SMART TRAFFIC MANAGEMENT SYSTEM USING IOT

by

Prof.Arjun K **Guide**

Students:

Swaroop K

Varun S

Bhavish Samani

Under the guidance of

Mr. Arjun K

Assistant Professor

Department of Computer Science & Engineering
SDM INSTITUTE OF TECHNOLOGY

SDM INSTITUTE OF TECHNOLOGY

(Affiliated to Visvesvaraya Technological University, Belagavi)

UJIRE-574240

Department of Computer Science & Engineering

Abstract

India's biggest issues with traffic congestion are primarily related to one or more of the following, such as poor traffic management practices, insufficient law enforcement, and signal failures. There shouldn't be any traffic jams because it greatly slows the speed of freight vehicles, lengthens lines at checkpoints and toll booths, costs untold numbers of productive man-hours in lost travel time, and causes physical and emotional exhaustion in people. Aside from that, the vehicles stuck traffic problems results roughly 40% higher pollution than individuals who regularly travel on roadways by way of additional fuel is consumed and therefore causing far too much carbon dioxide emissions, which would necessitate periodic maintenance. Our trials based on current data show that the suggested strategy can shorten the consumer's travel and waiting times. To address the sub risks to humanity, we devised a technical work around employing IoT.

Table of Contents

List of Figures

List of Tables

Chapter 1

Introduction

1.1 Project Introduction

Most of the time, there is uneven traffic coming from all directions to a junction. The majority of nations use fixed-time signals to control traffic, however some developed nations' main cities employ centralised management systems. Events that are unpredictable but frequently occur, such as accidents, vehicle problems, improperly timed signalized intersections, special occasions like massive social gatherings and political rallies, bad weather, etc. are all variables that contribute to numerous types of traffic capacity problems. On the other hand, macro level factors, such as trends in property use, profiles of employment, trends of income, trends of vehicle ownership, designs of infrastructure investment, trends of regional economic factors, etc., may indeed lead to congestion. Traffic management systems have used the Internet of Things (IoT) concept. In this framework, we are putting forth a potent method by which radio wave flagging tactic can be used to identify these cars. The crisis cars will be identified and incorporated in a system that emits a Sensor Observation Service (SOS) signal. A sign detection unit can detect this signal, and it will then send a crisis trigger to the traffic executive's system. The criticism and the methodology presented could be handy for analogous developing nations.

1.2 Problem Description

Traffic lights in Bangalore run in a methodical manner, which occasionally results in significant delays for drivers. Without taking into account the present jam in each lane, it gives a particular duration for each direction. The goal is to integrate traffic lights with a smart system to regulate time. The amount of the traffic jam at the inroad intersection is not documented by the Bangalore Municipality. Therefore, it will be challenging to determine which intersection requires a bridge replacement. Utilising intelligent devices can improve the quality of the road.

Chapter 2

Literature Review

2.1 Literature Survey

In [1] the Authors Gustav Nilsson, GiacomoComo presented a system in which the use of Advanced Traffic Management System (ATMS) can minimize traffic congestion, with the issues on the research route being identified after data collection and the execution of a road side discussion, a spot speed analysis, and a vehicular traffic study. Utilising traffic volume surveys at intersections and roadside interviews throughout the research route, it is possible to compute the volume/capacity ratio while learning more about the actual traffic-related difficulties. By implementing an Advanced Traffic Management System, an intersection's Quality of service and ability (LOS) can be improved (ATMS). Mohammed Khaliland In order to provide better service, Abida Sharif describes a low-cost future STS that will use traffic quick updates. Instantaneous collection and distribution of public traffic data for data processing are made possible by the Internet of Things (IOT). Utilising a number of analytical texts, predictive analytics can be utilised to monitor traffic density and provide solutions.

In [2] The authors M.N.V.M. SaiTeja, N.LasyaSree, LasyaHarshitha, and P.Venkata Bhargav have suggested a system in which the green signal is typically triggered for a comparable time span on two lines without taking traffic load into consideration, stretching the wait for vehicles in other lanes. In order to solve many of these issues caused by traffic congestion, we developed an algorithm that can shorten wait times by anticipating the amount of vehicles and adjusting the signal accordingly.

In [3] Authors P Indhiradevi, P Saravanakumar, R Varsha, S Sahithya have suggested a system where the area's traffic flow is governed by sensors and centrally controlled traffic signals. CCTV cameras have been installed for surveillance purposes to record the movement of vehicles on the road. CCTV cameras can help with image processing, making it successful. This enables prompt and accurate vehicle monitoring. Using a sensor, a modified image is sent to VMS (variable message sign) displays. Transportation users will be able to discover the path that is void of traffic and change their direction accordingly.

In [4] For the delivery and direct collection of traffic data for analysis, Rizwan and Suresh suggest a network that uses the Internet of Things (IoT). Big data analysis are also offered, in addition to real-time streaming data. There are several analytical methods

methods which could be used to examine the vehicle density and propose solutions. A mobile application is developed as a user interface which offers an innovative technique of traffic management and permits consumers to gain insight in to the traffic density at multiple places.

In [5] The author Septia Redisa Sriratnasari recommended using ITS in the form of Bus Rapid Transit (BRT), the Bus Information Management System (BIMS), which is disseminating accurate bus arrival statistics Agency (BPTJ), the Advanced Traffic Signal Control Systems (ATSCS), a device that controls dynamic traffic indicators in real time, the Electronic Toll Collecting System (ETCS), specifically the implementation of toll bills using a special On-Board Unit (OBU) device, and

2.2 Comparative Analysis of the Related Work

The table 2.1 discusses the comparative analysis of the current systems in light of the suggested proposal.

Table2.1 Comparative Analysis

Sl. No	***Author(s)***	***Algorithms/Techniques***	***Performance Measures***
1.	Gustav Nilsson, Giacomo	Advance Traffic Management System(ATMS)	Accuracy
2.	N.LasyaSree, LaSyaHarshitha, and Venkata Bhargav, M.N.V.M.SaiTeja	Real Time traffic Control Algorithm for congestion	Accuracy
3.	P Indhiradevi, P Saravanakumar, R Varsha, S Sahithya	Image Processing Techniques	Accuracy
4.	Rizwan and Suresh	Big data and IoT Techniques	Accuracy
5.	Septia Redisa Sriratnasari	ATSCS Technique using IoT	Accuracy

2.3 Summary

These were the research papers that we studied which on implementation reduced traffic volume is reduced about 16% in NH 209 Coimbatore to Sathyamangalam. Better results can be obtained by widening the road in future which would be more effective. The traffic in SH 80 is also declined by 20.5% as compared to early cases. This process is carried out in particular area of Annur town as the traffic is very heavy in peak hours at morning and evening. Initiating this process in every place where traffic congestion is heavy and the road is narrow gives better result in monitoring and controlling of the traffic in cost effective way. It mainly results in fuel consumption which will enrich our economy.

Chapter 3

Problem Formulation

3.1 Problem Statement

Network traffic forecasting is a crucial management and operational task for any data network. It serves a crucial role in the networks of today, which are become more complicated and diverse. Network traffic prediction is more essential for IoT networks to guarantee dependable connectivity. With significant success, traffic predictions have been made using artificial neural networks (ANN). In this study, we employ a multistep ahead prediction method to forecast IoT traffic time series utilising Time Series NARX Feedback Neural Networks. The performance functions MSE, SSE, and MAE have been used to assess the estimation error of a prediction strategy. The mean absolute percent of error has also been used as a measure of prediction accuracy. 2019 (Ali R Abdellah)

Network traffic forecasting is a crucial management and operational task for any data network. It serves a crucial role in the networks of today, which are become more complicated and diverse. Network traffic prediction is more essential for IoT networks to guarantee dependable connectivity. With significant success, traffic predictions have been made using artificial neural networks (ANN). In this study, we employ a multistep ahead prediction method to forecast IoT traffic time series utilising Time Series NARX Feedback Neural Networks.

The spread of the automobile and the concomitant motorization are notably linked to congestion, which has raised the need for transportation infrastructure. The availability of transport infrastructure, however, has frequently been unable to keep up with the rise of mobility. Specifically as traffic numbers approach a road's capacity, traffic congestion difficulties include incremental delays, vehicle operational costs including fuel consumption, pollution emissions, and stress that results from interference among vehicles in the traffic stream. In cities everywhere, more people are sitting in traffic jams for longer stretches of time than ever before. Traffic congestion happens when demand exceeds the capacity of the roads. There are various factors that contribute to congestion; the majority of them diminish the road's capacity at a certain location or over a specific distance, such as when people park on the road or when the number of vehicles increases. Traffic congestion also occurs due to traffic signal. At traffic signal when road traffic density is low signal still shows the same traffic time due to which other lane traffic increases which result in traffic congestion.

3.2 Objectives of the Present Study

The objectives of the proposed project are as follows:

- To study and analyze the related work on Smart Traffic Management System and avoid congestion in traffic.
- To design a Smart Traffic Management System that is effective.
- To implement the proposed system using IOT.
- To detect and classify vehicles for traffic controls.

3.3 Summary

The system gives a brief overview of the persistent problem of traffic congestion in several Indian towns. The main causes of India's traffic congestion include one or more of the following: ineffective traffic management techniques, insufficient law enforcement, and signal malfunctions. There shouldn't be any traffic jams because they significantly reduce the speed of freight vehicles, prolong the queues at checkpoints and toll booths, cost countless hours of lost productivity due to travel time, and wear out individuals physically and psychologically. In addition, traffic jams caused by backed-up automobiles produce about 40% more pollution than those who routinely use the roads due to increased fuel consumption and excessive carbon dioxide emissions, which calls for routine maintenance.

Chapter 4

Requirements and Methodology

4.1 Hardware Requirements

The hardware requirements for the proposed project are depicted in Table 4.1.

Table 4.1: Hardware requirements

Sl. No	Hardware/Equipment	Specification
1.	Graphics Card	Intel 621 Graphics card or 2GB
2.	RAM	4GB or above
3.	Arduino Uno	Microcontroller based on ATmega328p

4.2 Software Requirements

The software requirements for the proposed project are depicted in Table 4.2.

Sl. No	Software	Specification
1.	Windows OS	64 bit
2.	Arduino IDE	64 bit

Table 4.2: Software requirements

4.3 Methodology Used

The proposed model is implemented using the following steps:

1) Data Acquisition: The sensor gathers information on the current vehicle density on the route.

2) Data Storage: The sensors' data is gathered and kept on the cloud.

3) Data Computation and Processing: The microcontroller uses this data to decide how to modify the signal.

4) Data Delivery: Data is delivered immediately to the microcontroller in an emergency, which ends the preceding loop and promptly changes the signal.

5) Models to generate better predictions, identify items, or comprehend the system to model. Models with clean data and a thorough knowledge of the content.

Chapter 5

System Design

5.1 Architecture of the Proposed System

Figure 5.1 shows the architecture of the proposed system.

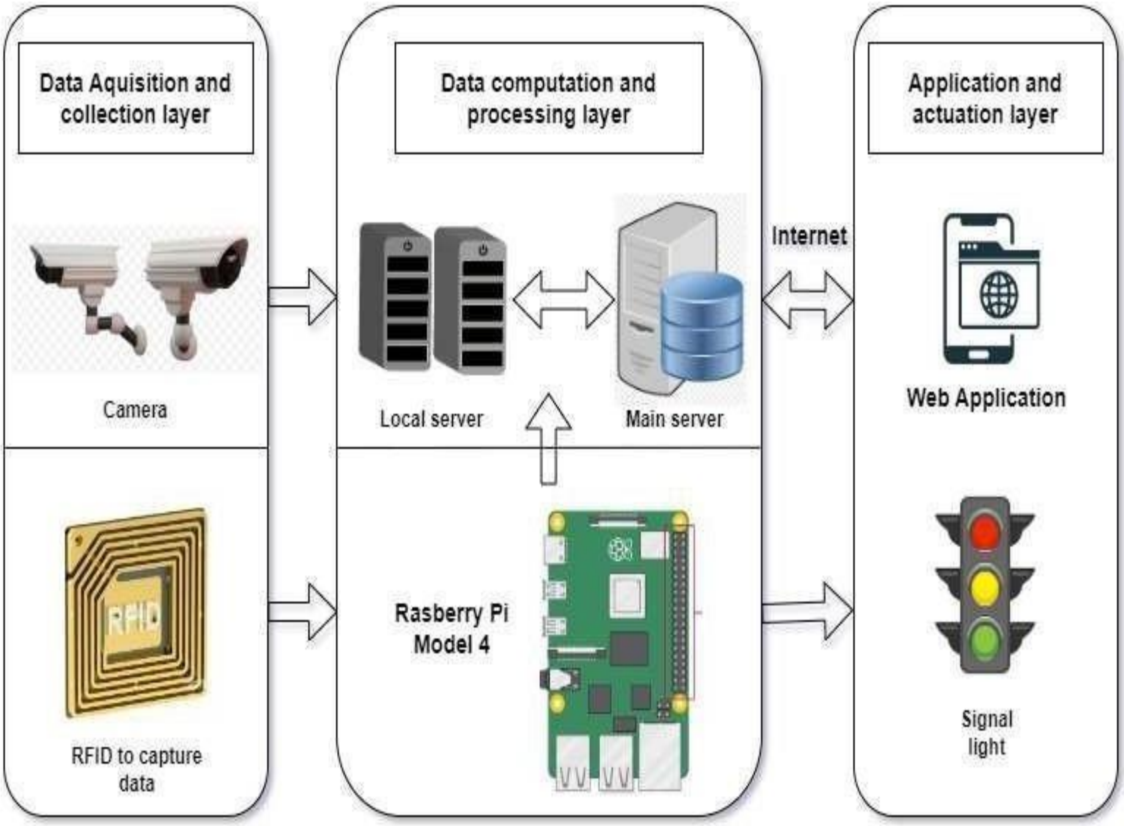

Figure 5.1: Architecture of the proposed system

The architecture of Smart Traffic Management System model is depicted in figure. The first step is to collect suitable information using Cameras etc in the data Acquisition and Collection Layer. The Collected data is then fed to the Data Computation and Processing Layer. The Computed data in the computation layer outputs the suitable change in the traffic signal using certain congestion control techniques thus causing the changes in an application as shown in the figure.

5.2 System Flowchart

The flowchart of Smart Traffic Management System is depicted below. The standard real time for traffic change is taken and suitable signal change is calculated based on congestion in the traffic.

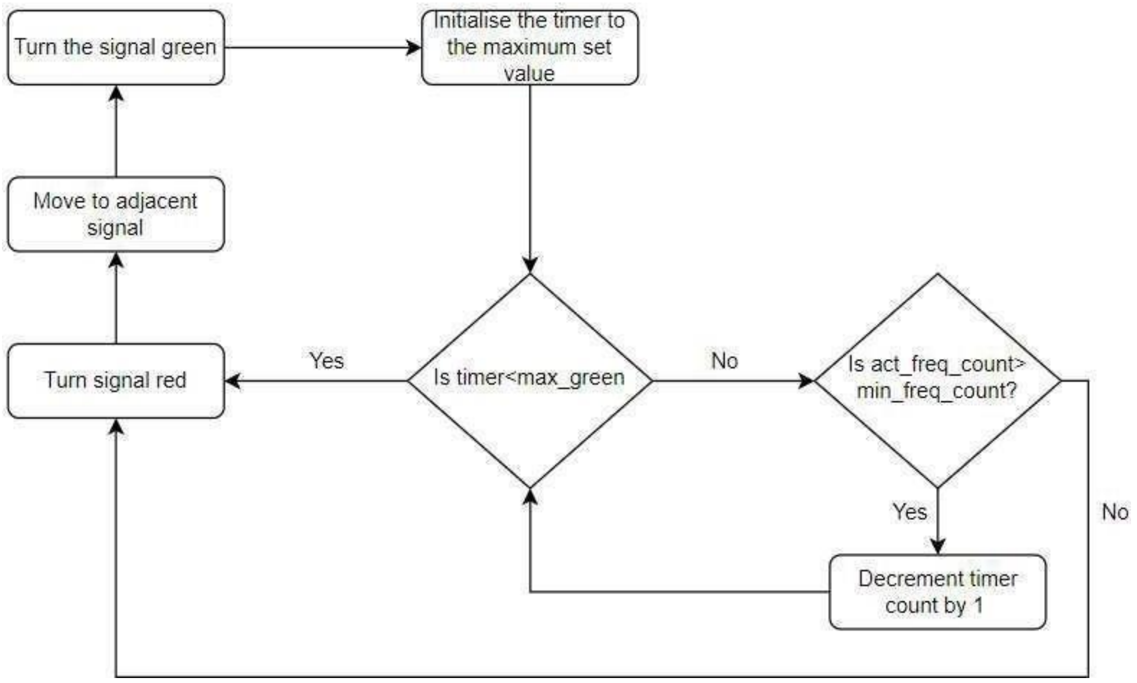

Figure 5.2: System Flowchart

Chapter 6

System Testing, Results and Discussion

6.1 System Testing

Table 6.1: Unit test cases

Test case number	**Input**	**Stage**	**Expected behavior**	**Observed behavior**	**Status P=Pass F=Fail**
1	Working of all the LEDs	Detection using suitable connection with Arduino	If detected, the led blinks	As expected	P
2	Working of Arduino board corresponding to the board	Detection using power supply and suitable connection	The status led of Arduino glows alongside all the LEDs	As expected	P

Table 6.1 shows results of the test conducted using the proposed model. As we conducted several test and our model is responding properly to required output.

In First test case we detected the working of all LED,s via suitable connections to the Arduino.

In Second test case we detected the working of arduino to the relative code via suitable connections.

6.2 Result Analysis

Figure 6.1 shows the overall assembly of the smart traffic management system where all the LEDs and microcontroller board are assembled in a systematic way.

Figure 6.1: Overall architecture of Smart Traffic Management System

Figure 6.2 shows the Arduino connectivity to the various LED’s.

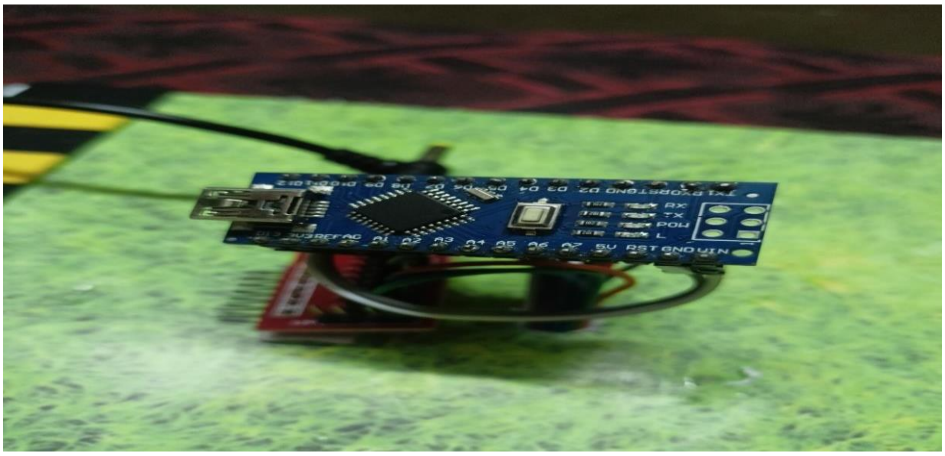

Figure 6.2: Arduino Connectivity to LED’s

Figure 6.3 shows the connection of Cable to Stabilizer and further connections to Arduino board.

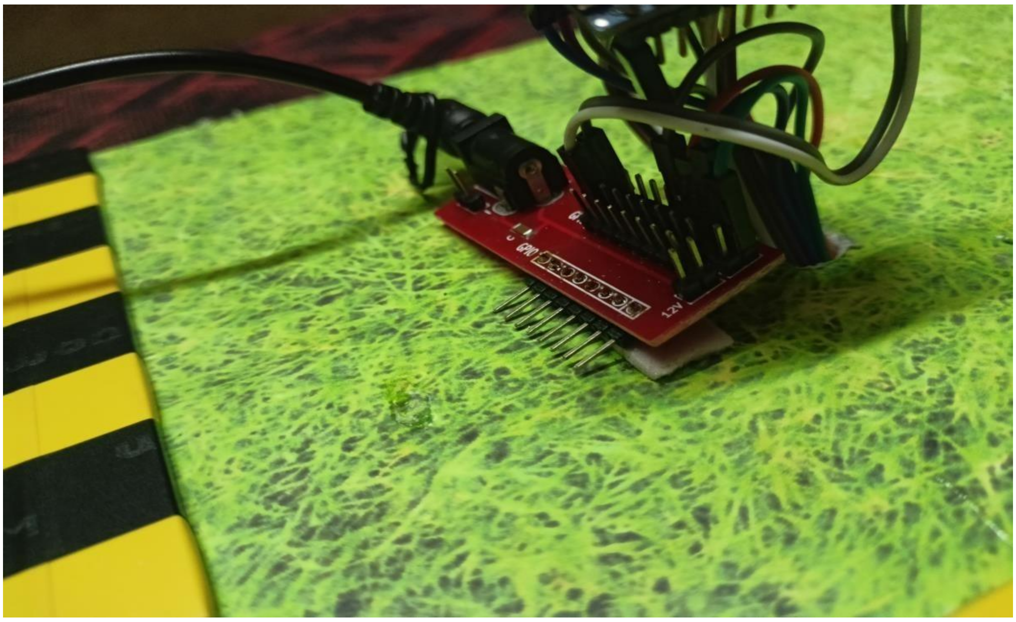

Figure 6.3: Connections to Stabilizer

Figure6.4 shows the working of four way traffic control system with suitable traffic control signal.

Figure 6.4: Four way traffic control system

Figure 6.5 shows the working of Green light when other lights are turned red.

Figure 6.5: Working of green light

Figure6.6 shows the working of white light before turning red.

Figure 6.6: Working of White light

Figure 6.7 shows the working of red light for a proposed time.

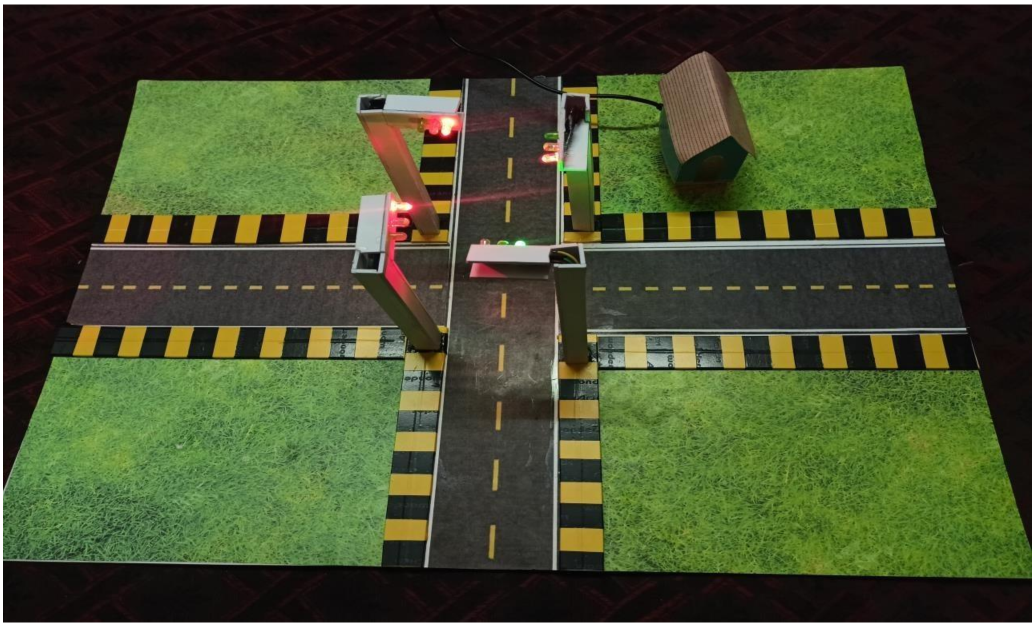

Figure 6.7: Working of Red light

6.3 Summary

India's biggest issues with traffic congestion are primarily related to one or more of the following, such as poor traffic management practices, insufficient law enforcement, and signal failures. There shouldn't be any traffic jams because it greatly slows the speed of freight vehicles, lengthens lines at checkpoints and toll booths, costs untold numbers of productive man-hours in lost travel time, and causes physical and emotional exhaustion in people. Aside from that, the vehicles stuck traffic problems results roughly 40% higher pollution than individuals who regularly travel on roadways by way of additional fuel is consumed and therefore causing far to much carbon dioxide emissions, which would necessitate periodic maintenance. Our trials based on current data show that the suggested strategy can shorten the consumer's travel and waiting times. To address the sub risks to humanity, we devised a technical work around employing IoT.

Chapter 7

Conclusion and Scope for Future Work

7.1 Conclusion

By anticipating a large number of cars, our study proposes a real-time traffic information gathering and monitoring system to address the issue of real-time monitoring and controlling road vehicles through traffic signals. The lifestyle of individuals living in metropolises with dense populations is equally impacted by a variety of application and service systems. As a result, the majority of cities are converting to smart cities by using automated technologies across all industries. In light of the aforementioned, we have created an algorithm that minimises waiting times and traffic to get you where you need to be as quickly as possible.

7.2 Scope for Future Work

The goal of the study is to examine the potential benefits of STMS adoption in different countries. This paper also looks into the possible positives of utilizing STMS. Additionally, this section examines the technical barriers.

REFERENCES

7.2.1 Gustav Nilsson, Giacomo Como, On Generalized Proportional Allocation Policies for Traffic Signal Control, International Federation of Automatic Control, 50(1) (2017), pp 9643–9648

7.2.2 https://www.researchgate.net/publication/360031924_A_Dynamic_Model_and_Al gorithm_for_RealTime_Traffic_Management

7.2.3 https://www.researchgate.net/publication/351858120_A_Review_on_Smart_Traffi c_Management_System

7.2.4 https://www.semanticscholar.org/paper/Real-time-smarttraffic-management- system-for smart Rizwan Suresh/39472fda71f6b53cfe59c4a2461b111f9c7 ed 09.

7.2.5 https://www.researchgate.net/publication/325116849_IoT_based_smart_traffic_sig nal_monitoring_system_using_vehicle s_counts

7.2.6 Amudapuram Mohan Rao and KalagaRamchandraRao, Measuring Urban Traffic Congestion A Review,IJTTE, 2012, 2(4), pp 286 – 305

7.2.7 Gadiyar, H. M. T., Goudar, K., Thyagaraju, G. S., Harshitha, K., Kurdekar, M. J., & Manjushree, K. (2016). DETECTING ANOMALOUS ACTIVITIES INSPATIOTEMPORAL REGION.

7.2.8 Ksiksi, S. Al Shehhi, and R. Ramzan, “Intelligent Traffic Alert System for Smart Cities,” 2015 IEEE International Conference on Smart City/SocialCom/SustainCom (SmartCity), Dec. 2015

7.2.9 Chandrasekhar.M, Saikrishna.C, Chakradhar.B, phaneendrakumar.p, sasanka.c, Traffic Control UsingDigital Image Processing, International Journal of Advanced Electrical and Electronics Engineering ISSN 2278-8948, 2, May 2013

7.2.10 X. Wang, “Calibration of Big Traffic Data for a TransportSmart City,” CICTP 2015, Jul. 2015.