Decision Support System for Road Traffic Violations

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Declaration

I declare that this thesis is my own work and has not been submitted in any from for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of reference is given.

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Abstract

Traffic violations frequently occur in Sri Lanka. The number of death and damages due to road accidents are increasing continuously. It can be reduced, on the one hand by educating people about road rules and giving knowledge in severity of road violations. It can be managed by introducing a well-defined traffic management system that can collect and analyze information accessible to authorized person. This cannot be fulfilled with the existing system. Because the current manual system is not efficient enough to implement fines or file court cases against road rule violators.

Each police station has a traffic division. ruled by a separate officer under main police station officer in charge. It provides various kind of services for the public community by coordinating related department ministry such as law department. In that case they want a good system for information sharing with each other departments. However it is difficult to share and update information using the current manual system. Road users such as pedestrians and drivers do not have a proper way to learn road rules and regulations. Even though books with road signs and regulations are available in book shops, most of them are not updated.

This research is divided into two parts. First part is introducing web based information systems for police traffic division and other related authorities because this type of system is easy to handle island wide. This system has five types of users. They are main admin, traffic police officer in charge, traffic police offices, low enforcement authority and road users. In this system it covers the all day to day activities in traffic unit, related authorities easy link, updating, searching information and generate island wide report and provide interface to violated drivers to pay their fine online. Road user can get information about road rules, road signs and information related to road traffic.

Second part in this research is analyses traffic violation using previous data from Tangalle, Galle, and Imaduwa police stations traffic violation data have been collected for this research. Currently data available in the book and data preprocessing has been done in the data extracting time. Then use Rapid Miner software further data preprocessing and identified violation pattern.

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Chapter 1

1 Introduction

1.1 Overview

Vehicle density in Sri Lanka is daily increasing. For examples in 2008, there were 381448 cars in the Sri Lanka. However 2016 Sri Lanka had 675982 cars registered [1]. Also Ministry of Transport & Civil Aviation says new driving license issuing rate has increased by yearlyAviation [2] . However, Sri Lanka road infrastructure has not developed fast. It is insufficient for vehicle and new drivers increasing rate. Sri Lanka have only t o Highways currently. Most of the roads are still narrow. As a result traffic violations and road accidents have increased in recent years[3].

World health organization reported that over 1.3milion people die yearly in case of vehicle accident and traffic violation [3]. Also the WHO said middle and low income country vehicle accident and death rate are high. Because road infrastructure does not develop, most of the country police have not well structure accident and traffic violation databases. Majority death reported in age 15 to 29 young peoples. Major issue of Top ten causes of death among people aged 15–29 years is vehicle accident. This is a very bad effect for country workforce. Considering whole world traffic accident half of accidents are vulnerable road users, pedestrians, cyclists and motor cyclists.

1.2 Background

In Sri Lanka police act as a main protecting. The police have enough man power and island wide branches to protect people. They are mainly responsible for enforcing criminal and traffic law, enhancing public safety, maintaining order and keeping the peace throughout Sri Lanka. The professional head of the police is the Inspector General of Police who reports to the minister of defense and the Police service is currently under the Ministry of Law and Order.

Currently Sri Lanka has Over 12000 KM A, B and C grades Roads (RDA Sources).Thousands of people and vehicles use this road daily. There is a separate unit at each police station called traffic division to maintain the safety and traffic laws of those who travel along the road

Sri Lanka polices traffic division act as the main player for reducing traffic jam, traffic violations and accidents. The official Sri Lanka Polices website says that actively participate in five main functions. Such as Enforce Traffic Laws, prevent violations of traffic regulations and prosecution of offenders, investigate into accidents, Control traffic on highways, Provides pilot duties for VIPP and Assist the public in various social events and functions where motor traffic is involved.

The Sri Lanka police still use manual system to enter and process traffic violation and other rules violations. However it is difficult to manage traffic violation process, identify previous behaviors of divers, critical accident places, frequently traffic violation areas, frequently road rule violate vehicle type and other related things. It is difficult to identify traffic violation Pattern and predict future trend of traffic violation.

Drivers violate road rules in mainly in two ways. First is violate rule in the driving time such as driving over the speed limit in the area, wrong overtaking, violate parking rule and cross double line etc. Second way is before driving a vehicle on the road vehicle and driver should have many essential documents such as valid driving license, vehicle insurance and yearly revenue license.

The Police investigate traffic offence in several ways. That is issuing fine papers to drivers on the spot, introduce court to violated drivers, give grace period to drivers to pay fine if Rule violated drivers do not react during that period the police file case in the court against drivers, give grace period to driver to remove unnecessary lights, equipment and change unauthorized changes in vehicles and give grace period to set necessary equipment to vehicle.

1.3 Problem in the Current System

The Police still use manual file processing system in day to day activities. According to the current system, it is a very difficult task for officers because they have to check records every day. Also in the current system it is very difficult to analyze pervious data in traffic violations because only availability of hard copy, different type data format use it however Identifying traffic violation Patten is very useful to reduce traffic violation, accident rate and improve road users safety.

The information about road rule violations is stored in the book. After the rule violation has been recorded; the road rule violator must pay the fine within 14 days. After the inquiry of the road rule violation the traffic officer takes road rule violator's driving license or NIC until the relevant payment of fine to the government via post office or otherwise. If fine was not settled within14 days the case will be forwarded to the court. Therefore road rule violator has to pay fine and the payment voucher must return to police station within 14 days for finish the case.

Road rules are the most important information, but there is no quotable document about all road rules at some police stations. So centralizing of this document as a web page is very important. It will help to road rule and regulation to be clearly followed up by the police and the general community.

Another main problem there is no any quick link between traffic branch and motor traffic branch. So it is very difficult to verify or get accident or road rule violator information. Also officer can't check this person or vehicle past unsold problem.

All the daily records have to be summarized into monthly report by every police station and this report will be sent to divisional officers and then send to the national report. At present it takes more time to finalize all detail, because the details are manually entered, also the errors can happen. Not only monthly reports biannual, annual report has to be prepared in such a manner that all the details could be clearly identified. Manual data base can not provide those information in the same time, accurately, and in user friendly manner.

If traffic police branch wants to clarify the given information about any vehicles there is no way to do so in the existing system. They are doing by sending the collected information to the Department of Motor traffic.

In other current system drivers also have faced difficulties for pay fine after catch the police. Now fine only pay post office however holidays and nonworking hours driver unable to pay fine and get their license in police. If drivers are caught by police far away from their homes they face big problem to pay fine and get licenses.

Therefore, data recording system is to be integrated with the computer network system based on the web.

If the Police use computerized system it is easy to handle day to day activities, easy to analyze historical data and data is consistent and accuracy is high. Some place in the Sri Lanka they monitor traffic jam and violation using CCTV technologies. That CCTV System is in operation mainly Colombo city area at main junctions. However, the government is unable to implement that system all island because basic investment is very high. Government difficult to allocate money for develops this type of system in current economic situation in the country. Private sectors are not interested in invest this type of project. As it's unable to get profit for their organization. At least Sri Lanka police have not systemically developed traffic and accident data database and web base application.

1.4 Research Problem

The quality Road system is an essential factor to increase the standards of a country. Also the road safety is an important factor for people who use the roads regularly. In Sri Lanka there are few institutes which carried out the road safety and maintenance as their main duty. Road Development Authority (RDA), National Council for road safety, Attorney General's Department and Sri Lanka Police are some of the institutes responsible for the safety and quality of the roads.

It should have a good interrelationship with the above institutes to provide, the better service to the people. But the fragile correlation between those will gave the limited service to the road users. There is no proper system to interchange the information between them.

Sri Lanka police Traffic division use manual system for their duties. So it is difficult to do their day to day activities and analyze previous incident, file a case in court, issuing driving license after pay fine, predict and identify traffic violation pattern such as frequent time, place, vehicle type and other specific criteria.

The violating of road rules will result a punishment for any driver. It will be an on the stop penalty or court cases based on the type of violation. If it is an on the spot fine, the driver has to pay the fine for the nearest post office and need to come back to the police

to take the driving license. Some of these paths are hard and the driver may face the difficult situations during the process.

1.5 Aim and specific objectives

The aim of research project is to implement a well-defined web based information system for law enforcement authorities and easily identify and predict traffic violation pattern previous Information.

1. Provide interface to all police station traffic divisions to enter their area traffic violation details.
2. Maintain one centralized database in all police stations
3. Provide facility to search island information quickly for authorized police officers.
4. Introduce computerized fine pay model.
5. Analyses traffic violation and identify and predict frequently pattern
6. Identify relationship second type road rule violation.
7. Give interface to people to submit complaints directly to IGP via web interface.

1.6 Summary

This chapter has introduced about what is the problem statement having in the road traffic violations, the solution to traffic violation management using computerized system and important of identify violation pattern using data mining techniques.

Chapter 2

2 Literature Review

2.1 Introduction

Traffic violation, accidents and traffic jam are related to each other. Many researches and countries to implants many models and publish their papers to avoid traffic violation.[4] was said traffic violation is main factor of reducing road safety. Drivers are doing many traffic violations such as wrong overtaking, darkness driving, not considering road sign, block the road in unauthorized parking, high speed driving etc. Researchers are using different models and techniques to avoid traffic offence and improve road safety.

2.2 Related work

Thus [5] many factors cause traffic violations. They have analyzed how factors affect severity of traffic violation and accident using traffic data for 2015 in china Guangzhou area. They have considered factors like drivers age, sex, driving time, year of driving, vehicle type, ownership of the vehicle and severity of traffic violation and accident in their study. Bayesian network model, cumulative logistic regression model and the neural network model have been used for data analysis and prediction. However analyst has not considered drivers current state such as drunkenness, mental condition which directly affect severity of traffic violation and accident. Also road condition, weather, behavior of the pedestrians and traffic condition the accident times have not been considered.

The most frequent traffic violation place is road intersections. Authorities set the traffic lights at intersection for prevent accidents and smoothly running vehicle. However peoples do not consider traffic light signals. According to statics most Severe case in red light violationJahangiri, et al. [6]. In this paper they consider vehicle speed, reaching time to intersection, distance to intersection, driver age, gender, etc. Researchers used machine learning algorithm to detect and identified what factors effected red light running violation. Factors divided in to two categories such as kinetic factor (speed of the

vehicle), and driver related factors (age, gender). In their model they use location base video camera and set on board device on the vehicle to gather information. Camera collective resolution, processing speed, current wind speed and light condition effectively affect for vehicle speed measurement Researchers did not consider this kind thing for their data collection. Another way to gather vehicle information method is set device in the vehicle. It is does not practical solution. Support Vector Machine (SVM) and Random Forest (RF) algorithms were used to analysis the data. These two algorithms are complicated than regression test. They said driver related factors are difficult to identify.

In Germany rural road overtaking violation was analyzed by Richter, et al. [7]. They selected 78 rural two lane road. Those roads were two sections such as overtaking enable section and overtaking prohibited section. 15173 overtaking cases were analyzed in that study. They investigated both overtaking enable and overtaking prohibited area for their study. In that study tried to implement relationship between vehicle speed, overtaking distance, overtaking path and vehicle type how to effect overtaking violation. In the night time road condition is different such as some drivers do not dim their head lights, animal cross over the rural road, change visibility path and vehicle density in the road. That kind of factors were not considered their research.

Wrong overtaking is the most dangerous habit of drivers. Many drivers tend to overtake vehicles for save their time. However sometimes it is dangerous for all road users because drivers do irregular overtaking. Miletics [8] had discussed background traffic violation details and irregular overtaking cases to reduce useless overtaking and overtaking violations. They recommended to discussion support application to reduce overtaking violations. In that research they considered many road and vehicle related attribute such as traffic volume in both direction, vehicle type, vehicle length, Sight distances at the beginning of passing, speed of the vehicle, etc. In that research it was found drivers tend to overtake based on road characteristic (alignment and space) and traffic condition. However drivers did not consider road signs.

Traffic violation and offence have increased daily. Peoples have used vehicles for lot of illegal activates such as robbery, property damage, number plate change ,illegal

modification, driving influence with alcohol, etc. Ou, et al. [9] said that kind of thing affect the people safety and emphasize current diction system capabilities was insufficient. They proposed real time high throughput traffic monitoring system. It used real and synthetic data for analysis. The system captured data using traffic surveillance cameras. They got records in three different places such as entering parking, exit parking and roadways. They obtained real time blacklist vehicle information from the public security bureau system. There were two modules in that system such as plate clone dictation and speed dictation. First check the plate clone dictation. Their algorithm first checks plate cloned dictation after check speed violation. That system can identify palate clone well and identify some amount of speed violation. Drivers do not drive fast in parking areas so parking entrance and exit camera were unable to catch high speed vehicle information. However research did not discuss identify other traffic violation in captured image.

Roadway traffic and accident data were important to investigate fats were closely affect to fatal vehicle accident Li, et al. [10].That paper used Apiori algorithm, k- mean clustering algorithm and Naïve Base classifier for identified variable traffic violation. Researches had analyzed collision manner, weather condition, surface condition and drunk drivers, how to affect to traffic violation. That research considered USA traffic data. Data preparation techniques applied for data set before analyzes. They used Weka data mining tool for identified fatal condition. In Apiori algorithm they selected 0.4 minimum supports and 0.6 for minimum confidences. The paper said weather condition, light condition and surface condition did not affect for violation rate. Vehicle speed and drunk drivers fats strongly affected for violation rate. However vehicle type and age limit were not considered for that research.

Road traffic violation data is very important to identify road safety measurement. Country traffic data collection is not well structured and it is difficult to identify road safety fats. Nandurge and Dharwadkar [11]proposed model for road offence data analyze using data mining methods. In their pilot project collected Maharashtra area traffic data. They used Weka data mining tool to analyzed data. Using K-means clustering algorithm paper defined five clusters based on offence attribute. Five clusters were driver

drunkenness, road type, light condition and road sign. Association mining rule applied for each clusters and defined violation related attribute.

Frequent locations of Road traffic accident and road rule violation frequently locations were called black spot said by Jiaxing, et al. [12]. They said traffic violation was main case for fatal vehicle accidents. That research focused on identified black spot for road users future safety. Support vector machine method was used to identify black spot. They collected history of traffic violation details in road section and intersection. After using that data built forecasting model and used support vector machine method to forecasting future violation. Future prediction is useful for low enforcement to get suitable action for reduce traffic violation. However, that research did not consider driver behaviors, vehicle type and road condition in identified black spots. Sometimes road condition directly affects for accident and road rule violations.

In recent years specially, motor car manufacturer developed various type of discussion to support system. That is based on three categories. Perception support, judgment support and execution support were three type of discussion supports systems. Nakamura, et al. [13] selected elderly persons and discussed how to affect discussion support system to avoid traffic violations and accidents. In that research used (HONDA, DA-01) driving simulators. It used 12 healthy 66 mean age persons for experiment. Participants were well trained before research. In that research provided risk factor related images in car navigation monitor. It provided five categories such as stationary vehicles, speed limits, temporary stops, and decreased road width and potential intersection collisions. They tested traffic violation information support and without information support. Finally, they said information support alert system effectively used for accident avoidances. However information supports static item such as road signs, traffic lights did not potentially effect to reduce accidents.

There are many accidents and traffic offences happed in road intersections. Authorities set traffic lights to reduce accidents. However drivers violated lane change rule before and after stop near red light. Klubsuwan, et al. [14] had proposed system to reduce and identify lane change violation. It used image processing method. They set video cameras

near red lights and captured illegal lane change vehicle in forbidden area. When the system detected violated vehicles high resolution cameras identified number plate and print penalty ticket to be sent to the violated vehicles owner. However it depend on video quality and how many vehicles can be captured in one time because after lightning green light, many vehicles pass intersection at the same time.

Developed countries in the world use different type of traffic monitoring and violation detection system. Such as CCTV System, RFID Systems and many image processing methods. Many people have been done computer based traffic monitoring systems.Agrawal, et al. [15] had introduced research paper and android application called Vehitrack. That system detected traffic violation using RFID and image processing technologies and automatically deduced fine from driver bank account

Many researches published their papers and computerized solutions for traffic violation and accidents. Data mining is a good approach to analyze road accidents and violation data and identifying offence Paten Kumar and Toshniwal [16]. They used k-means algorithm and Clustering data mining techniques for analysis accident and violation data in India. k-means algorithm used to divide in to selected location in to different groups. Three location wise groups are identified such as high frequency, low frequency and moderate frequency locations. Association mining rules used to identify the relationship among different sets of attributes that frequently occur together when an accident and violation location. Authors Said intersection of Highways are more dangerous for all type of violations. However they did not consider road condition, vehicle type, speed of vehicle and weather condition for their prediction.

Police have information about most vehicle accidents. However sometimes police have not record for non severe accidents. Staton, et al. [17] used two type accident detail data set to identify frequently accident area. One data set they got police record. Other data set they got survey in selected area road. Galle Municipal council area in Sri Lanka and Kabali city area in Ruwanda were selected for research. Spectial data analysis techniques used to compare data set and identified places. Each dataset identified location was marked in the map. Finally overlapping two data set result and implement their result.

Association Rule Mining and Clustering algorithm used to identify road rule offence black spot Thapa and Lee [18]. They collected previous traffic data in road section or intersection with in analyzed time period. The information are further pre-handled utilizing particular channels in Weka. Concealed best guidelines are resolved utilizing Association Rules mining. At that point, by utilizing the K-means Algorithm a particular clustering information is acquired. In the waked of preparing, Support Vector Machines was utilized to estimate the future criminal traffic offense number. Each street area and intersection processed with the technique. Results identified by the researches displayed in map using GPS module. That project is in fact make individuals to be additional watchful before going into the dangerous zones and drive consistently and precisely.

Intelligent transport management introduced by Guo [19] for forecasting traffic violation. Data mining method used to develop their model. That research data mining process divided in to three stages such as data preparation, pattern discovery, result expression and interpretation. Their proposed mode is as follows

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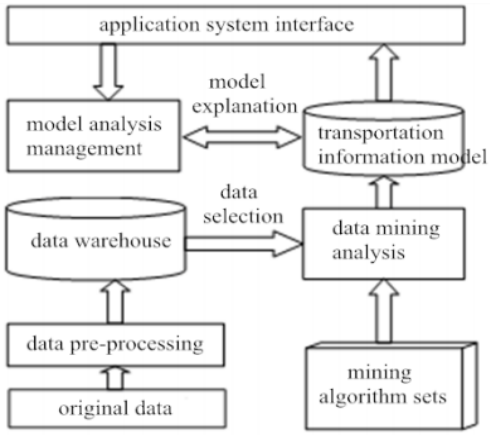


Figure 2.1 Application System Interface

When vehicle density increses manual system was diffcult to dectect road rule violation. Therefore computrerized traffic monitering system was proposed [20]. It was based on Fog based desicussion support model. It used two type of smart processing device to captureinformation. Gobal camarea sensor (GCS) was used for identifing vehicle number and local camrea sensor (LCS) put inside vehicle and uesd to passed warn massege to drivers. Both GCS and LCS comminctate with fog servers. Research proposed framwork to divide three layres such as lower layer, midel layer and upper layer. The main aim of

that frame work prevent use mobile device in driving time. Because authores said it was the major case of traffic accident. When drivers use mobile devieses.

High speed driving in city area is a very dangerous effect for road uses Mohammed and Osman [21]. They proposed proper communication method between roads and car alert system to alert speed limit. Authors implemented that system using simulators. The system consisted three modules such as computer, road device (TR1) and device on the car(TR2). It used two type of car device one for normal cars and other for ambulance. Road device permantely fixed on the road and send speed limits information to entered vehicles on the road. Using personal computer graphical user interface provided appropriate speed limits to road device. Road device identified ambulance and normal cars separately. While normal exceeds legal speed limit on the road system automatically send to alert message to cars. When ambulance came to the road TR1 device identified and send message to other road user and

According to Shirazi and Morris [22] research identified drivers did not careful to consider in traffic light signals. In that case there were many accidents occurred in near traffic light. To prevent accidents they proposed method for using traffic cameras. They set cameras in near traffic light and captured violate road uses and analyzed captured data using K Nearest Neighborhood (KNN), Naive Bayes (NB), Neural Network (NN), Deep Neural Network (DNN) and Support Vector Machine (SVM).However they founded some drawback in the their proposed system such as camera captured frame rate, image quality depending on weather condition, high performance hardware equipment need to process image, etc.

El Tayeb, et al. [23] had analyzed Dubai traffic department data and identified traffic violation attribute using data mining techniques. They used Weka data mining application software. After preprocessing data they applied both Apiori algorithm and Predictive Apiori algorithm to same data set. Using that result they compared and explored link between accident factor and severity.

Marikhu, et al. [24] proposed real time traffic violation monitoring system using image processing techniques. The proposed system called Police Eye Real time Traffic Monitoring system. They said highest road accidents occurred on high speed driving.

Dangerous lane changing, illegal overtaking, and driving in the wrong lane have another major problem for traffic violation. They proposed model addressed in second problem. They used high performance cameras and sensor device to identify violation. However there were many practical issues in that model such as difficult task to set camera in all road, weather and light condition affect by image quality.

There are many private buses in Sri Lanka. It has been contributed major role in public transport service. However bus drivers tend to violate road rule frequently because of their competition. According to Jayatilleke, et al. [25]study private bus traffic violation very Severe for community. They collected police records in Kandy district private bus traffic violation. using that data they said traffic rule violations, such as illegal overtaking, overloading, and taking passengers outside the bus bays, were significant risk factors for private bus crashes in Sri Lanka.

Suvitha, et al. [26] have proposed reliable robust traffic management system to reduce traffic management overhead, vehicle accident and air pollution in smart cities. In that paper they used Fast Incremental Model Trees- Drift Detection method to predict and explore traffic situation road wise. They collected real time traffic date using sensor support. Regression analysis and an optimal research method was used for validate real time data.

Ghomi, et al. [27] Studied at highway-railway crossing traffic violation and accident. Classification-Regression Tree (CART) and Association Rules algorithms applied to large dataset. In that study conceded between 2006 to 2103 U.S. Federal Railroad Administration (FRA) HRGC accident database accident data for their study. According to the study they identified several factors for driver injury severity such as train speed, type of road vehicle, driver age and gender, position of road vehicle before accident, type of accident and highway pavement type. However paper did not consider traffic signal and railway safety gate availability in road-railway intersection.

According to Agrawal, et al. [28] study Association rule is the powerful techniques to explore different attribute in database. Based association rule mining Addi, et al. [29] proposed paper for improve road safety in morocco. They analyzed historical records in

morocco high vehicle density roads. Proposed model divided in to two modules such as association rules extraction module and multi criteria analyses approach

2.3 Summary

This chapter describes the previous studies done related to the road traffic violations, traffic violations management systems and related technologies. Also mentioned the factors which are directly related to the road traffic violations.

Chapter 3

3 Technology Adapted

3.1 Introduction

In this chapter most suitable and adaptable technologies are elaborated that can be selected for the project. In this project consist of implementation and research part. Web based technology use to build the system for police traffic division. Data mining techniques use for analysis traffic violation historical data.

3.2 Web based system

The proposed System for the police traffic division is designed as a web base system. There are many benefits available and easy to use eliminating problems.

3.3 Core benefits of web based applications[30],[31]

Access anywhere any time**:** If internet facility is available web application can access any where any time computer or any smart device not only accesses it can modify or update remotely login.

Cross platform compatibility: It can work in any operating system such as windows, Linux, Mac. It does not depend on build up platform. Web application can access any web browsers. Like internet Explorer, Google Chrome, Firefox.

Security: There are many security options available in web application. Such as secure protocols like https, firewalls, user management, store data in separate server.

Easier installation and maintenance: Open source web servers available it can download under GPL license like Apache. Configuration file available in understandable comment. so easy to configure and maintain. All most all web browsers are freely available in internet.

Support more language: Any of the three major technologies can be used to create web applications depending on the application requirements such as java based application (J2EE),Microsoft .NET platform (Active Server Pages, SQL Server and .NET scripting languages) and open source platform (PHP, Mysql).

3.4 Multitier architecture

Basically web applications build on client server model and 3-tier architecture. However it can expand to N-tier. Three tiers are presentation tier, application or business layer tier and data tier. In the web development usage three tiers are front end, middle and back end. Web server serving to front end. It consists of static or dynamic content. Web browsers render information into human readable format. Middle layer consists of server side scripting and business logic. Middle layer uses scripting languages to connect front end and back end (Php, Asp.net, Spring).Back end tier use for storing data and mange data using database management software [32].

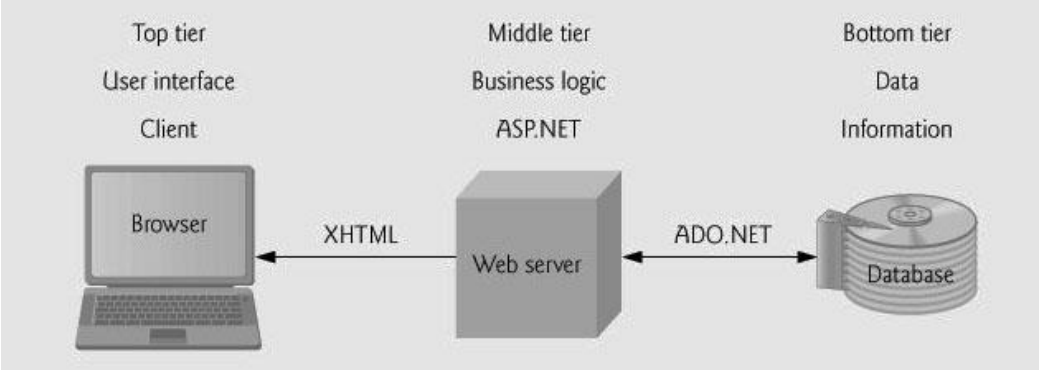


Figure 3.1 Three tier

Main benefits of 3-tier architecture are easy to mange content of any tier without affection other tiers in web application. In case of three-tier architecture, the business logic code would be resident in the middle, where you would need to make a change to the front end containing the code for your web designer. Also, if you need to change database systems, for example, from Access to Mysql, you would only need to change the database on the data server without having to make any changes within the code of middle tier.

The three-tire architecture can enhance the efficiency of web application. Because all the business logic and databases not necessary to store single server. It can use load balancing techniques and user more than one server increase performance. It can use any number of servers to backend application called n-tier or multitier architecture.

3.5 Use software's, language and packages

3.5.1 Operating System and Web server

There are many reasons to consider when selecting operating system and web server. It has selected open source operating systems for server operating system. Because most of the versions are freely available under GPL, enterprise version also chief than other windows server versions, less virus attack, high security firewall available, remote login facility and easy upgrade and maintain. Red hat enterprise latest version has been sleeted to in this project.

3.6 Web server

Web server is main software for providing web service. It is services provide many services such as store web pages, load balancing, protected web pages with SSL (secured Socket Layer).Here is the list of some web servers and what server side scripts they can run.

Web Server Name	**Support Language**
Internet information server	ASP, ASP.NET, Python, PHP
Apache	PHP, Perl, Python
Tomcat	Perl, JSP,Servlets, JavaBeans

Table 3.1 web server support languages

The following is the complete web comparison chart, tells about the platforms which they run and their cost.

Web Server	**Operating System**	**Price**
Apache	NetBSD, UNIX, AIX, OS/2, Windows 3.x, SCO, HPUX, Novell NetWare, Macintosh, Windows NT, Linux,	free
IIS	Windows 2012	Free with Win2 server

Table 3.2 web Server compression

[33]Apache web server is faster than Tom cat when considering static pages, it is more configurable than Tomcat, robust than tomcat, and apache doesn't support Server let or

java server page but it support PHP, Perl, Python like most fames scripting language. But real world situation developers want to work gather with java server let and PHP like scripting language. Then better solution is integrated this two servers. Such as Apache, for serving static content, and use Tomcat as a Servlet/JSP add-on. Hence for real world site, apache would generally be a better choice than tom cat. IIS and Apache are the two most widely deployed Web servers. Before IIS 6 version came. it has many security and modular architecture problem. IIS is not a capable server and it is commercial software. Following graph also illustrates world market still apache in number one position.

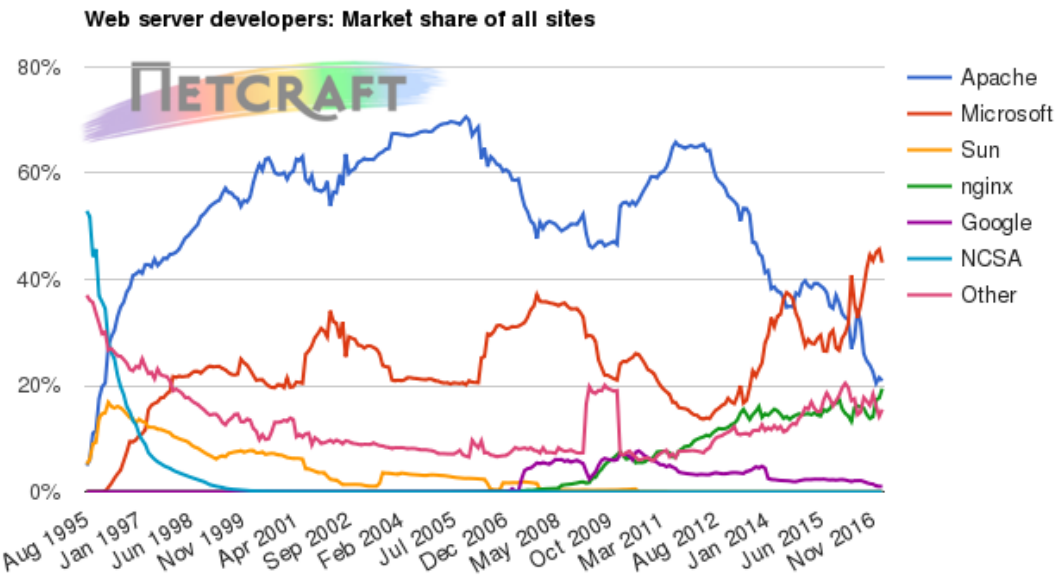


Figure 3.2 Web server distributions

3.7 Hypertext Markup Language (HTML)

HTML is not pure programming language. It is actually markup language. HTML can use with other technologies and languages. It can work with client side scripting like java script to provide interactivity in the web pages. On the server side in web development languages like PHP, ASP.NET use with html.

Server-side scripting is a web technology that allows custom HTML to be delivered to a client machine where the code that generates the custom HTML is processed on the web server before the HTML is sent to the user's machine over the internet.

3.1 Server side scripting language

PHP (PHP: Hypertext Preprocessor) is a reflective programming language originally designed for producing dynamic web pages. PHP is used mainly in server-side scripting, but can be used from a command line interface or in standalone graphical applications. The main implementation is produced by "The PHP Group" and released under the PHP License. It is considered to be free software by the Free Software Foundation.

ASP (Active Server pages) is micro soft product. It is commercial version. Following diagram illustrate difference between ASP.net and Php [34].

Factors	Asp.net	PHP
Rapid application Development	Yes	No
Multiple Programming Languages	Yes	No
Object Oriented Language	Strong	Weak
Database Support	Less	Many
Data Controls	Yes	No
Platform	Windows Only	Multiple platforms
Web Servers	IIS Only	Apache, IIS
Cost	High	Low
Support & Documentation	MSDN	Multiple Sources
Exception Handling	Yes	Yes
Mobile applications Support	High	Low
Web Services Support	Yes	Yes
Garbage Collection	Best	Constructor & Destructor
Multithreading	Yes	No

Table 3.3 Comparison PHP Vs ASP.NET

However both languages are scripting languages of choice and are equally being used to develop rich websites with database connectivity. However PHP is open source.

PHP server software ability to runs windows, Mac OS, Linux and Unix distribution.

It can change the operating system platform without changing PHP Script. Just copy them from Windows server to Unix server, and they will still work. PHP can use famous Apache, IIS and any other web server that support CGI stands. PHP also work with major data bases like MYSQL, Microsoft SQL server, oracle and Postgresql.

3.8 Databases

Many type of the bigger players in the Database market, Microsoft SQL, oracle, MYSQL, they are offer several different database management solutions. These are most popular database management system. Microsoft and oracle are commercial software, However MYSQL open source software. In this project MYSQL has been selected for database management system.

3.8.1 Features of MYSQL

MYSQL is Cross-Platform**:** Develop database on a Windows laptop and deploy on Windows Server 2008, a Linux server, an IBM mainframe, or an Apple XServe, just to name a few potential platforms. Even set up replication using a master on a Windows platform with Linux slaves. It's incredibly easy to move between platforms

MYSQL is fast: MYSQL can help achieve the highest performance possible with available hardware, helping to cut costs by increasing time between server upgrades.

MYSQL is Free: MYSQL is Open Source software. As per its GPL license, you are free to redistribute those changes as long as your software is also Open Source. However oracle, MS sql server are commercial software.

3.9 Client side Scripting languages

Client side scripting language runs on client machine. It actually runs on web browser software. It is provides many features to users.

Features of Client side scripting [35]

Makes interactive web pages

Make stuffs work dynamically

Interact with temporary storage

Works as an interface between user and server

Sends requests to the server

Retrieval of data from Server

Interact with local storage

Provides remote access for client server program

There are many client side scripting languages. Such as java script, Cascading Style Sheets (CSS), jquery, Ajax, etc. All above languages are used for this project.

3.9.1 Java Script

Java script is high level interpreted language. It is commonly found embedded in HTML code and used to enhance HTML pages. It is provides interactive and dynamic fashion to web pages.

3.9.2 Jquery

Jquery is library of java script. It is easy to uses animation and event handing in web application. The only difference is that jQuery has been optimized to perform many common scripting functions in fewer lines of codes.

3.9.3 AJEX(Asynchronous JavaScript and XML)

AJAX is a technology for creating better, faster, and more interactive web site with the help of HTML, XML, CSS, and Java Script.

Usage of AJEX[36]

Update a web page without reloading the page

Request data from a server - after the page has loaded

Receive data from a server - after the page has loaded

Send data to a server - in the background

3.10 Cascading Style Sheets

It is use for format the web page layout. Using CSS it is easy to maintain uniform look of the web site. It can easily formatted text, table, layout, images, paragraphs, etc

3.11 Bootstrap

Bootstrap is popular front end web development frame work. It is free and open source. It has HTML and CSS based web designing template. Using bootstrap easily design and formatting button, forms, navigation, page layout and other interface component. Bootstrap provides a way for developers to easily build responsive websites rather than designing them from scratch. In this project use bootstrap for interface design.

3.12 Luhn Algorithm

[37]Luhn algorithm is very popular algorithm for validating bank and other security numbers. It is also called modular 10formula. it used to validate a variety of identification numbers, such as credit card numbers, IMEI numbers, National Provider Identifier numbers.

3.13 Collective Account

[38]A collective account is a control or savings account that a beneficiary uses to collect and administer social security or SSI funds allocated to the recipient by each beneficiary they represent. The recipient must use the collective account to pay the recipient's expenses. The recipient must document expenses in a bookkeeping account and keep separate records in the records for each recipient and recipient associated with the collective account.

3.14 Data mining

Data mining can be used for the process of extraction of interesting, nontrivial, implicit, previously unknown and potentially useful patterns or knowledge from huge amount of data.

It is the set of activities used to find new, hidden or unexpected patterns in data or unusual patterns in data. Using information contained within data warehouse; data mining can often provide answers to questions about an organization that a decision maker has previously not thought to ask.

Data mining tools can answer business questions that traditionally were too time consuming to resolve.

3.14.1 Rapid Miner

Rapid Miner is a data science software platform developed by the company of the same name that provides an integrated environment for data preparation, machine learning, deep learning, text mining, and predictive analytics. It is used for business and commercial applications as well as for research, education, training, rapid prototyping, and application development and supports all steps of the machine learning process including data preparation, results visualization, model validation and optimization.[39]

Rapid Miner can implement many Data mining Algorithm such as clustering ,regression, association rule mining, Fp Growth ,etc. it also reach many extension it can be download and install easily via rapid miner official website. It supports some weka data science software algorithms like appori.

3.14.2 FP growth Algorithms

[40]FP growth is frequent pattern growth. It is developed base on apriori algorithm. It is used to find frequent item set without generating candidate item set big data.

3.14.3 Association Rule

[41]It is represent probability of relationship between item in big data. It work like if then statement. It is widely used for discover pattern in big data. An association rule has two parts: an antecedent (if) and a consequent (then). An antecedent is an item found within the data. A consequent is an item found in combination with the antecedent.

3.14.3.1 Support and Confidence in association rule

3.14.3.1.1 Support

[42] The rule $X \Rightarrow Y$ holds with support s if s% of transactions in D contain $X \cup Y$. Rules that have a s greater than a user-specified support is said to have minimum support. Table 3.4 shows example of Support

TID	Items	Support = Occurence / Total Support
1	ABC	
2	ABD	Total Support = 5
3	BC	Support {AB} = 2 / 5 = 40%
4	AC	Support {BC} = 3 / 5 = 60%
5	BCD	Support {ABC} = 1 / 5 = 20%

Table 3.4 support example

3.14.3.1.2 Confidence

[42]The rule X ⇒ Y holds with confidence c if c% of the transactions in D that contain X also contain Y. Rules that have a c greater than a user-specified confidence is said to have minimum confidence. Table 3.5 shows example of confidence.

TID	Items	Given X ⇒ Y Confidence = Occurrence {Y} / Occurrence {X}
1	ABC	
2	ABD	
3	BC	Confidence {A ⇒ B} = 2 / 3 = 66%
4	AC	Confidence {B ⇒ C} = 3 / 4 = 75%
5	BCD	Confidence {AB ⇒ C} = 1 / 2 = 50%

Table 3.5 Confidence Example

3.15 Summary

In this chapter focused on what are most suitable technologies to use fulfill research aim and objectives. Also discussed advantage and disadvantages of these technologies.

Chapter 4

4 Approach

4.1 Introduction

In this chapter discuss how to design the web base traffic management system and analysis model using previously chapter discuss technologies.

4.2 Approach for web base system

Decision support system for traffic violation is included in this research. According to this research it is divided in to two parts. First part is implements web based application for police traffic division and other related authorities. Red hat Enterprise operating system, Apache web server and MYSQL database have been used for web server. After analyzing manual process of traffic division and related authorities identified users, user authority level, process, input data, validation and what type of report should generate. In this requirement and processes clearly design using use case diagram and entity relation diagram. In the program development stage HTML is used for basic languages. Bootstrap frame work has been used to interface design. Java script, Jquery, and ajex is used to implement dynamic look and data validation process. PHP is used to server side coding and connect data bases. MYSQL is used for create databases.

Police officer can access the system privileges in their authority level to do their day to day activities. Law enforcement authorities access the system for updating fine and laws, generate report and search information. Also civil persons have interface to access the system. Such as pay fine online, get information about traffic laws, new update and submit their complaints to relevant authorized persons.

4.3 Approach pay fine

Fine pay system is also very important module of this web base system. It is designed by using collective account concept and Luhn algorithm. 15 digits reference number

generate for identified paying information. This number consists of two parts. First 14 digit generate by using violation information such as violation number, police officer identification number and police station Number. Last digit of reference number is generated by Luhn algorithm using first 14 digits.

4.3.1 Validate reference Number

In this purposed model validate reference number in bank system and automated money collect machine system before collect the fine. It uses first 14 digits and regenerate last digit using Luhn algorithm.

4.4 Approach to a Data Analysis

Second part of this project is identified traffic violation pattern, frequent traffic offence, what the attribute related to traffic offence and frequent offence places. Galle, Imaduwa and Tangalle police area are selected to get previous traffic violation information. Galle and Tangalle are urban area. There are lot of similarities these two cites. Such as Road infrastructure, population, Different nationalities, vehicle density. However imaduwa is not a big city. Most of the areas are rural. Vehicle density is low.

4.4.1 Data collection

First we gathered data in three police station using their log books. The data is very inconsistent and they restrict to gather some fields. Offence type, data, time ,gender, vehicle type, punishment type, fine amount, offence place and driving license number are gathered. Drivers who did offences more than once collected. Microsoft Excel is used for storing data. Show police station collect data.

offence	offence place	Date	time	male/Female	Driving licence no	adderss	vehicle number	vehicle type	fine	fine
2	Imaduwa	30-Apr	9.05	f	B2951758	habaraduwa	SP-BBC-6359	2	500	
5	Imaduwa	30-Apr	10.15	m	B809200	Paragoda	SP-HU-2907	1	150	
3	Imaduwa	30-Apr	15.3	m	DL521450	panadura	SP-HC-7825	1	500	
3	Imaduwa	30-Apr	17	m	B952150	Angulugaha	SP-QP-5946	1	500	
17	Imaduwa	30-Apr	17.3	m	B3389895	Imaduwa	SP-KV-3349	6	500	
2	Imaduwa	30-Apr	17.4	m	B3259992	Kodagoda	SP-BE-7957	2	500	
3	Imaduwa	30-Apr	19.13	m	b1611058	Imaduwa	sp-wl-2651	2	500	
5	Imaduwa	30-Apr	9.2	m	b203222	galle	sp-vr-3422	2	150	
5	Imaduwa	30-Apr	9.25	m	B3066471	PARAGODA	SP-GZ-9335	1	150	
5,7	Imaduwa	30-Apr	9.4	M	B942352	Kodagoda	NW-AAK-6750	1	150	
5	Imaduwa	30-Apr	11.3	M	B368890	Pitabaddra	Sp-LC-3558	7	150	
2	Imaduwa	30-Apr	19.3	m	B1283767	Galle	Sp-BDQ-1423	2	500	
2	Imaduwa	30-Apr	20	m	B279115	Angulugaha	SP-UM-5920	2	500	
2	Imaduwa	30-Apr	20.3	m	B3581010	Imaduwa	Sp-QX-4577	2	500	

Table 4.1 police collect data

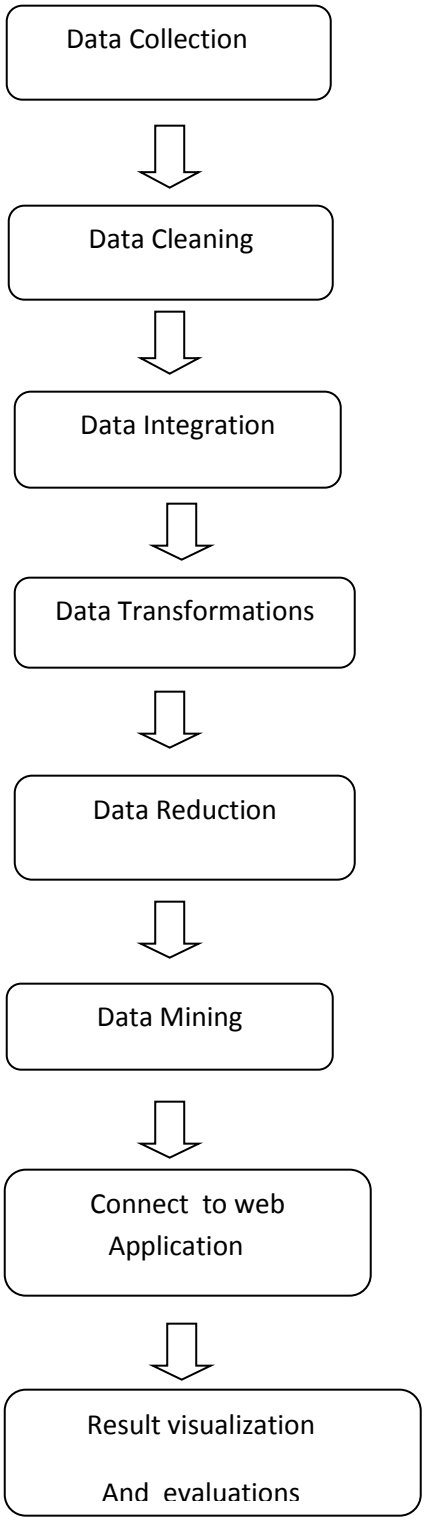


Figure 4.1 Model for Data Analysis

4.4.2 Data cleaning

There are many outliers available in that primary data such as missing data, data duplicate, inconsistent data and data duplicates. Microsoft excel filter and other basic function used for correction of data.

4.4.3 Data Integration

In this research there are 3 police stations used for gathering data. In the data integration stage build one data source using three police station data.

4.4.4 Data Transformation

Data transformation is the big task in this research. Because different type of data, different format, and many discrete values.

In offence column actual offence name in too long so offence represent “off” and offence Number table4.6 represent actual offence name and represent symbol.

According to the data set police punished violated drivers in different type table4.2

Represent discrete punishment type.

Punishment type	description
Fine paid	Police issue fine paper for violated offence
Court	Sometime driver violates more than one rule or some serious violation police decide to file case in court
No fine	Unauthorized modification, leakage of necessary part police warning to repair and represent vehicle to police

Table 4.2 punishment type

According to the offence There are different fine amount revised by the police. In analysis purpose table4.3 shows fine amount categories. No fine category also divides in to three types

Fine category	description
1_100	Fine amount between Rs 1.00 and Rs100.00
101_500	Fine amount between Rs 101.00 and Rs 500.00
501_1000	Fine amount between Rs 1501.00 and Rs1000.00
1001_2500	Fine amount between Rs 1001.00 and Rs 2500.00
2501_5000	Fine amount between Rs 2501.00 and Rs5000.00
5001_10000	Fine amount between Rs 5001.00 and Rs10000.00
Over_10001	Fine amount is over Rs 10001
Repair	No fine charged, vehicle should be repair and represent to police
Made	No fine charged, vehicle should be added to necessary part and represent to police.
Remove	No fine charged, owner should be remove unauthorized parts and represent to police

Table 4.3 fine type

According to the data set there are eight vehicle types identified table4.4 shows type of vehicle in my data set.

Id	Vehicle type
1	Motor bicycle
2	Three Wheelers
3	Bus
4	Van
5	car
6	Lorry
7	Small lorry
8	Tipper

Table 4.4 vehicle type

Offences are recorded in all time in the day. So there are many discrete time values. In the analysis processes this values divided in to several time intervals. Excel if function used to convert the actual time in to interval table4.5 shows this time intervals.

interval	description
00 AM to 6.00AM	Time between 00AM to 6.00 AM
6.00AM to 10.00AM	Time between 6.01AM to 9.00AM
10.01 AM to 2.00PM	Time between 10.01Am to 2.00 PM
2.01 AM to 7.00 PM	Time between 2.01 AM to 7.00 PM
7.01 AM to 9.00 PM	Time between 7.01 AM to 9.00PM
9.01 PM to 12.00PM	Time between 9.01 PM to 12.00PM

Table 4.5 Time Interval

4.4.5 Data Reduction

Some drivers punished by more than one offence however frequency is very low so offence 2 and offence3 are not considered for this research. Driving license number and offence place recorded in the data set however it removes in analysis data set because it has many discrete values

4.4.6 Data Mining

Rapid miner data science software is used for analysis data. Aim of analysis is to find frequent paten in traffic violation. Association rule is used to find frequent pattern and also use w-appori rapid miner extension to find frequent largest item set.

4.4.7 Connect to web Application

Rapid Miner result is extracted to excel sheet using rapid miner extension and import to Mysql database using PHP.

4.4.8 Result visualization and Evaluations

Association rule results are displayed in web application in nicely formatted user friendly way. Final data set divided in to two parts such a training data and test data. Training data set association rule results are tested using test data result

offence id	Symbol	offence
1	off1	Block Access
2	off2	Riding without helmet
3	off3	Not driving along the left side
4	off4	Ridding Running Boards etc
5	off5	Carriage of Persons in exccss
6	off6	Hands not on the handle
7	off7	parking
8	off8	Driving without License
9	off9	Drank and Drive
10	off10	Block When Turning
11	off11	Improper Overtaking
12	off12	Revenue License without carring
13	off13	Sound or Light Warninges
14	off14	Stop on the predestrion crossing
15	off15	Block By Stop at the Bus Halt
16	off16	Driving without Registering
17	off17	Shapes of the Identification Plates
18	off18	Driving Without Insurance
19	off19	Way to traffic from the right
20	off20	Fail to keep the left when turning Left
21	off21	Use Mobile while driving
22	off22	Driving without Number plats
23	off23	Position of the Driver
24	off24	Unclear licensee
25	off25	Driving Without Right Door
26	off26	Driving with Unconditioned tyre
27	off27	Driving with Inactive Signal lights
28	off28	Signal Direction of Police officer
29	off29	Obstruction moving from the lane
30	off30	Fixing Additional part
31	off31	Driving Without Head lights
32	off32	No of passengers in front Seat
33	off33	Overtake without considering White Line
34	off34	Driving with Extra lights
35	off35	Driving Without Side Mirrors
36	off36	Driving to Wrong Directions
37	off37	Dangers Driving
38	off38	Driving without Break lights
39	off39	Traffic on the main road

Table 4.6 offences

Chapter 5

5 Methodology

5.1 Introduction

Aim of this chapter is to represent step by step procedures to implementation of web based system and data analysis part. It includes different type of diagram, programming code, algorithms and data mining techniques.

5.2 Traffic violation Management System

Here followed unstructured methods (combination of Interviews and Written Information fact finding techniques) for analysis the current system of traffic section. Discussed with traffic officers and get idea about their responsibilities, what information has collected in traffic unit and how current system work and method of use for information transferring.

Based on gathered information Figure 5.1 shows top level use case diagram and figure 5.2 shows activity diagram of traffic violation management process

5.2.1 Design databases

Traffic rules and fine define and update by law enforcement authorities. Drivers and road users are violating rules. Police Traffic division catch and investigate rule violation. Sometimes Drivers can violate more than one rule. The Same driver violate rule in different vehicle. Handle this type cases, it should be good database design.

The database is a major concept of the computer software or web system which use to store information. The database which use for web base traffic violation system, was designed by using data normalization method and Entity-Relationship modeling (ER Modeling).

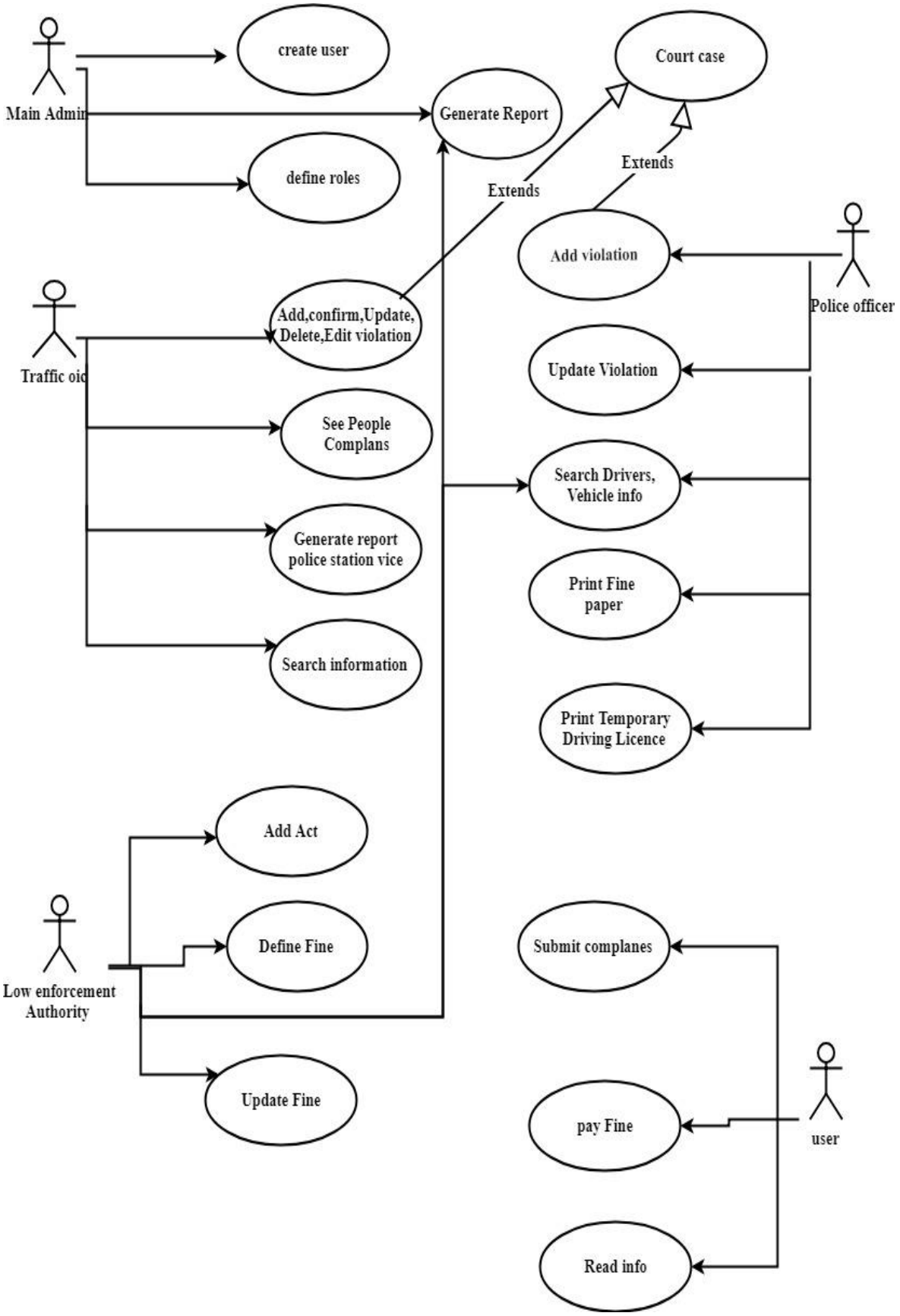


Figure 5.1 Top level process Use case Diagram

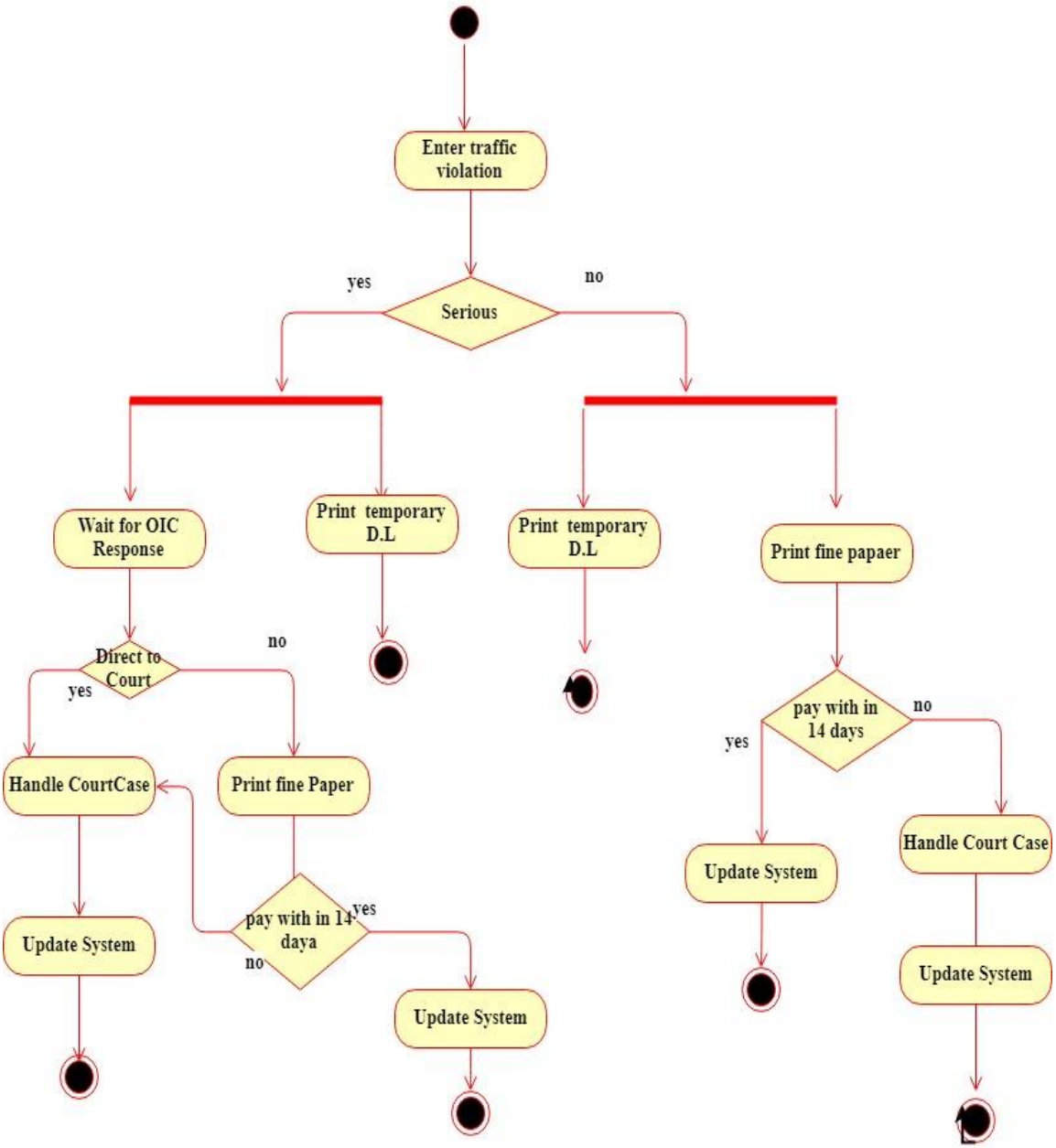


Figure 5.2 Activity Diagram Traffic Violations process Handle

The ER modeling facilitates to design the data base and ER diagrams also can be used to describe the data base. Entity, Attribute and Relationship are the major concept of the ER model. Entity can be real world physical object and Attributes representation their particular properties or characteristics A meaningful association between entities called as a Relationship. This system has 11entities.

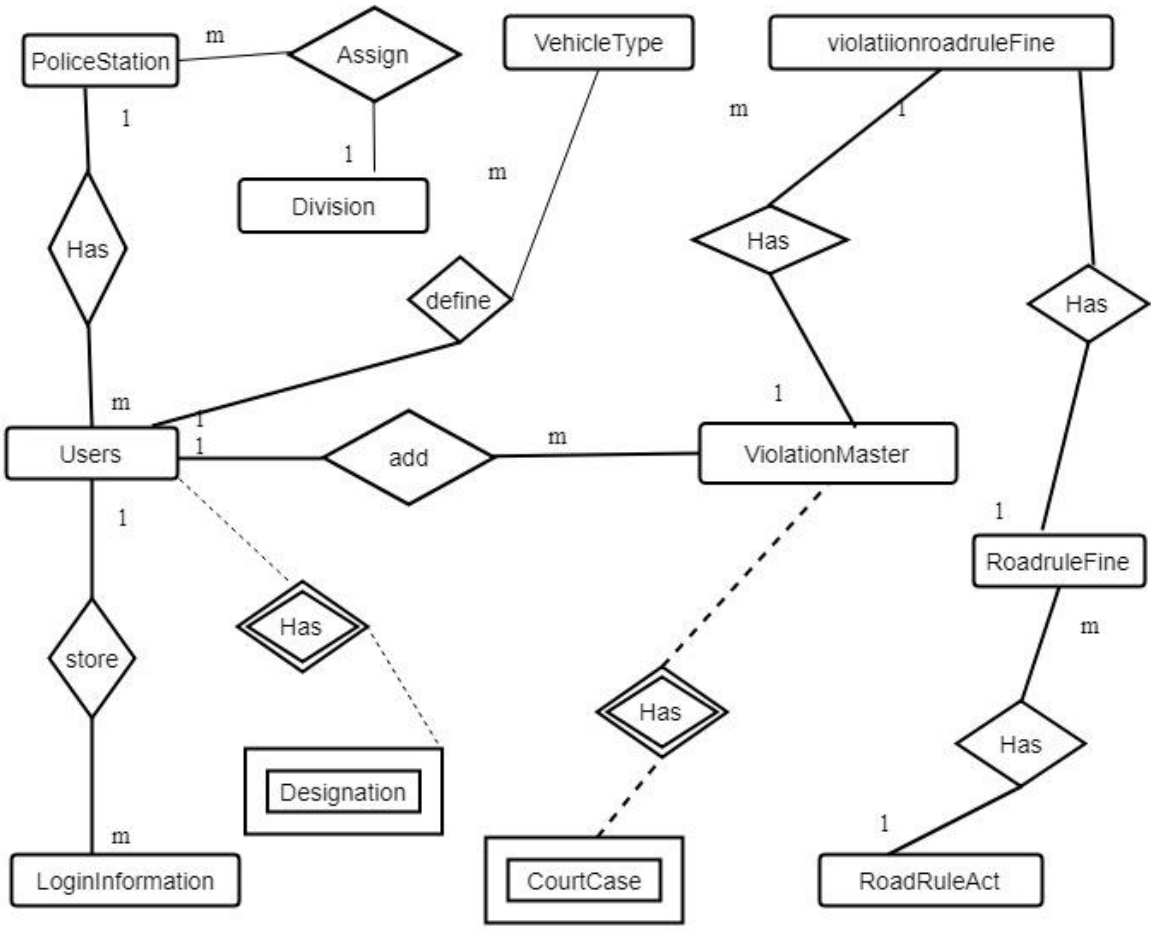


Figure 5.3 ER Diagram

5.2.1.1 The Entity

Users entity: user entity represent all user and privilege level in the system.

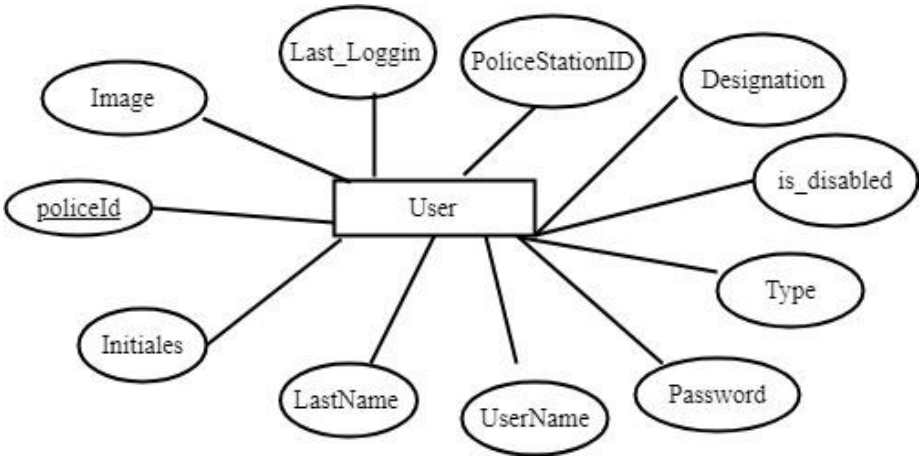


Figure 5.4 User Entity

Attribute description about user entity

PoliceID	Unique, police identification number
image	User image
policestationID	Current working police station id
Designation	Designation of offcer
Is_disabled	
Type	User type (Administrator, privilege user or normal user
password	User password
username	username
lastName	User last name
Initials	Initial of the user
Last_logn	Last login time

Table 5.1 Attribute of User Entity

User login Information entity: in this table use to user login time and activities

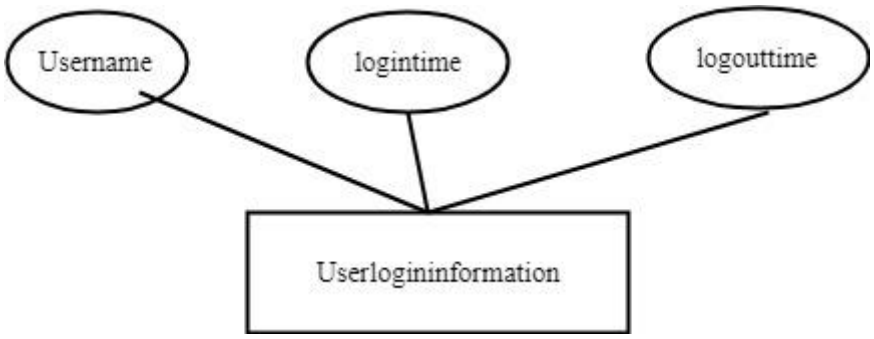


Figure 5.5 User login information Entity

username	Username of user
logintime	User entire time in system
logouttime	Logout time in system

Table 5.2 Attribute of login information Entity

Division Entity : several police stations managed and ruled by a division. It is uniquely identified by division number

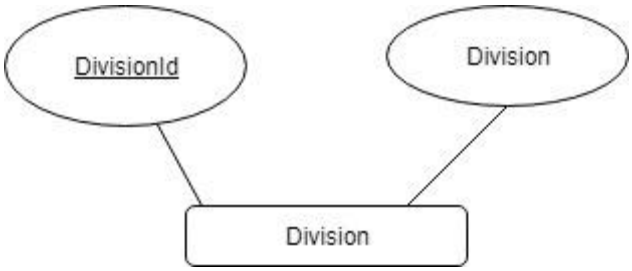


Figure 5.6 police Station Entity

DvisionId	Each division uniquely identified by division id
Division	Police division name

Table 5.3 Attribute of Division Entity

PoliceStationEntity : define island wide police station their number and name

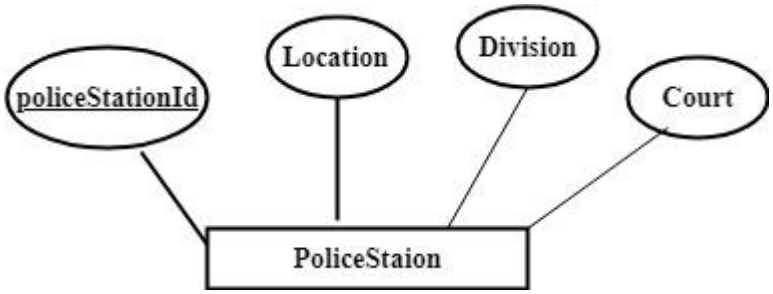


Figure 5.7 police Station Entity

PoliceStationId	Each police station has unique number
Location	Police station situated location
Division	Each police station rule by division
Court	Each police station assign to court for file case

Table 5.4 Attribute of Police station Entity

VehicleType Entity: all the vehicle type identified by id number and name

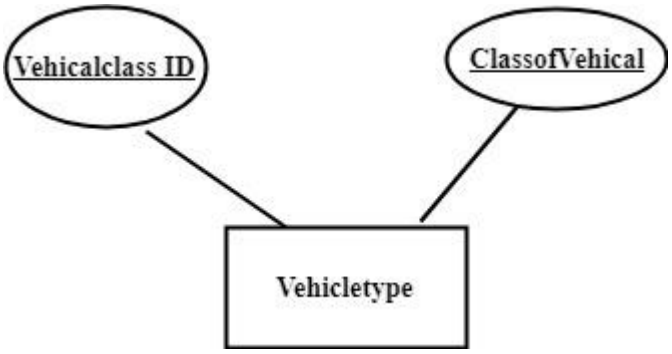


Figure 5.8 vehicle type Entity

vehicleClassId	Unique number to each vehicle
Classofvehicle	Vehicle name

Table 5.5 Attribute of Vehicle type Entity

Violation master entity : this table include violation basic information

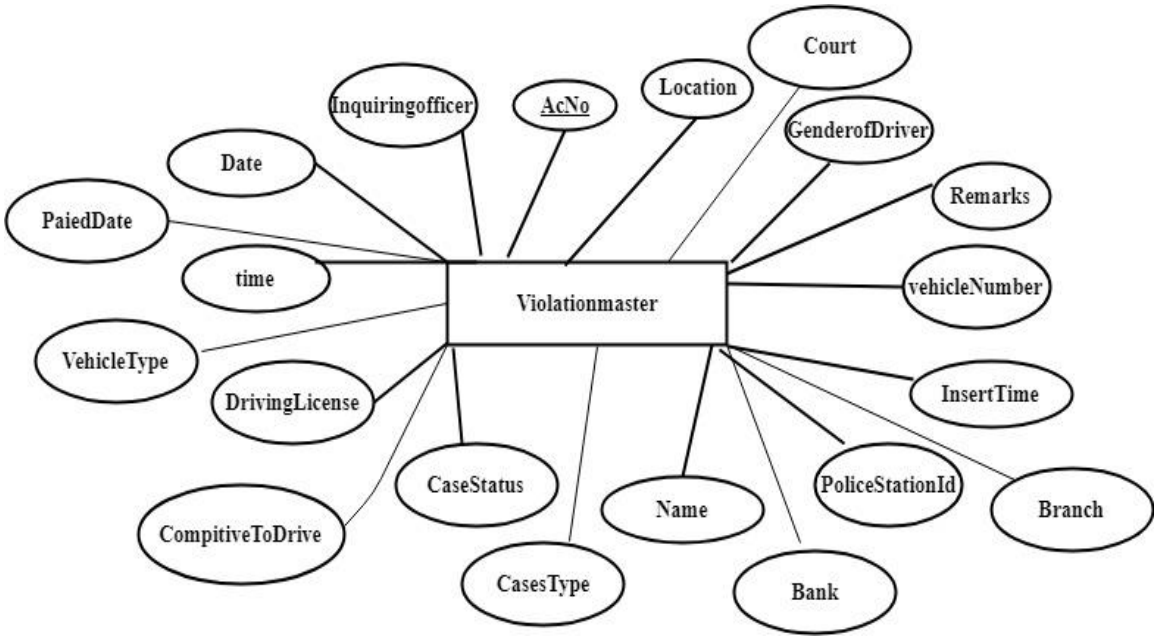


Figure 5.9 Violation master Entity

ACNo	Each incident identified unique number
Location	Location of offence
GenderOfDriver	Gender of driver
Remark	Special think
vehicleNumber	Unique vehicle identification number
InsertTime	Offence insert time in system
PoliceStationId	Investigation officer police station Id
Name	Name of traffic rule violator
casestatus	Current status of case
DrivingLicence	Violator driving license number
Time	Offence time
Date	Offence date
Inquiringofficer	Inquire officer police id
VehicleType	Type of Offence vehicle
Court	Police Station Assign Court Name
CaseType	Normal case or Court case
Bank	Fine Pay Bank
Branch	Fine Pay Branch
PaiedDate	Fine pay date

Table 5.6 Attribute of violation Master Entity

RoadRuleActs entity :

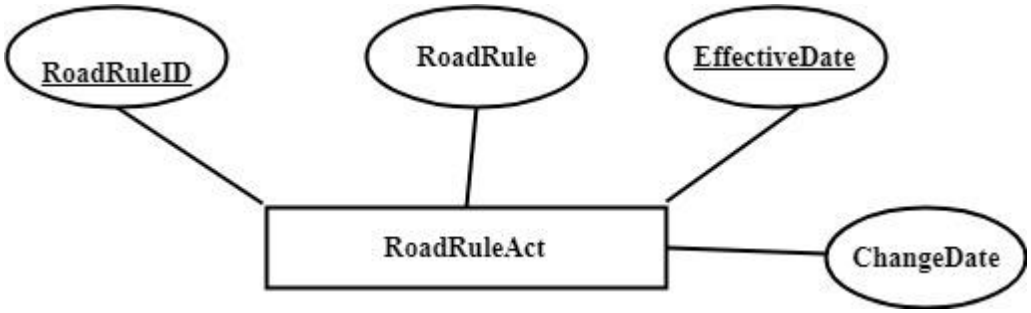


Figure 5.10 Road Rule Act Entity

RoadRuleID	Actual low id in road rule
RoadRule	Name of the road rule
EffectiveDate	Effective date of rule
cangedate	If update, update date

Table 5.7 Attribute of Road Act

RoadRuleFine entity : in this entity use to define and update fine.

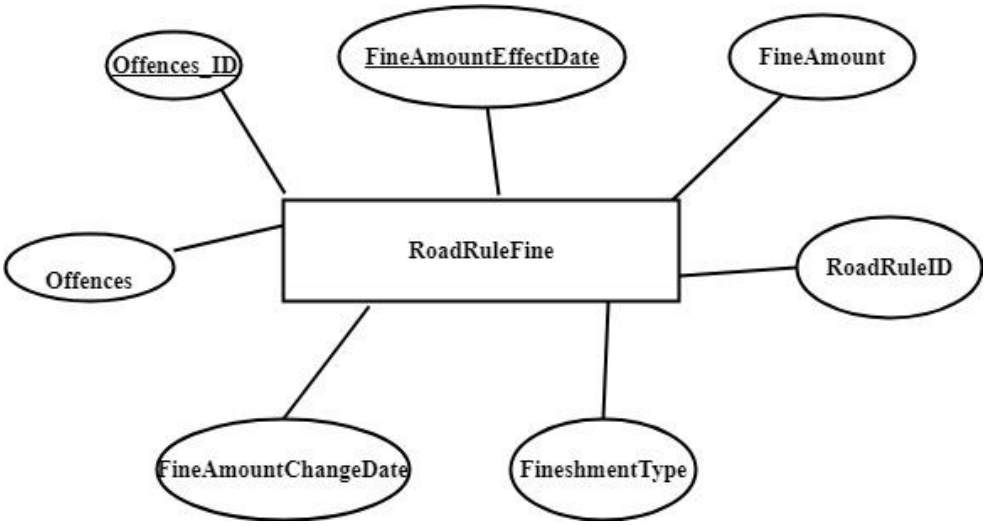


Figure 5.11 Road Rule Fine

offenceId	Unique id of offence
Offence	Name of the offence
FineAmount	Fine value of offence
RoadruleId	Offence id related rule id
FunismentType	Describe the funesment fine court or repair
FineAmountEffectDate	Effective date of current fine amount
FineAmountChangeDate	Fine amount update date

Table 5.8 Attribute of Road Rule Fine

ViolationRoadRuleFine entity: some drivers or vehicles same time violate more than one rule. In this cases easily manage by this entity

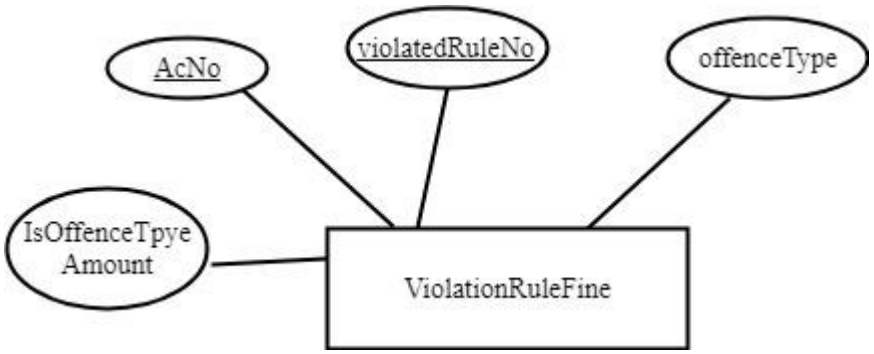


Figure 5.12 Violation Rule Fine Entity

Acno	Each incident identified unique number
violatedRuleNo	Violated rule identification number
offenceType	punishment type offence court or fine or repair
IsoffencetypeAmount	Total fine amount

Table 5.9 Attribute of Violation Rule Fine

Courtcaseentity : this entity depends on violationmaster entity. It is called week entity

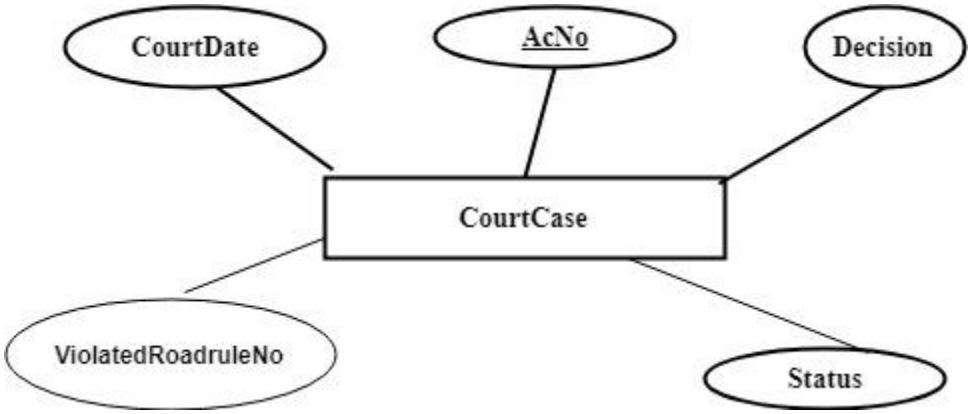


Figure 5.13 Court case Entity

AcNo	Each incident identified unique number
courtDate	Date of court commence
Decision	Decision of court
ViolatedRoadRuleNO	Violated road rule Number
Status	Case Status , Finish or Active Case

5.10 Attribute of Court case Entity

In this system contains basic three modules

1. Law enforcement authority module
2. Police traffic division module
3. Civil people module

5.2.2 Low enforcement authority Module

In this module develop for higher administration person and authorities. Such as low and order ministry, Department of Attorney General, police commission, police head quarters and Inspector General of Police.

5.2.2.1 Task of module

Overall administrations of web application.

Manage users account and user permission.

Add and updating traffic rules fine.

Generate island wide report

Manage fine pay module

Publish educational information about traffic rules.

Revised civil people complaints.

Maintain system backup

5.2.3 Police traffic division Module

In this module facilitate to police station traffic division to do their day to day activities easily. There are two user levels available in this module. One is traffic division office in charge. It is administrative privileges user in the station. Other user is police officer.

Main task of the module.

Add traffic violated details in to system.

Issue fine paper

Issue temporary driving license

Update traffic violation

Manage court case

Generate police station vice report

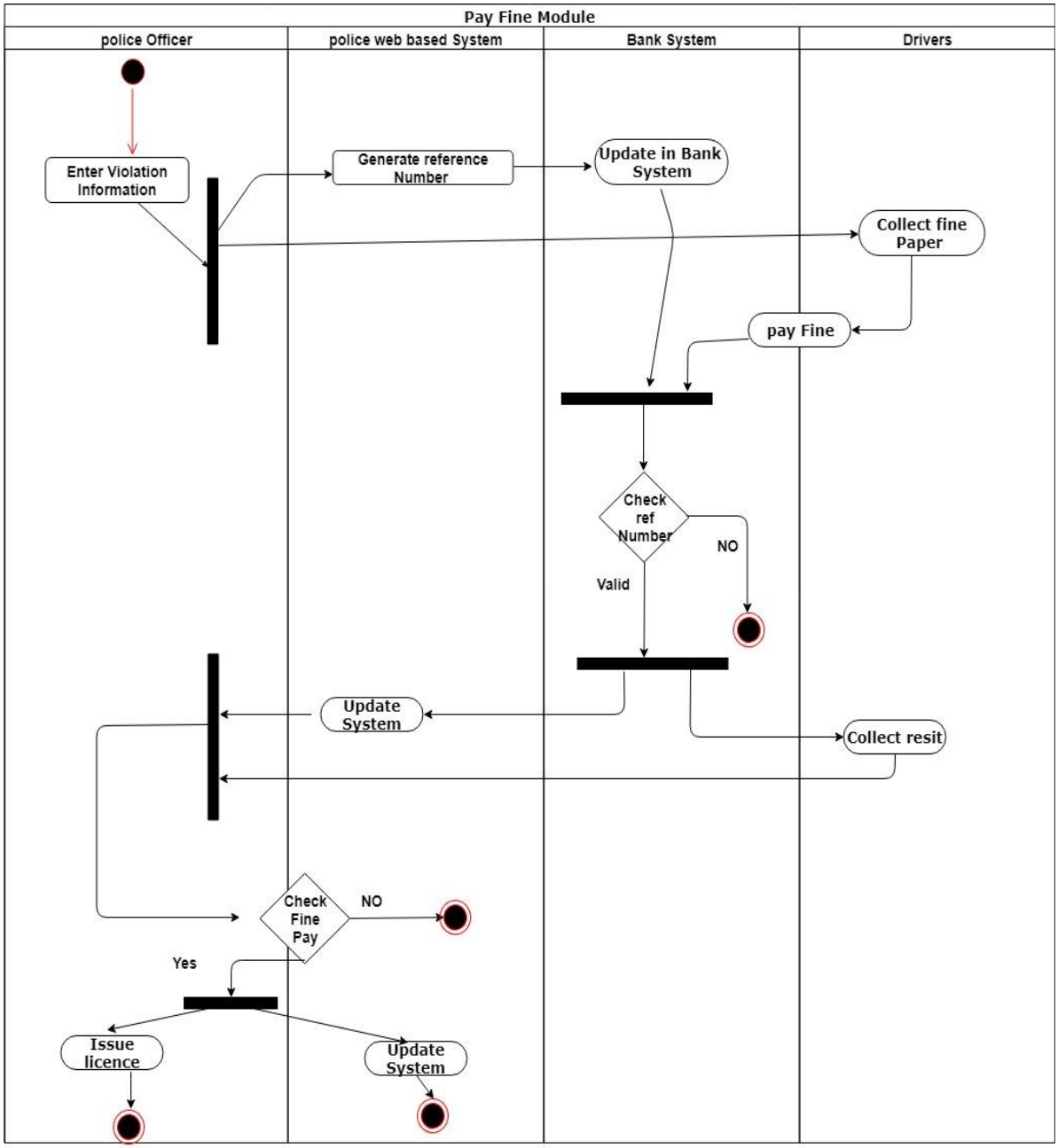
Search vehicle and driver information.

5.2.4 Civil people or driver's module

The module is basically designed to help drivers who were involved in traffic offenses to avoid difficulties in fine pay and recovering driving license. Also people can directly complaints to higher level officers about their problems.

5.2.4.1 Method to fine pay

Figure 5.14 represent Purpose model activity diagram for fine pay model



Text

Figure 5.14 Activity diagram of fine pay model

5.2.5 Generate reference Number

In fine pay process it is very important to identify correct information about violated offence and other detail. It should be use to secure and trusted method to all the parties such as police bank and violated persons. To solve this problem it is define 15 digits reference Number. It has two parts and includes all related information about violated offence.

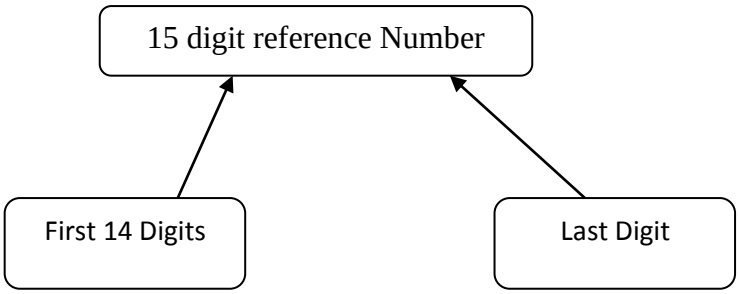


Figure 5.15 Reference Number

5.2.5.1 First 14 Digits

First 14 Digits consist of violation information

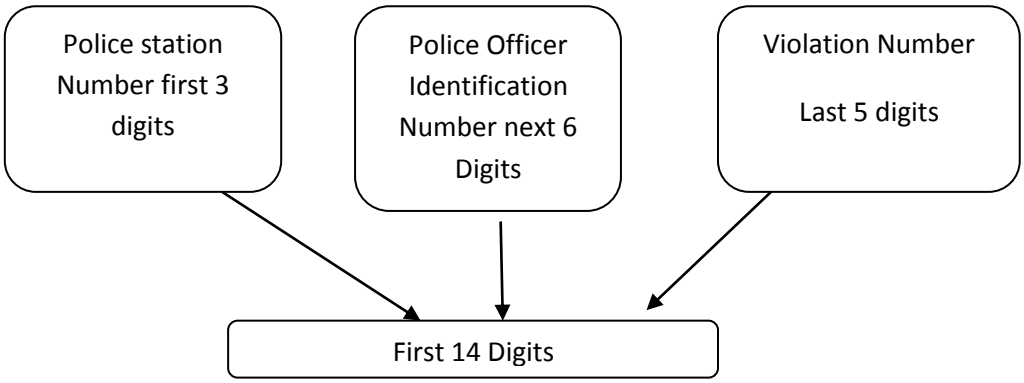


Figure 5.16 First 14 digits

5.2.5.2 Last Digit

First 14 Digits use to input for Luhn algorithm and generate last digit. It shows figure 5.15

```php
<?php
class Luhn{
    private $sumTable = array(array(0,1,2,3,4,5,6,7,8,9),array(0,2,4,6,8,1,3,5,7,9));
    public function calculate($number){
        $length = strlen($number);
        $sum = 0;
        $flip = 1;
        for($i=$length-1;$i>=0;--$i) $sum += $this->sumTable[$flip++ & 0x1][$number[$i]];
        $sum *= 9;
        return (int)substr($sum,-1,1);
    }
    public function calculateOld($number){
        $length = strlen($number);
        $sum = 0;
        $p = $length % 2;
        for($i=$length-1;$i>=0;--$i){
            $digit = $number[$i];
            if($i % 2 != $p){
                $digit *= 2;
                if($digit > 9){
                    $sum += $digit[0];
                    $sum += $digit[1];
                } else{
                    $sum += $digit;
                }
            } else{
                $sum += $digit;
            }
        }
        $sum *= 9;
       return (int)substr($sum,-1,1);
    }
public function validate($number,$digit){
        $calculated = $this->calculate($number);
        if($digit == $calculated) return true;
        else return false;
    }}?>
```

Figure 5.17 Luhn Algorithm

5.2.6 User Role (Actors)

There are five type of users directly involve with the traffic System.

Police officer: Add traffic offence in to system and search drivers and vehicle information.

Main administrator: in this user can control the all the activities system. Person is responsible for the Inspector General of Police and the Attorney General's Department. Task of user are Create users, Update users or user privileges and Define user privileges

Law enforcement authority user: In this user responsible defining act, fine and updating process. Person is responsible for Attorney General's Department. Also user can generate island wide report, search information and analysis data features are available.

Administrative officer each police station: in this user responsible police stations activities. In this user responsible for managing traffic related activities in privileges manner. Such as edit case, finish case, generate police station wise report, etc.

Civil users: pay fine online and can view existing / new rules and regulation, what are the most dangers place in the road system like summarize data.

5.2.7 Reports/Charts

Reports and charts are very important to get decision easily to authorized persons. In this system PHP, Jpgraph library use to generate charts

5.3 Methodology for data Analysis.

Main aim of the research is find frequent pattern in collected historical police data set. Rapid Miner data science software used for the task.

[43]Association rule is very popular machine learning techniques. It used this research to find traffic violation pattern Before apply association rule in the data set. FP Growth algorithm used for find largest frequent item set

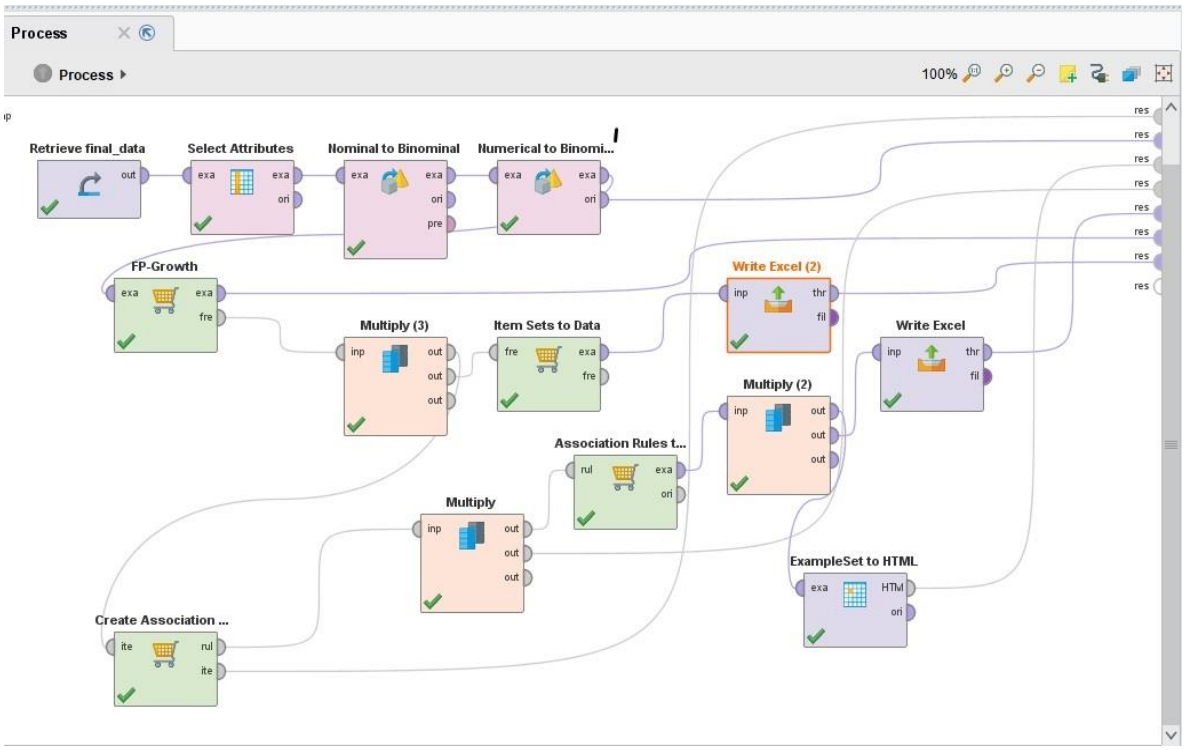


Figure 5.18 Rapid Miner Process

Figure 5.18 shows creating association rule process in using Rapid miner. There are many sub process and techniques used to get final output of association rule.

5.3.1 Sub process of Create Association Rule

Select attribute

Nominal to binomial

FP-Growth algorithm

Multiply

Item set to data

Create Association rule

Association rule to example set

Write Excel

Example set to HTML

Select Attribute

Select attribute use to select important column in available data set. There are many options available in select attribute such as select all, subset, single, etc.

Nominal to binomial

FP-Growth and association rule can apply only Binomial values (True /False). The Nominal to Binominal operator is used for changing the type of nominal attributes to a binominal type.

FP-Growth algorithm

It is used to frequently occurring item set in the data set. It has several important attributes such as minimum support, min_items_per_itemset, max_items_per_itemset, etc

Multiply

It is used to get more than one same output

Item set to data

FP-Growth generate frequent item set . However that item set cannot export to Excel or other format. Item set to data function facilitate to Export Excel format.

Create Association Rule

It is main aim of the process. It can generate association rule using frequent item set. Minimum confidence is the important attribute of association rule. It directly defends on number of association rule generate. it can be change zero to one. Minimum confidence high more less rule. Minimum confidence is low generating more rules.

Association rule to example set

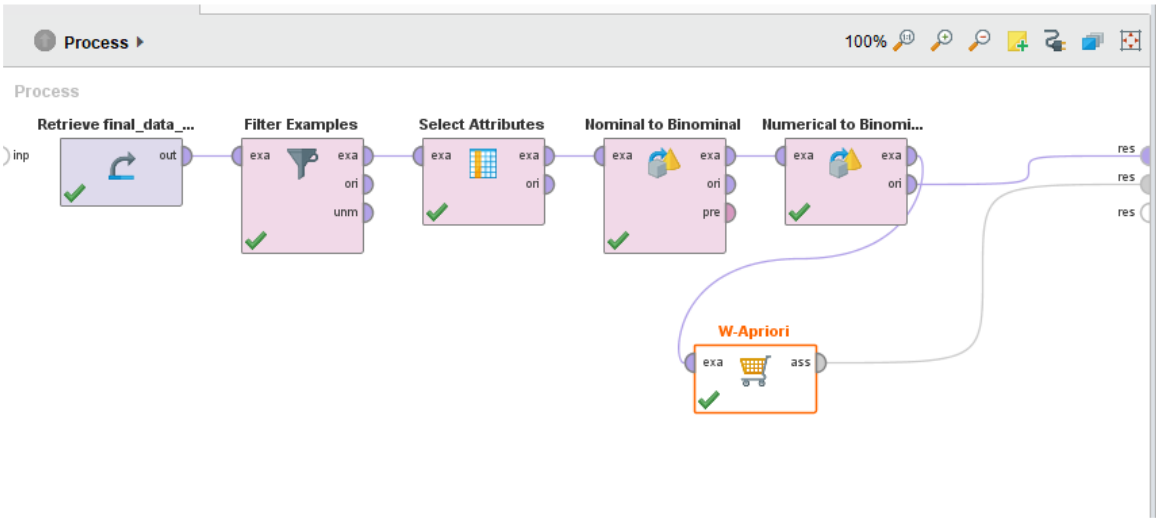
Association rule out put cannot export other format. This function facilitate to Export Excel format.

Write Excel

It used to export result in Excel format

5.3.2 W -Apriori

W -Apriori extension used to execute Apriori algorithm in rapid miner for find frequent largest item set figure 5.19 show rapid miner process in W -Apriori



5.19 W-Apriori process

w-Apriori have two main attribute such as support and confidences. In this process change these two attribute and get optimal results. In final result 0.1 selected for support and 0.3 selected for Confidence.

5.4 Summary

In this chapter step by step discuss how to build traffic management system and historical data analysis using data mining theories.

Chapter 6

6 Implementation

6.1 Introduction

In chapter 4 and chapter 5 design the solution has been described in terms of what each component does. This chapter implementation of each component regarding web base traffic management system and association rule algorithms. In that sense this chapter is how the system is implemented.

6.2 Implementation web base Traffic management System

Before access the web-based traffic management system all the users should be log in to the system in their username and password. Following figure display the login interface.

Figure 6.1 login interface

Different user type has different welcome screen and different user menus in their privileges level. Figure 6.2 display the administrator login screen.

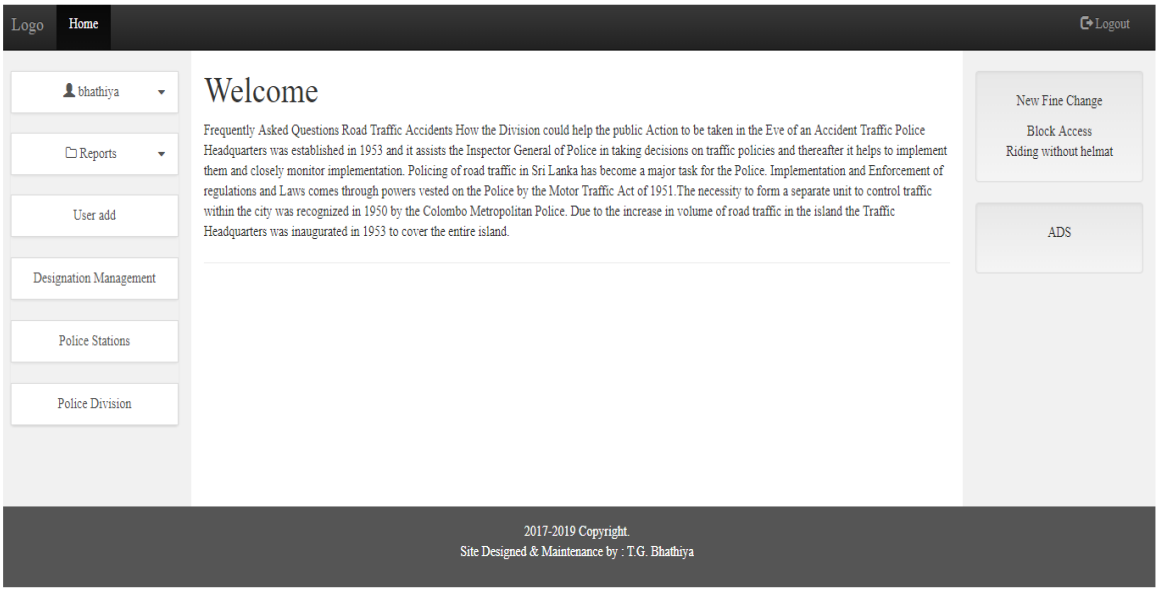


Figure 6.2 Administrator interface

Traffic Office in charge is another type of privilege use. It is separate menu available. Following 6.2 figure display the menu

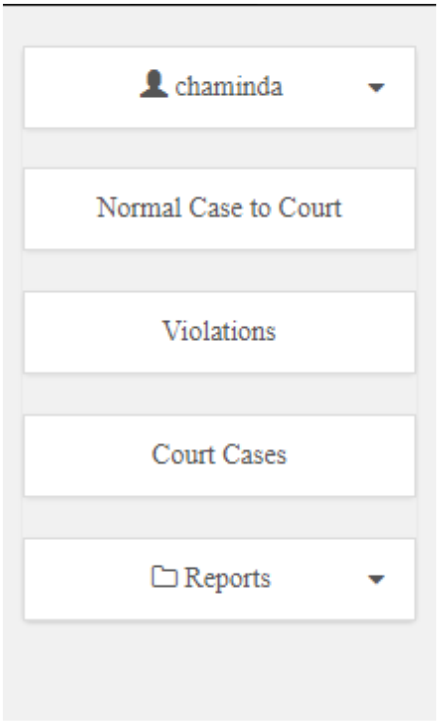


Figure 6.5 Traffic oic menu

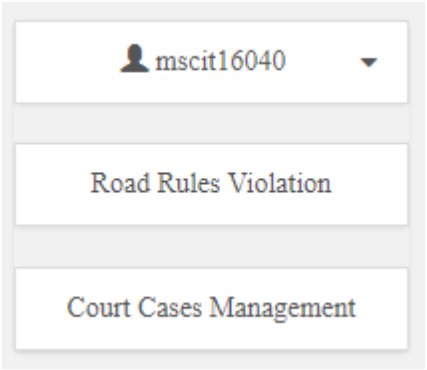


Figure 6.3 police officer menu

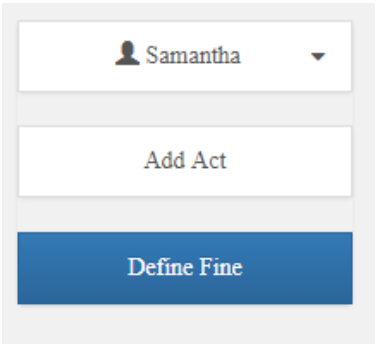


Figure 6.4 Low Enforcement users Menu

vel. It has diff[illegible] 6.3 display police officer menu.

Law enforcement authority uses are another administrative user type. Figure 6.4 display their menu.

According to figure 6.4 police officer can manage traffic violation incident related activities. Such as add violation into system Figure 6.6, search, edit, view, print temporary license and print fine paper in figure 6.7

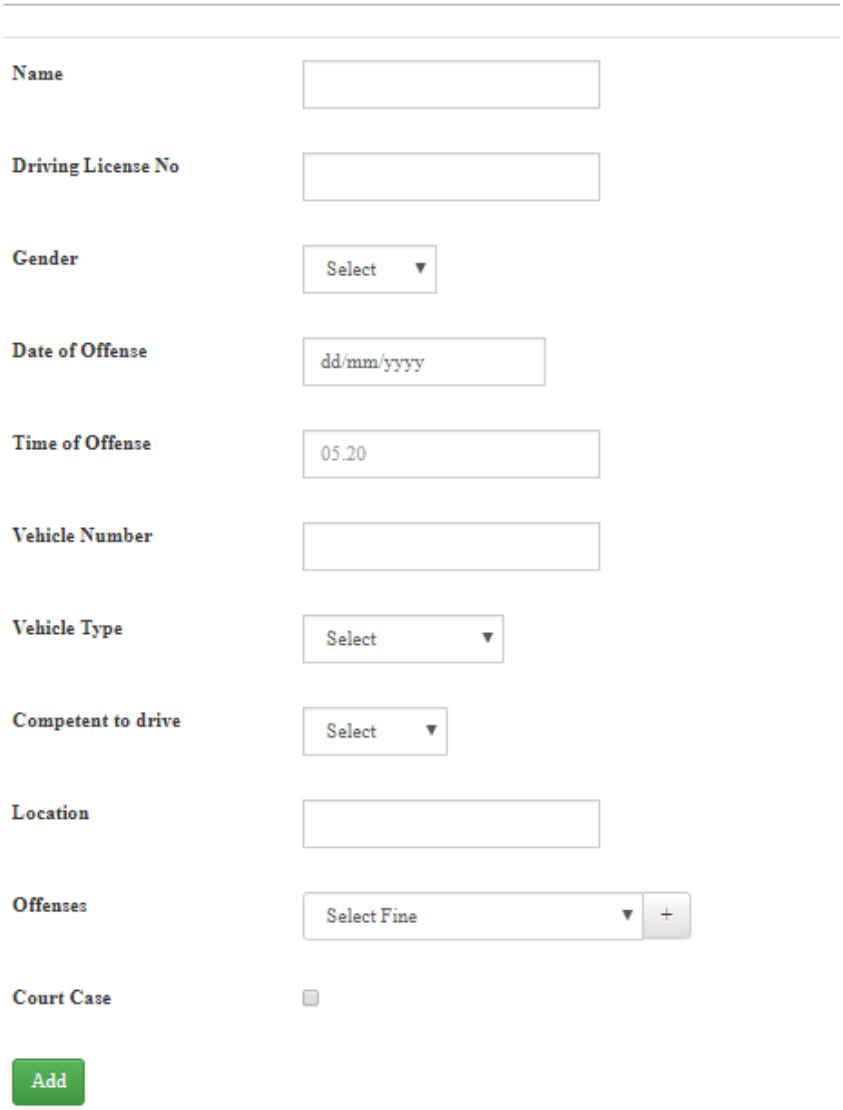


Figure 6.7 Add traffic violation

In the traffic violation incident police officers issue fine paper and temporary driving license. In this system provide printing facility to police officer. Figure 6.8 display System generated temporary driving license and Figure 6.9 display fine paper.

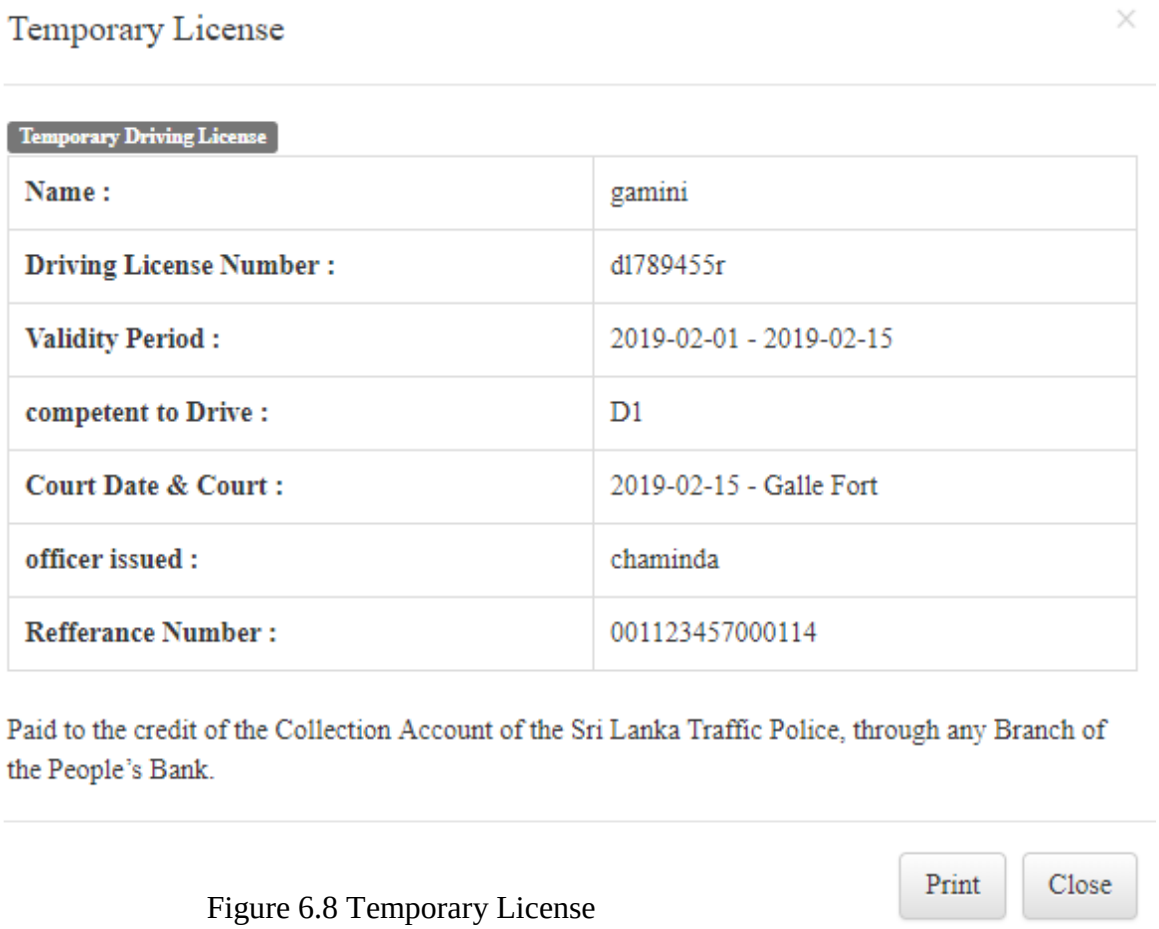


Figure 6.8 Temporary License

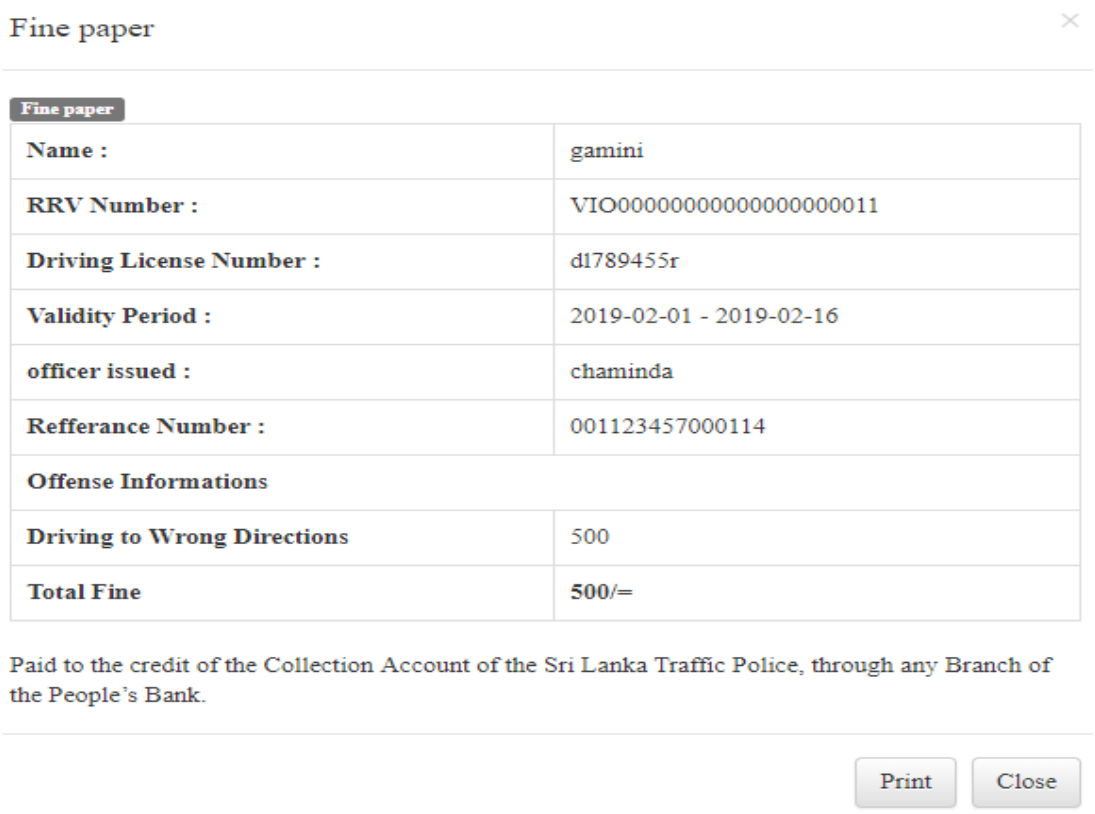


Figure 6.9 Fine paper

police officer and police Office in charge can add violation in to system figure 6.10 shows entered violations

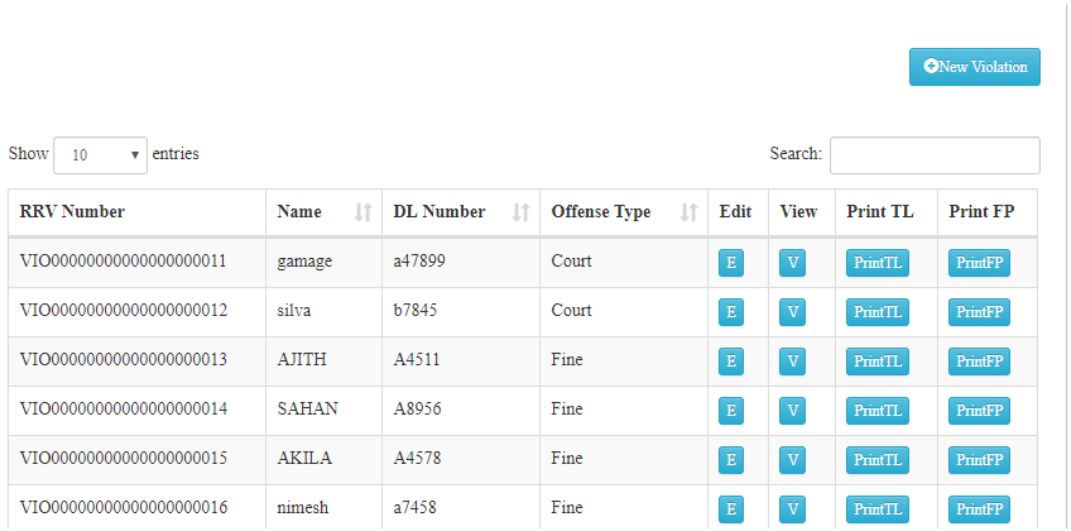


Figure 6.10 Offence Management

Low enforcement users can add and edit Road rule and fine. Figure 6.10 and Figure 6.11 display in fine and rule management interfaces.

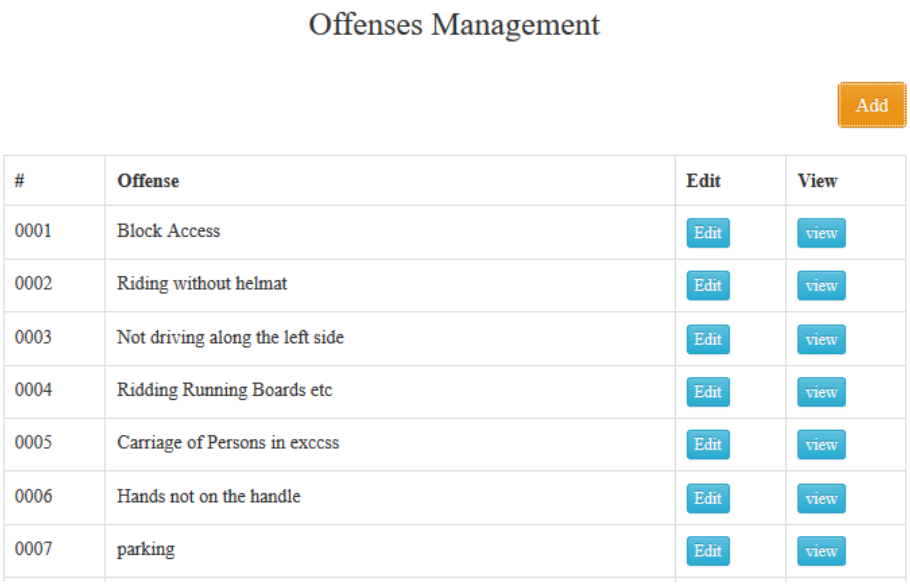


Figure 6.11 offence Management

6.3 Reports/Charts

In this system generate two types of reports. Such as web based system generate reports and display rapid Miner outputs embed in to system to generate reports

There are many type of reports generate in web based system according to their privilege levelsIn figure 6.12 display number of offences. It provide interface to change parameters get different outputs.

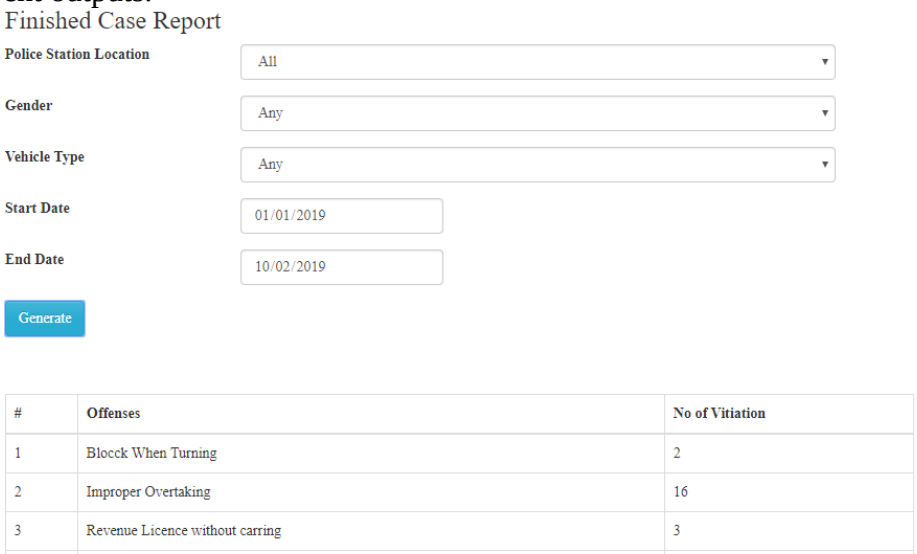


Figure 6.12 Number of offences

Figure 6.13display offences vs vehicle type report. It can generate police stations wice.

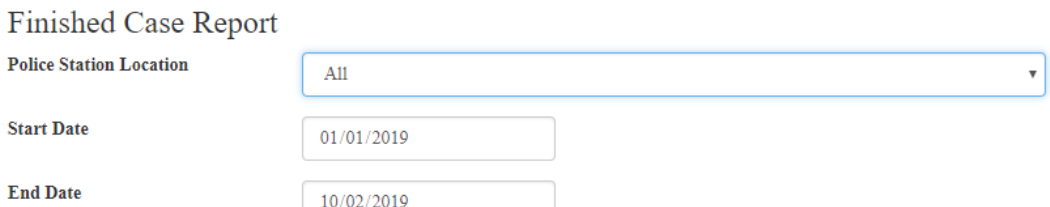


Figure 6.13 offences vs vehicle type

6.4 Implementation of Data mining Result

Association has been developed using Rapid Miner with Data Mining technologies. After identifying the traffic violation problem domain data gathering should be done in three police stations. Historical data gathered in police log book in their permissions

Support and confidence are two main important variables for creating association rule. In this study change these two values in several times and select optimal values for this variables. 0.4 and 0.97 values used to support and confidence respectively. Figure 6.14 shows generate association rules.

In figure 6.14 association ruls convert into Excel format and upload to mysql data base. After that web based privileges user can easily access the association rule using web based system. In this system user have facility to change some attribute in association rule left part and display conclusion .figure 6.15 represent interface of assesses association rule

AssociationRules

```
Association Rules
[court = Fine Paied, vehicle_type = Three wheeler] --> [Sex = M] (confidence: 0.974)
[time = 9.01 PM to 11.59 PM] --> [Sex = M] (confidence: 0.975)
[vehicle_type = Three wheeler] --> [Sex = M] (confidence: 0.978)
[court = Fine Paied, POLICE STATION = TANGALLE] --> [Sex = M] (confidence: 0.980)
[vehicle_type = Motorcycle, time = 6.01AM to 10.00 AM] --> [court = Fine Paied] (confidence: 0.980)
[POLICE STATION = TANGALLE] --> [Sex = M] (confidence: 0.982)
[Sex = M, POLICE STATION = TANGALLE, offence1 = off11] --> [court = Fine Paied] (confidence: 0.993)
[POLICE STATION = TANGALLE, offence1 = off11] --> [court = Fine Paied] (confidence: 0.994)
[Sex = M, offence1 = off2] --> [court = Fine Paied] (confidence: 0.995)
[Sex = M, offence1 = off2] --> [court = Fine Paied, vehicle_type = Motorcycle] (confidence: 0.995)
[Sex = M, vehicle_type = Motorcycle, offence1 = off2] --> [court = Fine Paied] (confidence: 0.995)
[Sex = M, offence1 = off3] --> [court = Fine Paied] (confidence: 0.995)
[Sex = M, offence1 = off1] --> [court = Fine Paied] (confidence: 0.995)
[offence1 = off3] --> [court = Fine Paied] (confidence: 0.995)
[offence1 = off1] --> [court = Fine Paied] (confidence: 0.995)
[Sex = M, offence1 = off11] --> [court = Fine Paied] (confidence: 0.995)
[offence1 = off2] --> [court = Fine Paied] (confidence: 0.995)
[offence1 = off2] --> [court = Fine Paied, vehicle_type = Motorcycle] (confidence: 0.995)
[vehicle_type = Motorcycle, offence1 = off2] --> [court = Fine Paied] (confidence: 0.995)
[offence1 = off11] --> [court = Fine Paied] (confidence: 0.995)
[offence1 = off2] --> [vehicle_type = Motorcycle] (confidence: 1.000)
[Sex = M, offence1 = off2] --> [vehicle_type = Motorcycle] (confidence: 1.000)
[POLICE STATION = TANGALLE, vehicle_type = Three wheeler] --> [Sex = M] (confidence: 1.000)
[court = Fine Paied, offence1 = off2] --> [vehicle_type = Motorcycle] (confidence: 1.000)
[Sex = M, court = Fine Paied, offence1 = off2] --> [vehicle_type = Motorcycle] (confidence: 1.000)
```

Figure 6.14 Association rules

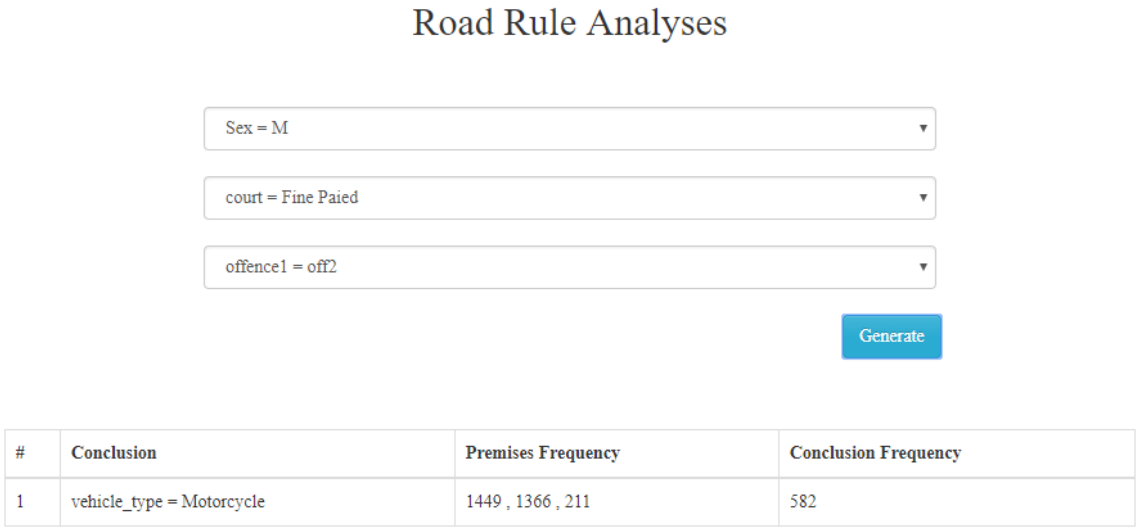


Figure 6.15 Association rules in web

In FP-Growth algorithm provides frequent pattern in the data set figure 6.16 shows rapid miner result in frequent pattern and 6.17 shows figure 6.16 result resent in web based system

No. of Sets: 74

Total Max. Size: 4

Min. Size: 1

Max. Size: 4

Contains Item:

Update View

Size	Support	Item 1	Item 2
1	0.943	Sex = M	
1	0.900	court = Fine Paied	
1	0.383	vehicle_type = Motorcycle	
1	0.361	POLICE STATION = TANGA...	
1	0.346	POLICE STATION = IMADU...	
1	0.254	time = 10.01 AM to 2.00 PM	
1	0.244	vehicle_type = Three wheel...	
1	0.238	time = 2.01PM to 7.00 PM	

Figure 6.16 frequent pattern result

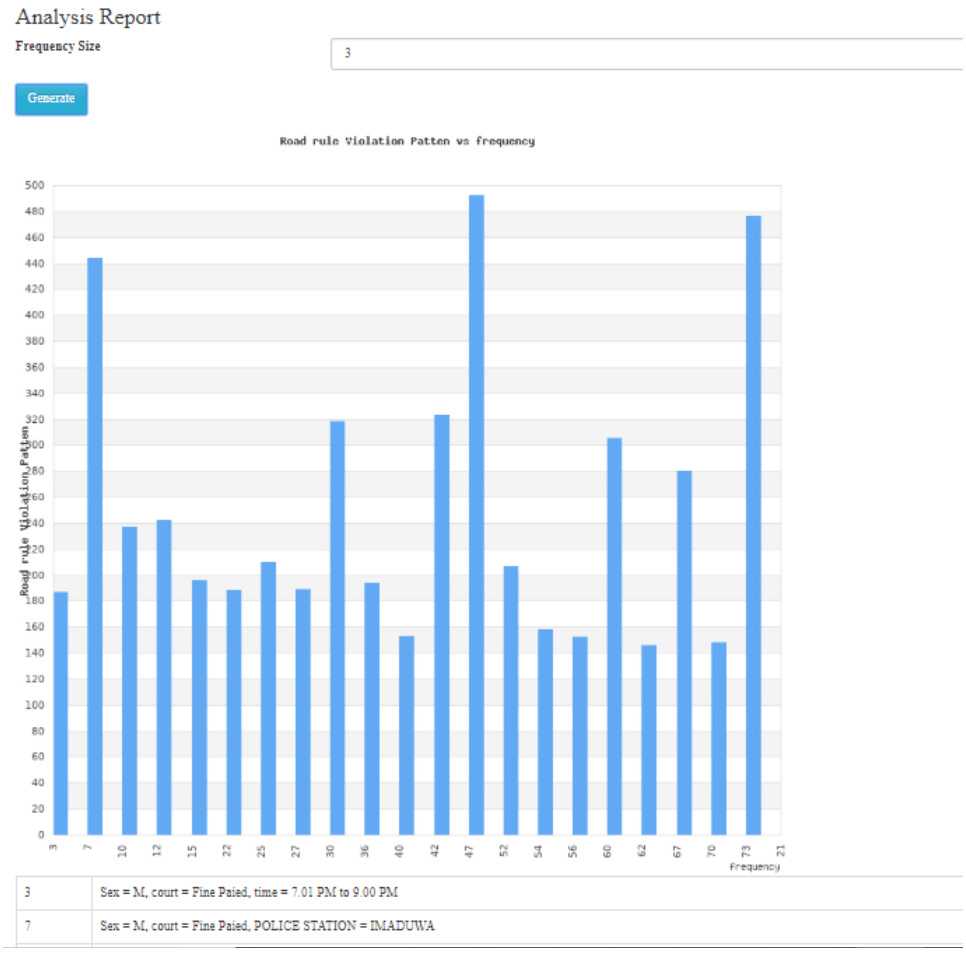


Figure 6.17 frequent pattern in web

6.5 W-Apriori algorithm result

In same data set apply W-Apriori algorithem to find most frequent largest item set. Figure 6.18 shows output of W-Apriori

W-Apriori

```
Apriori
=======

Minimum support: 0.1 (152 instances)
Minimum metric <confidence>: 0.2
Number of cycles performed: 3

Generated sets of large itemsets:

Size of set of large itemsets L(1): 16

Size of set of large itemsets L(2): 5

Best rules found:

 1. offence1 = off2=true 211 ==> vehicle_type = Motorcycle=true 211    conf:(1)
 2. offence1 = off11=true 218 ==> POLICE STATION = TANGALLE=true 159    conf:(0.73)
 3. POLICE STATION = IMADUWA=true 525 ==> vehicle_type = Motorcycle=true 265    conf:(0.5)
 4. vehicle_type = Motorcycle=true 582 ==> POLICE STATION = IMADUWA=true 265    conf:(0.46)
 5. time = 10.01 AM to 2.00 PM=true 387 ==> POLICE STATION = IMADUWA=true 161    conf:(0.42)
 6. POLICE STATION = GALLE=true 445 ==> vehicle_type = Motorcycle=true 173    conf:(0.39)
 7. vehicle_type = Motorcycle=true 582 ==> offence1 = off2=true 211    conf:(0.36)
 8. POLICE STATION = IMADUWA=true 525 ==> time = 10.01 AM to 2.00 PM=true 161    conf:(0.31)
 9. vehicle_type = Motorcycle=true 582 ==> POLICE STATION = GALLE=true 173    conf:(0.3)
10. POLICE STATION = TANGALLE=true 548 ==> offence1 = off11=true 159    conf:(0.29)
```

Figure 6.18 w aprori result

6.6 Summary

Implementation chapter represents solution of traffic violation management and historical traffic violation analysis results. Also provides rapid miner result in the web based system.

Chapter 7

7 Evaluation

7.1 Introduction

This chapter focuses on how the generated rule and pattern tested with testing data set. The association rule has been created by nearly 2/3 of whole data set and rest of the 1/3 has been used for testing association rule.

7.2 Evaluate in web based Traffic violation management System

The main aim of web based traffic management system is to fullfill requirement for police traffic branches and other related authorities. Imaduwa police station is selected torepresent system in to police officers. They appreciate system and give some idea for further development.

7.3 Evaluate association rule

In evaluation process use same model in generate association rule and change data source in to test data set. In this time the same support and confidence is used. However at that time only 12 association rule created and change confidence in to .8 , 22 association rule are created Figure 7.1 shows generate association rule using test data set

AssociationRules

```
Association Rules
[POLICE STATION = IMADUWA, offence1 = off2] --> [court = Fine Paied] (confidence: 0.824)
[POLICE STATION = IMADUWA, offence1 = off2] --> [court = Fine Paied, vehicle_type = Motorcycle] (confidence: 0.824)
[POLICE STATION = IMADUWA, vehicle_type = Motorcycle, offence1 = off2] --> [court = Fine Paied] (confidence: 0.824)
[vehicle_type = Motorcycle] --> [court = Fine Paied] (confidence: 0.830)
[POLICE STATION = IMADUWA] --> [court = Fine Paied] (confidence: 0.846)
[time = 6.01AM to 10.00 AM] --> [court = Fine Paied] (confidence: 0.848)
[offence1 = off2] --> [court = Fine Paied] (confidence: 0.880)
[offence1 = off2] --> [court = Fine Paied, vehicle_type = Motorcycle] (confidence: 0.880)
[vehicle_type = Motorcycle, offence1 = off2] --> [court = Fine Paied] (confidence: 0.880)
[time = 2.01PM to 7.00 PM] --> [court = Fine Paied] (confidence: 0.895)
[vehicle_type = Bus] --> [court = Fine Paied] (confidence: 0.913)
[time = 10.01 AM to 2.00 PM] --> [court = Fine Paied] (confidence: 0.950)
[vehicle_type = Van] --> [court = Fine Paied] (confidence: 0.955)
[POLICE STATION = TANGALLE] --> [court = Fine Paied] (confidence: 0.963)
[offence1 = off11] --> [court = Fine Paied] (confidence: 1.000)
[time = 7.01 PM to 9.00 PM] --> [court = Fine Paied] (confidence: 1.000)
[vehicle_type = Lorry] --> [court = Fine Paied] (confidence: 1.000)
[offence1 = off2] --> [vehicle_type = Motorcycle] (confidence: 1.000)
[POLICE STATION = TANGALLE, time = 10.01 AM to 2.00 PM] --> [court = Fine Paied] (confidence: 1.000)
[POLICE STATION = TANGALLE, offence1 = off11] --> [court = Fine Paied] (confidence: 1.000)
[POLICE STATION = TANGALLE, vehicle_type = Three wheeler] --> [court = Fine Paied] (confidence: 1.000)
[POLICE STATION = IMADUWA, time = 6.01AM to 10.00 AM] --> [court = Fine Paied] (confidence: 1.000)
[vehicle_type = Motorcycle, time = 6.01AM to 10.00 AM] --> [court = Fine Paied] (confidence: 1.000)
[court = Fine Paied, offence1 = off2] --> [vehicle_type = Motorcycle] (confidence: 1.000)
[POLICE STATION = IMADUWA, offence1 = off2] --> [vehicle_type = Motorcycle] (confidence: 1.000)
[court = Fine Paied, POLICE STATION = IMADUWA, offence1 = off2] --> [vehicle_type = Motorcycle] (confidence: 1.000)
```

Figure 7.1 test data set result in association rules

Consider figure 6.14 ,training data set association rules and figure 7.1test data set association rules most rules are same however confidences are not equal. According to training set off2, off11 ,off3, off5 are frequently available in rule also test data set these four offences are frequently available in association rule.

Symbol	offence
Off2	Riding without Helmet
Off3	Not Driving In the left side
Off5	Carriage of persons in excess
Off11	Improper overtaking

Table 7.1 frequent offences

According to time interval most offence are recorded in day time in two data set.

7.4 Evaluate W-Apriori

Figure 7.2 shows result of the Apriori algorithm using above test data.

W-Apriori

```
Apriori
=======

Minimum support: 0.1 (15 instances)
Minimum metric <confidence>: 0.5
Number of cycles performed: 3

Generated sets of large itemsets:

Size of set of large itemsets L(1): 16

Size of set of large itemsets L(2): 9

Size of set of large itemsets L(3): 1

Best rules found:

 1. offence1 = off2=true 25 ==> vehicle_type = Motorcycle=true 25    conf:(1)
 2. offence1 = off2=true POLICE STATION = IMADUWA=true 17 ==> vehicle_type = Motorcycle=true 17    conf:(1)
 3. court = Fine Paied=false 16 ==> fine = 101_500=false 16    conf:(1)
 4. offence1 = off11=true 27 ==> POLICE STATION = TANGALLE=true 20    conf:(0.74)
 5. offence1 = off2=true 25 ==> POLICE STATION = IMADUWA=true 17    conf:(0.68)
 6. offence1 = off2=true vehicle_type = Motorcycle=true 25 ==> POLICE STATION = IMADUWA=true 17    conf:(0.68)
 7. offence1 = off2=true 25 ==> vehicle_type = Motorcycle=true POLICE STATION = IMADUWA=true 17    conf:(0.68)
 8. vehicle_type = Motorcycle=true POLICE STATION = IMADUWA=true 28 ==> offence1 = off2=true 17    conf:(0.61)
 9. vehicle_type = Motorcycle=true 47 ==> POLICE STATION = IMADUWA=true 28    conf:(0.6)
10. POLICE STATION = IMADUWA=true 52 ==> vehicle_type = Motorcycle=true 28    conf:(0.54)
11. vehicle_type = Motorcycle=true 47 ==> offence1 = off2=true 25    conf:(0.53)
12. time = 10.01 AM to 2.00 PM=true 40 ==> POLICE STATION = TANGALLE=true 21    conf:(0.53)
```

Figure 7.2 w apriori result test data set

Consider figure 6.18 and figure 7.2 most of the rules are same and most of rules are built including same parameter values such as off2 driving without helmet, same time interval and vehicle type Motor bicycle.

In this chapter represent few interfaces of web based system. Other interfaces are represent in appendix .

7.5 Summary

This chapter discussed how to test and evaluated the web based system and historical data in association rules and Apriori algorithm. This shows how much of accuracy is having the model in association rules and apriori algorithm..

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-

Chapter 8

8 Discussion

8.1 Introduction

This chapter will discuss about the summary of the Traffic violation management System and data Analysis has been done to yet, what are the limitations having, what kind of systems that can build and what are the future works can be done based on this study.

8.2 Discussion

Traffic Violation is the major issue in road user's safety. Police and other related authorities are responsible bodies of manage and reduce traffic violations. In this system provides facility to mange, their activities smoothly and quickly in their privileges level. Traffic violation Pattern identification is very important to authorities to get correct decision to avoid traffic violation and improve road safety.

8.3 Limitations

There were few limitations affecting to system design and identified frequent pattern. According to system development fine pay model is the important part. However it cannot implement system to connect with bank system.

The data are available in only log books so Its needs to more time to collect data. Some information in books are not clear and available in less information

8.4 Further development

This study was limited to few police divisions in Galle and Tangalle. This can be enhanced considering all the police divisions in Sri Lanka. Then the results can be generalized for any location within the country.

In future researches, Associations can be obtained regarding month of the year. It will help to provide a vivid picture about road traffic in certain months. Furthermore, road traffic and road rule violations can be analyzed on daily basis which helps to monitor the days and time periods with high traffic conditions and road rules violations.

In this research, it was focused only the road traffic and road rules violations. This can be further enhanced by analyzing road accidents in each police divisions on daily, monthly and yearly basis. This would be more help helpful for the authorities who are engaged road traffic and accidents. By analyzing data properly, the delegated authorities will be able to forecast future possibilities of road traffic and accidents. Furthermore, by identifying the areas where road accidents frequently occur, they can get prior actions before the situation.

This system can be developed as a mobile application which helps the police officers as well as the road users. When a user select a certain location, the app should be able to provide the details of the road condition by analyzing prior data such. Then the system will provide information such as the average waiting time in the traffic situation, probability of occurring an accident, the possibility of getting caught for a road violation and so on. From the point of view of police officers, they can easily monitor and get immediate actions for traffic situations and accidents.

At present people come up with many difficulties an problems while paying fines for road rule violations. Therefore, this app can be developed with the facility of paying fines for road rules violations. When an offence has done by a driver, the police office can cancel the driver's driving license temporarily using the proposed app. Then a facility can be introduced for drivers to pay the fine through an online paying system. This will help to save the time of all the related parties. This app will help the police officers to monitor people who come up with road rule violations more frequently. This app can be further developed to take necessary legal actions by providing accesses to relevant delegated authorities.

As a further enhancement of this research, Island wide data can be used to cluster police divisions which have similar behaviors of road traffic and accidents. This will help the

government and relevant authorities to get necessary actions against these issues without a huge effort.

8.5 Summary

This chapter discusses about why the research has been done, what the limitations are observed during the study and what are the future works that are available based on the study.

Chapter 9

9 References

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