are using cellphones while driving.

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ANNEXURE A

LABORATORY ASSIGNMENTS ON PROJECT ANALYSIS OF ALGORITHMIC DESIGN

A.1 TO DEVELOP THE PROBLEM UNDER CONSIDERATION AND JUSTIFY FEASIBILITY USING CONCEPTS OF KNOWLEDGE CANVAS AND IDEA MATRIX.

I	D	E	A
Increase Safety on public roads	**Drive** Motorists to use helmet	**Educate** People to take precautions	**Accelerate** Awareness of preventive measures for road safety
Improve Traffic monitoring system	**Deliver** license plate of vehicles without helmet	**Evaluate** Street traffic using video feed of the street	**Associate** Technology with Police (traffic)
Ignore Pedestrians and cars/ Non bike vehicles	**Decrease** Fatality of accidents	**Eliminate** Motorists wearing helmet	**Avoid** Undetected rule violators

Table A.1: IDEA MATRIX

The project **increases** the safety by making it compulsory for the bike riders to wear helmet. It also **improves** the traffic monitoring system by reducing human errors **ignoring** the pedestrians, cars or non-bike vehicles on a busy street.
Helmet detection system also **drives** motorists to use helmet while driving on the street. The system **delivers** license plate of vehicles whose driver is without helmet. Finally **decreasing** the fatality of accidents.
It also **educates** public to take safety precautions while driving. The system **evaluates** street traffic using the snapshots of the street and **eliminates** motorists already wearing helmet.
It **accelerates** awareness of preventive measures for road safety. It **associates** technology with the traffic police and **avoids** undetected rule violators.

A.2 PROJECT PROBLEM STATEMENT FEASIBILITY ASSESSMENT USING NP-HARD, NP-COMPLETE OR SATISFIABILITY ISSUES USING MODERN ALGEBRA AND/OR RELEVANT MATHEMATICAL MODELS.

Explanation: For project we have different modules such as Background subtraction, Object detection, License plate recognition.
First step of system is to background subtraction. Next step is object detection. Multiple objects are identified in this step. From that we reduce search space to restricted area and that's where we apply OCR. There must always be same output for same input for given problem statement. That will decide accuracy of given solution. For any given input system will always give same output every time it is executed. Example: on given input I there will be same output O every time.That's why problem statement is deterministic.So we conclude that our problem statement is P.

ANNEXURE B

LABORATORY ASSIGNMENTS ON PROJECT QUALITY AND RELIABILITY TESTING OF PROJECT DESIGN

B.1 USE OF DIVIDE AND CONQUER STRATEGIES TO EXPLOIT DISTRIBUTED/PARALLEL/CONCURRENT PROCESSING OF THE ABOVE TO IDENTIFY OBJECT, MORPHISMS, OVERLOADING IN FUNCTIONS AND FUNCTIONAL RELATIONS AND ANY OTHER DEPENDENCIES

Divide and conquer strategy is used to split the given problem definition into multiple sub-module. Wherein each sub module is assigned a specific task to perform within the given time span. The tasks such as Background Subtraction, Feature classification, and object classification were designed in different modules. For License plate recognition, once the regions of interest are identified, each of them is assigned a separate thread. Hence, multi-threading concept is implemented. In multi-threading, the given process creates one or more threads to accomplish a task. Hence in a frame, the OCR module runs in parallel subsequently reducing the delay in processing. All the operations mentioned above which belong to a particular module will be in parallel, performed by the created threads, thus identifying every offender accurately.

B.2 USE OF ABOVE TO DRAW FUNCTIONAL DEPENDENCY GRAPHS AND RELEVANT SOFTWARE MODELING METHODS, TECHNIQUES INCLUDING UML DIAGRAMS OR OTHER NECESSITIES USING APPROPRIATE TOOLS.

Please refer 7.4(Figure 7.2) for Class Diagram, 6.2(Figure 6.1) for Use Case Diagram and 6.4(Figure 6.2) for Activity Diagram

B.3 TESTING OF PROJECT PROBLEM STATEMENT USING GENERATED TEST DATA (USING MATHEMATICAL MODELS, GUI, FUNCTION TESTING PRINCIPLES) SELECTION AND APPROPRIATE USE OF TESTING TOOLS, TESTING OF UML DIAGRAMS RELIABILITY.

We have assumed some test cases under certain conditions. If those cases satisfy the given constraints then result will get pass otherwise it will fail. These test cases are considered for the sake of actual results of the functions of an android application. The test cases are arranged from collecting the raw data based on user touch interactions till the final solutions of the project like deciding whether the user is a genuine user or an impostor. The table below contains all possible test cases for our system manually.

Sr No.	Description	Expected Result	Actual Result	Test Result
1.	Background elimination	Remove all the unwanted inanimate objects from video	Video consisting only of moving objects generated	Pass
2	Object Classification	Label all objects accurately	A bounding box around the required objects with label showing their names is seen	Pass
3	License Plate recognition	Every variety of license plates are identified	Text on all standard license plate is recognized by the system	Pass
4	Update Database	Make a new entry for every identified offender	Data base updated with all the required information	Pass

Table B.1: Unit Testing

ANNEXURE C

PROJECT PLANNER

Month	Schedule	Project Task
July	1st week	Idea about project topic
	3rd week	Project topic discussion
	5th week	Project topic finalization
August	1st week	Abstract submission
	2nd week	Discussion of synopsis content with project guide
	3rd and 4th week	Synopsis submission
September	1st week	Feasibility assessment using mathematical modeling
	3rd week	Discussion of UML diagram
	4th week	Project presentation
October	1st week	Submission of project report
	2nd week	Documentation of project paper
	3rd week	Coding various modules
November	1st week	Integration of various modules
December	1st week	Testing of modules
	2nd week	Fixing errors and bugs
January	1st week	Coding various modules
	3rd week	Integration of various modules
	4th week	Testing modules
February	1st week	Fixing errors and bugs
	1st week	System testing
	1st week	Trial of product
	2nd week	Delivery of product

ANNEXURE D

REVIEWERS COMMENTS

D.1 PAPER SUBMISSION

1. Paper Title: Real-time Automatic Helmet Detection of Bike riders
2. Name of the Conference/Journal where paper submitted : IJIRST Volume 4,Issue 11,ISSN:2349-6010
3. Paper accepted/rejected : Accepted
4. Review comments by reviewer : Accepted without any changes
5. Corrective actions if any : None

Paper Publication Certificates are attached here within

IJIRST
Innovation redefined

ISSN (online) : 2349-6010
IJIRSTV4I11043
No: 104557

The Board of
International Journal for
Innovative Research in Science & Technology
is hereby awarding this certificate to
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Real Time Automatic Helmet
Detection of Bike Riders
published in e-journal
Volume 4, Issue 11
April 2018

Prof. A. D. Chauhan
Editor in Chief

Prof. P. D. Patel
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Prof. R. N. Vaghela
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Executive Editor

Prof. R. N. Vaghela
Executive Editor

D.2 PROJECT PRESENTATION

The Project Modules were presented at following events and were reviewed by experts.

1. IET KARMAVEER EXPO 2018 - a National Level Working Model Contest

2. Nashik Engineering Cluster's Innovation Day 2018 - an idea presentation competition arranged by Nashik District Innovation Council

Participation Certificates are attached here within

IET KARMAVEER EXPO'18

IET The Institution of Engineering and Technology

NATIONAL LEVEL WORKING MODEL CONTEST

Certificate

This is to certify that Mr./~~Miss.~~ SHUBHANKAR DESHPANDE of K. K. W. I. E. E. R has participated and presented a model titled REAL TIME AUTOMATIC HELMET DETECTION OF BIKE RIDER in the National Level Working Model Contest "IET- KARMAVEER EXPO'18" organized by Department of Electrical Engineering, K. K. Wagh Inst. of Engg. Edu. & Research, Nashik, in association with IET (U.K.) Nashik Local Network during March 23-24, 2018.

PROF. Dr. B. E. KUSHARE
CHAIRMAN, IET(U.K.), NASHIK LOCAL NETWORK
CONVENOR, IET-KARMAVEER EXPO'18

PROF. Dr. K. N. NANDURKAR
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NATIONAL LEVEL WORKING MODEL CONTEST

Certificate

This is to certify that ~~Mr.~~/Miss. KAVYASHREE DEVADIGA of K. K. W. I. E. E. R has participated and presented a model titled REAL TIME AUTOMATIC HELMET DETECTION OF BIKE RIDER in the National Level Working Model Contest "IET- KARMAVEER EXPO'18" organized by Department of Electrical Engineering, K. K. Wagh Inst. of Engg. Edu. & Research, Nashik, in association with IET (U.K.) Nashik Local Network during March 23-24, 2018.

PROF. Dr. B. E. KUSHARE
CHAIRMAN, IET(U.K.), NASHIK LOCAL NETWORK
CONVENOR, IET-KARMAVEER EXPO'18

PROF. Dr. K. N. NANDURKAR
PRINCIPAL

IET KARMAVEER EXPO'18

The Institution of Engineering and Technology

NATIONAL LEVEL WORKING MODEL CONTEST

Certificate

This is to certify that Mr./~~Miss.~~ YASH GUJRATI of K. K. W. I. E. E. R has participated and presented a model titled REAL TIME AUTOMATIC HELMET DETECTION OF BIKE RIDER. in the National Level Working Model Contest "IET- KARMAVEER EXPO'18" organized by Department of Electrical Engineering, K. K. Wagh Inst. of Engg. Edu. & Research, Nashik, in association with IET (U.K.) Nashik Local Network during March 23-24, 2018.

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Certificate

This is to certify that Mr./~~Miss~~. PRATIK KHANAPURKAR of K. K. W. I. E. E. R has participated and presented a model titled REAL TIME AUTOMATIC HELMET DETECTION OF BIKE RIDER in the National Level Working Model Contest "IET- KARMAVEER EXPO'18" organized by Department of Electrical Engineering, K. K. Wagh Inst. of Engg. Edu. & Research, Nashik, in association with IET (U.K.) Nashik Local Network during March 23-24, 2018.

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CONVENOR, IET-KARMAVEER EXPO'18

PROF. Dr. K. N. NANDURKAR
PRINCIPAL

NDIC Nashik District Innovation Council

An Initiative of

Innovation Day 2018

NEC NASHIK ENGINEERING CLUSTER

This is to certify that Shubhankar Deshpande

participated in the Innovation Day 2018 an initiative of Nashik District Innovation Council & Nashik Engineering Cluster and presented an innovative project.

We thank you for your participation and wish you luck in your future projects !

Authorized Signature

NDIC Nashik District Innovation Council

An Initiative of

Innovation Day 2018

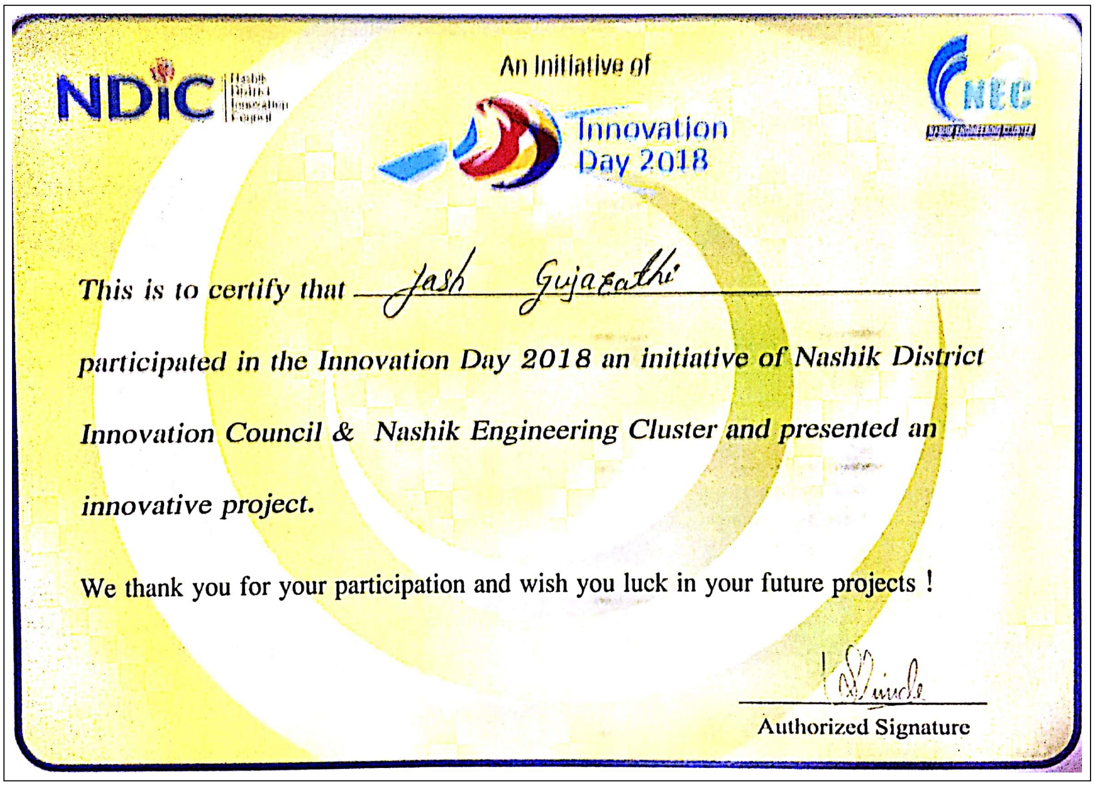
NEC NASHIK ENGINEERING CLUSTER

This is to certify that Kavyashree Devadiga

participated in the Innovation Day 2018 an initiative of Nashik District Innovation Council & Nashik Engineering Cluster and presented an innovative project.

We thank you for your participation and wish you luck in your future projects !

Authorized Signature



NDIC Nashik District Innovation Council

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This is to certify that Jash Gujarathi

participated in the Innovation Day 2018 an initiative of Nashik District Innovation Council & Nashik Engineering Cluster and presented an innovative project.

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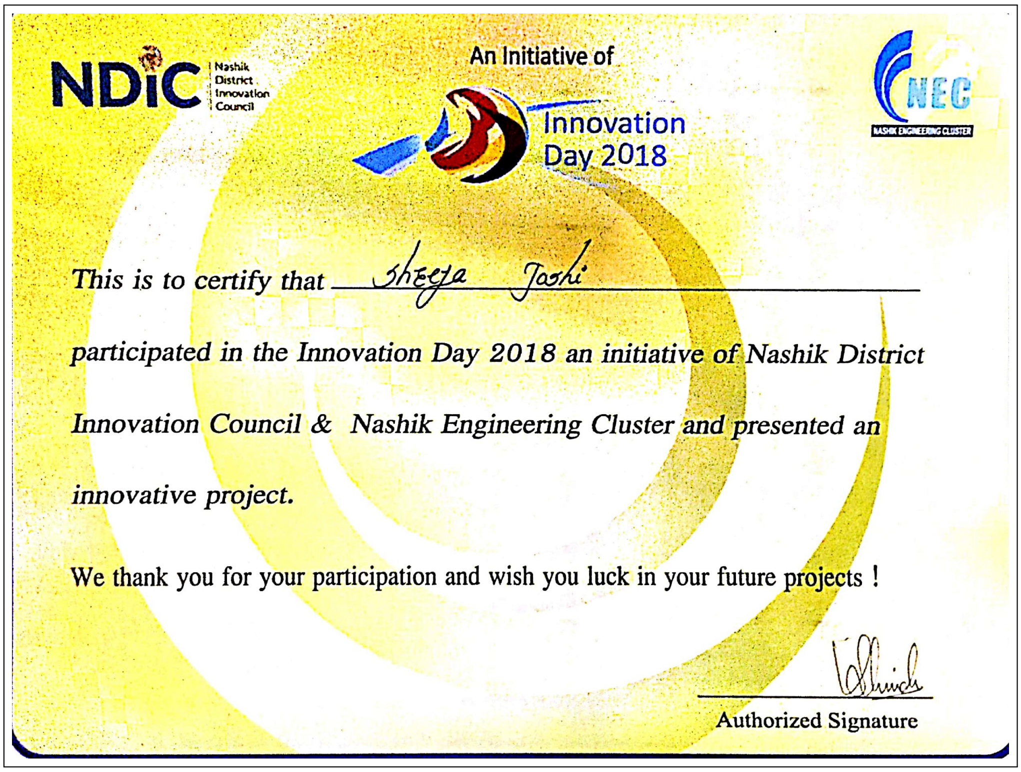
NDiC Nashik District Innovation Council

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Innovation Day 2018

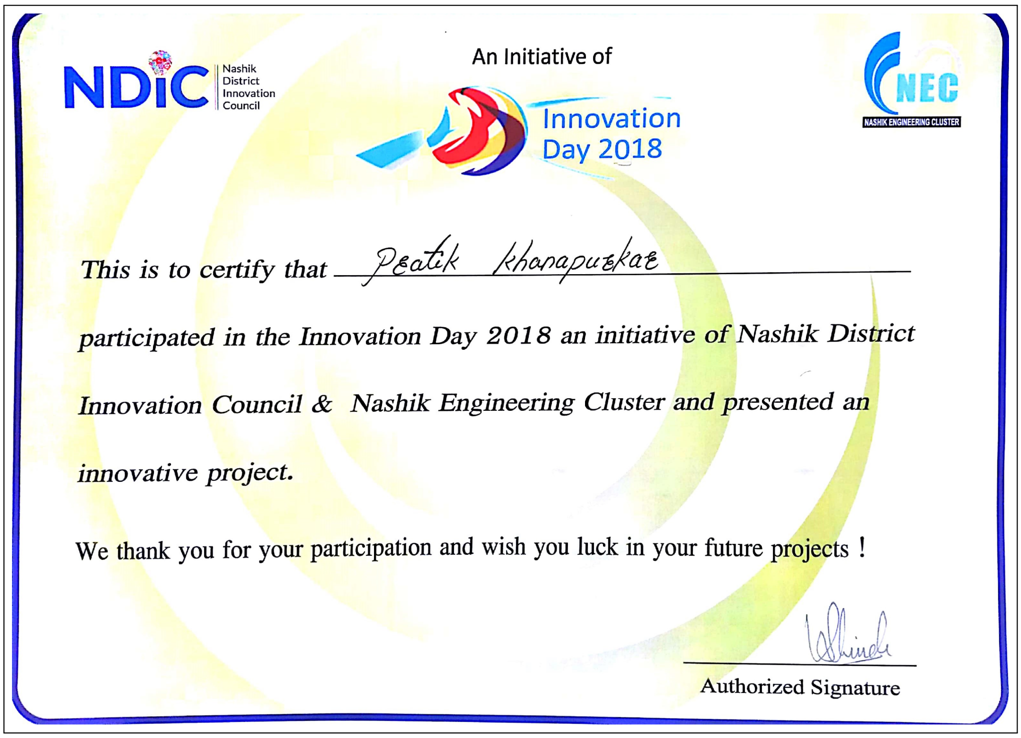
NEC NASHIK ENGINEERING CLUSTER

This is to certify that Shreya Joshi

participated in the Innovation Day 2018 an initiative of Nashik District Innovation Council & Nashik Engineering Cluster and presented an innovative project.

We thank you for your participation and wish you luck in your future projects !

Authorized Signature


NDiC Nashik District Innovation Council

An Initiative of

Innovation Day 2018

NEC NASHIK ENGINEERING CLUSTER

This is to certify that Pratik khanapurkar

participated in the Innovation Day 2018 an initiative of Nashik District Innovation Council & Nashik Engineering Cluster and presented an innovative project.

We thank you for your participation and wish you luck in your future projects !

Authorized Signature

ANNEXURE E

PLAGIARISM REPORT

Sr.No.	Chapter	Plagiarism	Unique Content
1.	Synopsis	9%	91%
2.	Technical Keywords	0%	100%
3.	Introduction	3%	97%
4.	Problem Definition and Scope	0%	100%
5.	Project Plan	0%	100%
6.	Software Requirement Specification	0%	100%
7.	Detailed Design Document	0%	100%
8.	Project Implementation	0%	100%
9.	Software Testing	0%	100%
10.	Results	0%	100%
11.	Deployment and Maintenance	0%	100%
12.	Conclusion	0%	100%
	Average	6%	94%

ANNEXURE F

TERM-II PROJECT LABORATORY ASSIGNMENTS

1. Review of design and necessary corrective actions taking into consideration the feedback report of Term I assessment, and other competitions/conferences participated like IIT, Central Universities, University Conferences or equivalent centers of excellence etc.

   Feedback:

   (a) About the degree of parallelism

   (b) Quality of training model

   Corrective Actions:

   (a) Multi threading was included where possible among the modules

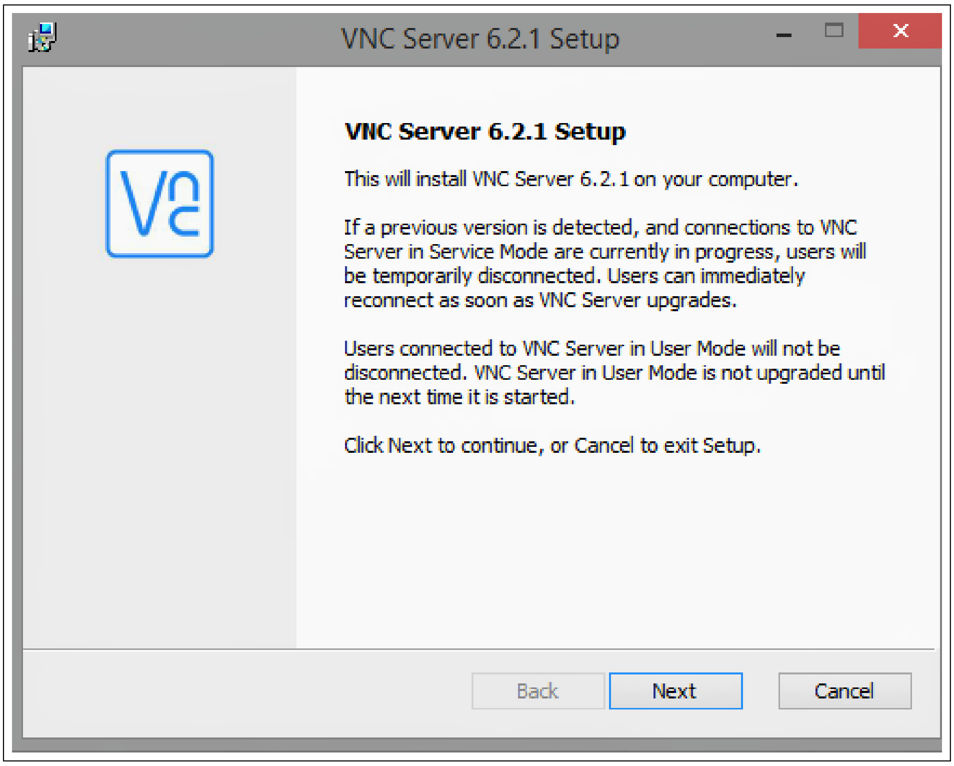
   (b) Negative data items were included to increase accuracy of training model

2. Project workstation selection, installations along with setup and installation report preparations:

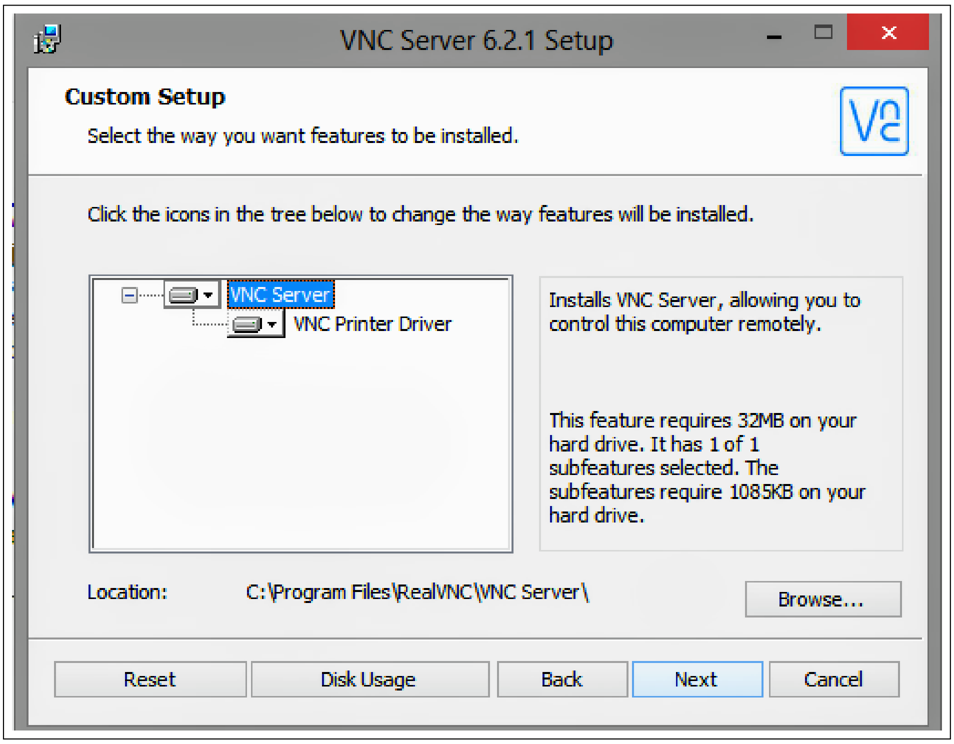
   The specifications of needed for training the model for helmet and Bike detection were very high end ie. Intensive parallelism and a powerful GPU. For this, we used one of the server machines of Google by obtaining a root access using VNC server.

   Following are the steps for installation of VNC server 6.2.1

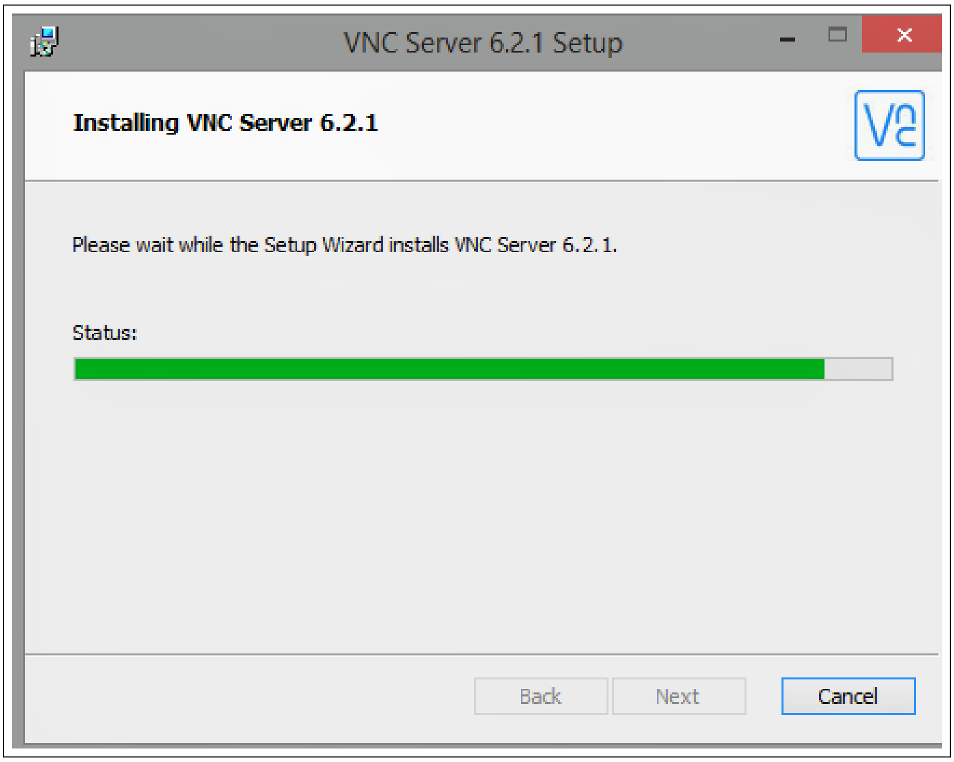
(a) Launch VNC6.2.1.exe



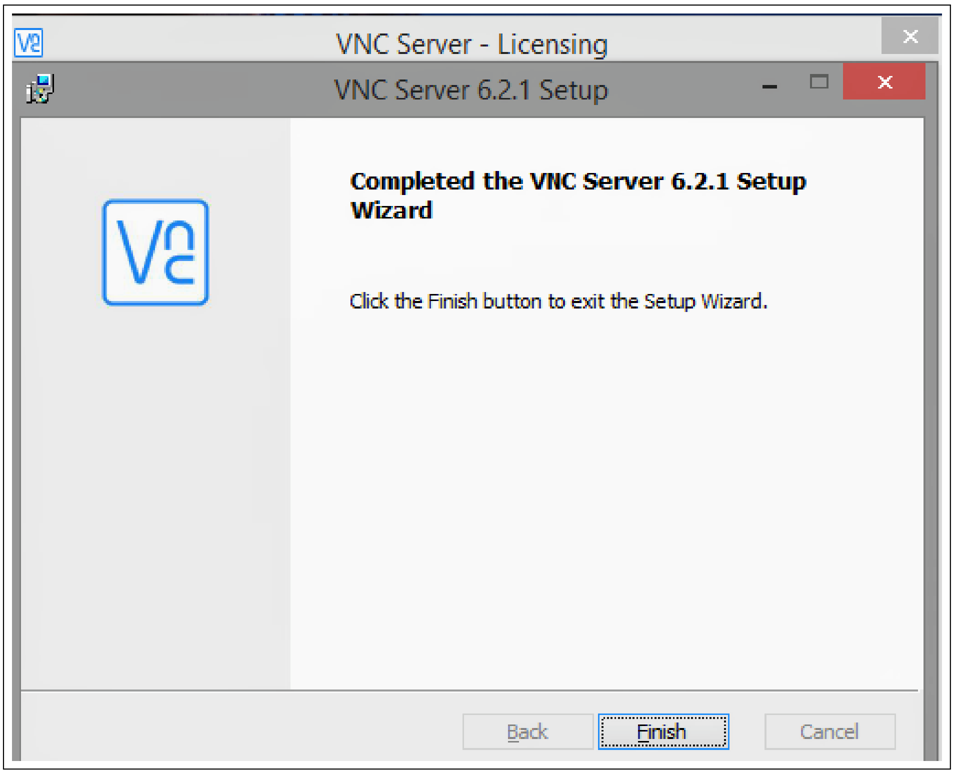
(b) Select the features to be installed



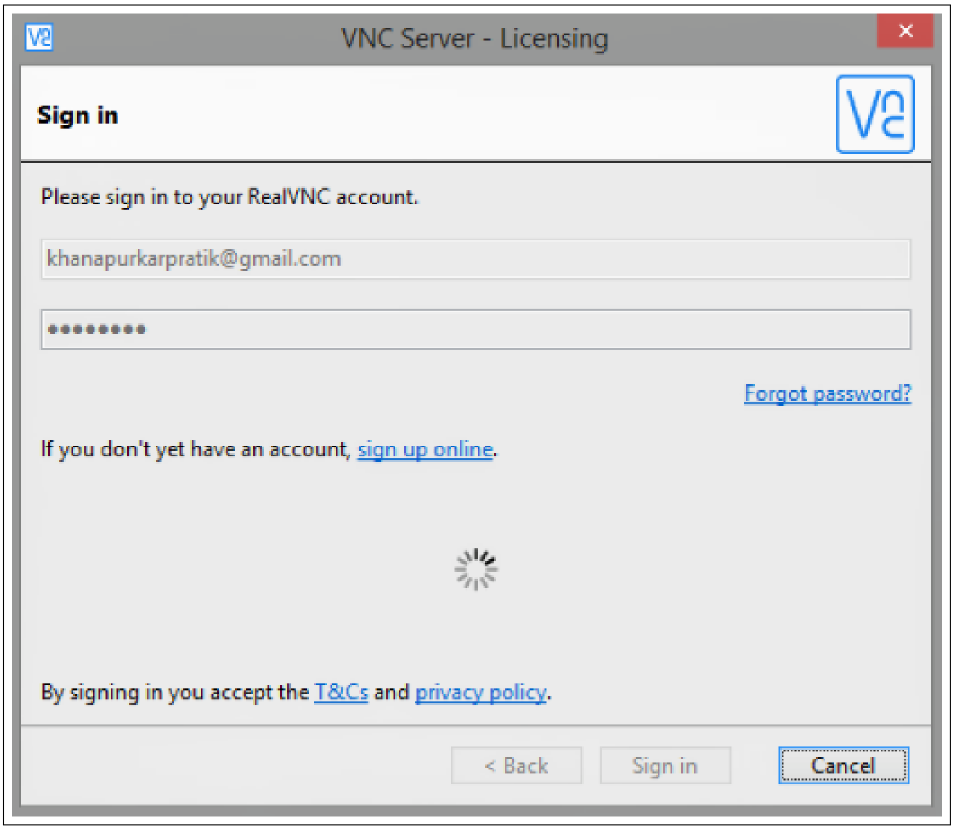
(c) Install



(d) Finish steup



(e) SignIn with the server IP and Password. After this step, a window with remote access to the server will open



3. Programming of the project functions, interfaces and GUI (if any) as per 1 st Term term-work submission using corrective actions recommended in Term-I assessment of Term-work.

   - Database Connectivity and basic front end GUI:
     Shreya Joshi, Shubhankar Deshpande
   - Dataset Generation and Collection:
     Shreya Joshi, Shubhankar Deshpande
   - Dataset Interpration:
     Kavyashree Devadiga, Yash Gujarathi
   - Feature Exactraction Module:
     Prtik Khanapurkar, Yash Gujarathi
   - Feature Selection Module:
     Kavyashree Devadiga, Pratik Khanapurkar, Shreya Joshi
   - Classification Module:
     Pratik Khanapurkar, Yash Gujarathi
   - Testing of Modules:
     Shubhankar Deshpande, Kavyashree Devadiga
   - Documentation:
     Divided equally between the team members
   - Communication:
     Yash Gujarathi, Kavyashree Devadiga

4. Test tool selection and testing of various test cases for the project performed and generate various testing result charts, graphs etc. including reliability testing.

Test Schedule

March	1^{st} Week	Unit Testing
	2^{nd} Week	Integration Testing
	3^{rd} Week	Validation Testing
	4^{th} Week	GUI Testing

Table F.1: Task Schedule

Test Cases and Test Results

Test Case	Purpose of Test	Expected Result
Background elimination	To check if the module successfully removes all the unwanted inanimate objects from video	Video consisting only of moving objects generated
Object Classification	To check if all the objects are labelled accurately, special focus is on objects appearing similar to helmet (Scarves, other head gears etc)	A bounding box around the required objects with label showing their names will be seen
License Plate recognition	To check if most variety of license plates are identified	The text on every standard license plate is recognized by the system

Table F.2: Unit Testing

Test Case	Purpose of Test	Expected Result
Integration of all modules	To check whether license plate of bike rider without helmet is detected or not.	Successfully detected license plate of bike rider without helmet.

Table F.3: Integration Testing

Test Case	Purpose of Test	Expected Result
Correct Output Generation	To check whether correct output is generated or not	Correct output must be generated (All Bike riders without helmet identified and no helmet must go undetected)

Table F.4: Validation Testing

ANNEXURE G

INFORMATION OF PROJECT GROUP MEMBERS

1. Name : Shubhankar Deshpande
2. Date of Birth : 14-06-1996
3. Gender : Male
4. Permanent Address :
   15, Swatantrya Sainik colony, Aurangabad-431001
5. E-Mail : shubhankardeshpande.14@gmail .com
6. Contact No. : +91-7507012657
7. Placement Details : NA
8. Paper Published :
   Real Time Automatic Helmet Detection of Bike Riders,International Journal for Innovative Research in Science & Technology, Volume 4 Issue - 11, Year of Publication : 2018 (Paper ID : JIRSTV4I11043)

1. Name : Kavyashree Devadiga
2. Date of Birth : 27-11-1996
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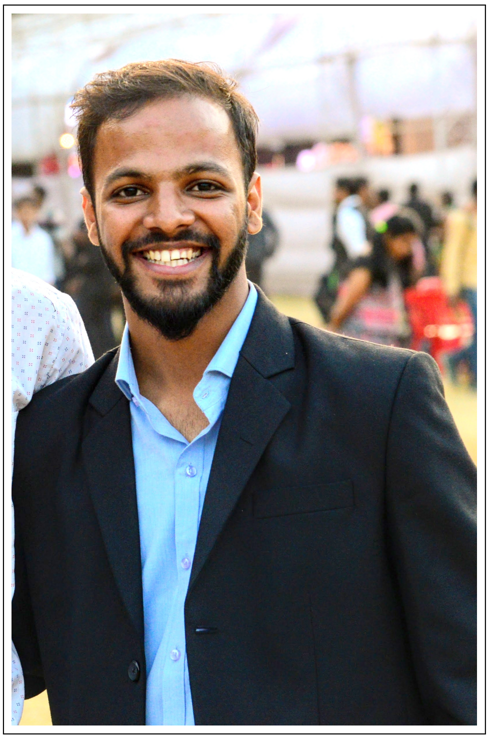
5. E-Mail : kavya27.devadiga@gmail.com
6. Contact No. : +91-7767946485
7. Placement Details : FinIQ Consulting India Private Limited
8. Paper Published :

   Real Time Automatic Helmet Detection of Bike Riders,International Journal for Innovative Research in Science & Technology, Volume 4 Issue - 11, Year of Publication : 2018 (Paper ID : JIRSTV4I11043)



1. Name : Yash Gujarathi
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6. Contact No. : +91-9422535138
7. Placement Details : NA
8. Paper Published :
   Real Time Automatic Helmet Detection of Bike Riders,International Journal for Innovative Research in Science & Technology, Volume 4 Issue - 11, Year of Publication : 2018 (Paper ID : JIRSTV4I11043)

1. Name : Shreya Joshi
2. Date of Birth : 16-12-1996
3. Gender : Female
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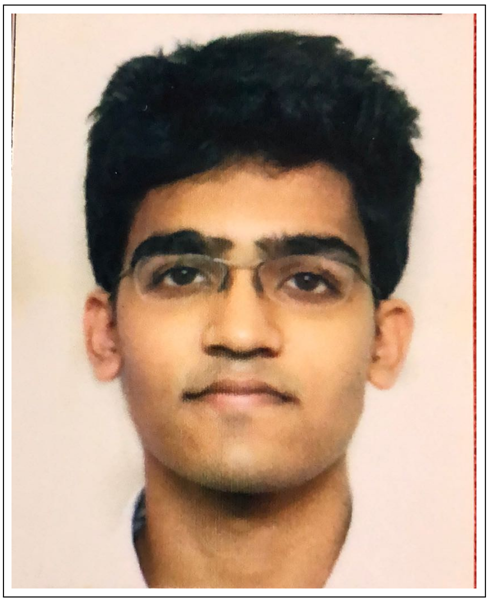
8. Paper Published :
   Real Time Automatic Helmet Detection of Bike Riders,International Journal for Innovative Research in Science & Technology, Volume 4 Issue - 11, Year of Publication : 2018 (Paper ID : JIRSTV4I11043)



1. Name : Pratik Khanapurkar
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   4, Ojasvi apt, Sambhaji chowk, Trimbak road, Nashik-422002
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6. Contact No. : +91-7719987999
7. Placement Details : NA
8. Paper Published :
   Real Time Automatic Helmet Detection of Bike Riders,International Journal for Innovative Research in Science & Technology, Volume 4 Issue - 11, Year of Publication : 2018 (Paper ID : JIRSTV4I11043)