# Introduction

Traffic on roads means all the vehicles and pedestrian. Traffic rules are those rules which govern traffic and regulate vehicles. Traffic is formally organized in many jurisdictions, with marked lanes, junctions, intersections, traffic signals or signs. As the number of vehicles on road increased, need for the traffic rules was realized due to recurring accidents which could be prevented by following simple rules. In 1865, first traffic rule was introduced in Britain. Later as the number of vehicles grew rules were added to increase safety and make traffic efficient. In Kathmandu valley though the number of vehicles grew the road, technology used are still the same. Many people do not know all the rules and many of those who know does not follow the rules. To prevent accidents many traffic rules are enforced. These rules must be followed by all the motorists.

Traffic violation occurs when driver fails to follow the traffic rules that regulates vehicle operation on the road. If any motorists fail to follow the traffic rules traffic ticket is issued to the driver. The main duty of the traffic police is to make motorists and two wheel drivers follow the rules and if they do not follow the rules traffic ticket is issued. A traffic ticket is a notice issued by a law enforcement official to a driver, indicating that the user has violated traffic laws. Traffic tickets generally come in two forms a moving violation such as exceeding the speed limit or non-moving violation such as a parking violation with the ticket also being known as parking ticket.

Any person caught violating traffic rules is slapped a fine between Rs. 500 and Rs. 1,500. As many as 378,927 rule violators were booked in the fiscal 2017-18. Out of them 5,060 motorists and two-wheeler riders were caught with the help of Closed Circuit Television (CCTV) cameras installed at more than 200 locations in the valley. Less than 2% of violators were caught using the CCTV cameras. [1]

Violation of lane discipline is driving recklessly on the road without using turn signals and not following the lane discipline. Violation of lane discipline tops the traffic offence chart with 33,377 violations though many violators of lane discipline are not fined.

Speeding is excessive speed (driving above the speed limit) or inappropriate speed (driving too fast for the prevailing conditions) recognized as a major contributory factor in both the number and severity of traffic crashes. Very few speeding tickets are issued in Kathmandu valley as speed monitoring is only enforced randomly on very few occasions with limited resources.

Some of the traffic rules violation that our system can detect are:

* Violation of lane discipline
* Drive over permitted speed limits

Detection system is a software that is used to monitor the traffic violation. Traffic violation detection system is the software that uses real time object detection to detect the violation committed by the driver. Real-time object detection is the task of doing object detection in real-time with fast inference while maintaining a base level of accuracy. Video footage from the CCTV is used as the data input for the system. Opencv can be used for real time object detection with the help of frameworks like You Only Look Once (YOLO). [2]

Speed of the YOLO framework is 45 frames per second which is better than realtime. Network understands generalized object representation which allowed them to train the network on real world images and predictions on artwork was still fairly accurate. It is also open source.

YOLO is like FCNN(fully convolutional neural network) and passes the image once through the FCNN and output is (m\*m) prediction. This the architecture is splitting the input image in m\*m grid and for each grid generation 2 bounding boxes and class probabilities for those bounding boxes. Note that bounding box is more likely to be larger than the grid itself. [3]

# Evolution of traffic detection system

Traffic violation has been one of the major problem since the development of roads and vehicles. On average 3,287 people are killed every day in road accidents. Different remedies have been made through the period. Due to advancement of technologies and increase of population the problem doesn’t seem to be declining. In cities, where the number of vehicles continuously increases faster than the available traffic infrastructure to support them, congestion is a difficult issue to deal with and it becomes even worse in case of car accidents.

## Latest status of traffic violation detection system:

The invention of vehicles dates many years ago but the first car brought to Nepal was in 1958 BS. Traffic control system was formulated in 2007 BS. The first traffic light was implemented in 2023 BS in Kathmandu. Traffic lights weren’t that useful back then since there weren’t many vehicles or we could say we were way ahead of our time. In today’s scenario, traffic lights are not enough in Kathmandu. The latest development in traffic control system is the use of RFID systems. RFID systems overcomes the drawbacks of problems related to image processing. Radio-Frequency Identification (RFID) is the use of radio waves to read and capture information stored on a tag attached to an object. Although traffic violation has been one of the major problem all over the world, very few countries have taken the step towards smart traffic system. For example, Dubai have implemented around 15,000 cameras which is constantly monitored by Traffic police officers but detection is still done by officers themselves. The people who violate the rules are fined digitally especially in Dubai. It is very rare to find these new detection systems. Speed detection system have been implemented in most of the developed countries. Even in Nepal, every now and then traffic comes for speed detection. We have CCTV control rooms for traffic management.

The system we are about to use is called “Traffic Violation Detection System” using image processing algorithm. We are planning to implement HD CCTV cameras as well as sensors at various places of roads (according to the study of road and traffic conditions). Our system should be able to scan the image of cars and its number plate. The violation will be recorded as a proof. The information about the driver will be present in the system so it will be very easy to fine the person. [5]

## Benefits

We have over 1.025 billion vehicles today in the world. If an appropriate system is implemented to manage these vehicles, road accidents will be drastically reduced. It will help all the traffic officers and volunteers who work extremely hard to control the traffic. These following points will help us to show some benefits of traffic management system.

1. Improving traffic safety

Over speeding, inappropriate changing of lanes, heavy traffic can lead to road accidents; traffic violation detection system will help with all of these. Our system can detect the vehicle who violated the rule and fine the necessary charge.

1. Reduce in infrastructure damage

Road accidents not only lead to damage of life but also destroy our road structures. It also hampers the decoration of the road. If we implement our system then we can reduce the expenditure on road repair, allowing it to be allocated somewhere.

1. Traffic control

We can clearly distinguish that today’s traffic system will not be able to huge mass of vehicles. Mostly people try to escape from the situation and traffic officers couldn’t care less. It’s like catching fish in the sea. There are so many of them that if we catch like thousands then other hundreds still run away. So a system is needed in order to keep everyone inside the rule, not letting even one to escape.

1. Improved journey times

Most of the people violate traffic rules so that they can reach to the destination as fast as possible but unknowingly they are creating mesh and disturbing everybody on the road. Our system will make the road traffic condition better and everybody will reach to their destination in time.

1. Prevents road accidents

People claim accidents are unfortunate events but most of the accidents are due to failure of people discipline on the road. There are many causes behind the accidents. Lack of experience, over confidence, overcrowded roads, are the cause of accidents.

1. Serviceable help for traffic volunteers

In the context of developing countries where government doesn’t invest required amount of money for road development, traffic controllers play huge role. We can see their hard work but it seems insufficient and it turns sometimes violent. Increment in vehicles every day make their traffic controlling task burdensome so let the system take all the stress and traffic officers and use their time someplace else.

# Existing System

# Customer’s perspective

Our customer was Traffic Head from Traffic Police, Satdobato. On the basis of existing systems mentioned above, the customer had an overall positive perspective towards the system. He highlighted following points:

1. There is no any prevailing system and has been none attempts to computerize the traffic rule violation.
2. When a misunderstanding takes place in between driver (referred to both motorists and motorcyclists), the current system of showing CCTV footage proof is both tedious and time consuming.
3. He mentioned how the traffic violence was increasing at an exponential pace and was going out of control with only manual existing system.
4. He highlighted the need for a computerized system in traffic violence control as manual detection and fine to individual breaches are close to impossible.
5. He pointed out the lack of enough manpower in the field of traffic control as a whole, most of the manpower is centralized towards traffic control than traffic violation monitoring.
6. He also pointed out the increasing ignorance of drivers due to incompetency in implementation of rules & regulations well.
7. Less than 2% of the all of the violations are captured through CCTV, thus, the system is necessary. [4]

# Observation of existing or similar systems

## Table of Comparison

|  |  |  |
| --- | --- | --- |
| S.N. | Title | Method |
|  | A video-based traffic violation detection system | C++ with OpenCV |
|  | Traffic Violation Detection System based on RFID | RFID technology |
|  | A System for Traffic Violation Detection |  |
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