Marathwada Shikshan Prasarak Mandal's
Deogiri Institute of Engineering and Management Studies, Aurangabad

Seminar Report

On

Real Time Traffic Management and Air Quality Monitoring System Using IOT

Submitted By

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(2019- 2020)

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In partial fulfilment of
Bachelor of Technology
(Computer Science & Engineering)

Guided By
Mrs. Amruta Joshi

Department of Computer Science & Engineering
Deogiri Institute of Engineering and Management Studies, Aurangabad
(2019- 2020)

CERTIFICATE

This is to certify that, the Seminar entitled **"Real Time Traffic Management and Air Quality Monitoring System Using IOT**" submitted by **Ashish Narendra Rana** is a bonafide work completed under my supervision and guidance in partial fulfilment for award of Bachelor of Technology (Computer Science and Engineering) Degree of Dr. Babasaheb Ambedkar Technological University, Lonere.

Place: Aurangabad
Date:

Mrs. Amruta Joshi **Mr. S.B. Kalyankar**
Guide **Head**

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Abstract

Traffic congestion is extreme problem in many cities around the global world and due to this traffic congestion issue of air pollution can be arises. To solve this issue we've designed architecture for powerful traffic density administration and quality of air monitoring system combined with simulation model. Enthusiasm behind this approach is congested traffic areas along with air pollution. This specific paper is concerning about managing traffic & monitoring air quality and also reducing air pollution occurring due to vehicles when stopping on Traffic Signal. System utilizes IR sensor and MQ series gas sensor regarding measuring traffic denseness and polluting of the environment respectively. Procedure lives up to expectations by utilizing clustering method for focused on traffic thickness alongside supports log for nature of air checking. Strategy likewise accompanies a man to search for traffic movement thickness furthermore the air environment with respect to certain area.

Contents

1. INTRODUCTION

Nowadays, the highest percentage of air pollution comes directly from road traffic and not anymore from large industries, currently placed outside metropolitan & urban areas. Road traffic is considered to be responsible for 25% of all emissions in Europe, rising up to 31% only in Spain. Moreover, 90% of all transport emissions are due to road traffic. Loss of environmental quality is one of the biggest threats of our century to health and human well-being, together with environmental impacts. Recently, natural disasters and extremely abnormal climate situations happen frequently and globally, the culprit of which is the exacerbation of global warming. One of the measure reasons behind global warming is Air Pollution. Human can live or survive without water and food for few days but when it comes to air then surviving for 2 to 3 minutes may seems to be impossible. Air Pollution has significant influence on the concentration of constituents in the atmosphere leading to effects like global warming and acid rains. Air pollutants are added in the atmosphere from variety of sources that change the composition of atmosphere and affect the biotic environment. The concentration of air pollutants depend not only on the quantities that are emitted from air pollution sources but also on the ability of the atmosphere to either absorb or disperse these emissions. Transport has a significant impact upon the environment in which we live. In general, these impacts can be divided under four broad headings: local air quality, climate change, noise and watercourse pollution, while the clean air is vital to human health. High levels of fine particulate (PM10) air pollution in 2005 were estimated to have caused 1,031 accelerated deaths and 1,088 respiratory hospital admissions in London. By considering all these issues and facts we will go to design a system which will help to overcome these issues. The system is all about detecting the air pollution, generating alert for authority via SMS or email and monitoring the traffic density which is measure cause for an air pollution also managing the traffic signal timing dynamically. This system is designed based on IOT.

Internet of Things (IOT) is a recent communication paradigm that envisions a near future, in which the objects of everyday life will be equipped with microcontrollers, transceivers for digital communication, and suitable protocol stacks that will make them able to communicate with one another and with the users, becoming an integral part of the Internet. The IOT concept, hence, aims at making the Internet even more immersive and pervasive. Furthermore, by enabling easy access and interaction with a wide variety of devices such as, for instance, home appliances, surveillance cameras, monitoring sensors, actuators, displays, vehicles, and so on. This paradigm indeed finds

application in many different domains, such as home automation, industrial automation, medical aids, mobile healthcare, elderly assistance, intelligent energy management and smart grids, automotive, traffic management, and many others. Cloud server provides the storage and processing capability. Cloud stores and processes vehicle log and gas pollution log. Client can be view the air pollution with the traffic density on the android base phone. We are generating the SMS or Email alert for high gas emission in that area from the mobile which is connected by Bluetooth. And set the particular range for values to each gases, if the value of gas is exceed than the particular range then the system will going to generate the an alert.

In modern society, quick mobility is one of the most basic needs. Therefore, people are able to use different transportation facilities such as automotive vehicles, subways, and bicycles. However, among all these transportation facilities, automotive vehicles are still the most adopted due to its comfort and practicality. In this way, assuming a continuous population growth, the number of vehicles in large cities will increase as well, but much faster than transportation infrastructure; consequently, traffic congestion will become a pressing issue. It creates several negative concerns for the environment and society such as increasing in number of traffic accidents, economic impacts, and high levels of greenhouse emissions.

According to the US Department of Transportation (DoT),[4] traffic congestion may have three key sources. The first one is related to traffic-influencing events, such as incidents, working zones, and bad weather conditions. The second one is related to traffic demand, which means fluctuations in normal traffic and special events. The last source is the transportation infrastructure, which represents the traffic control devices and physical bottlenecks. Moreover, these bottlenecks are responsible for 40% of the overall traffic congestion, followed by traffic incidents, such as vehicles accidents with 25%, bad weather conditions with 15%, work zones with 10%, and poor traffic signal timing and special events with 5% each one.

In this way, focusing on preventing traffic congestion and improving the overall traffic efficiency, large cities rely on traffic management systems (TMSs). Which aim to reduce traffic congestion and its related problems? To this end, TMSs are composed of a set of applications and management tools to integrate communication, sensing and processing technologies. In summary, TMSs collect traffic-related data from heterogeneous sources such as vehicles, traffic lights, and in-road and roadside sensors. Furthermore, by aggregating and exploiting such traffic-related data into a cooperative manner (e.g. among vehicles) or into a traffic management centre (TMC) concentrated in a cloud or in a data centre, several traffic hazards can be identified and

consequently controlled improving the overall traffic efficiency and providing a smooth traffic flow. Within TMS, one building block that composes it is the vehicular ad hoc networks (VANETs), which provides data exchange between vehicles, roadside units (RSU) and TMC. In VANETs, vehicles are mobile nodes with an on-board unit (OBU) that has embedded sensors, processing units, and wireless interfaces in which vehicles can communicate among themselves to create an ad hoc network. To support such communications, VANETs rely on dedicated short-range communication (DSRC) specially designed to this end. However, despite RSUs are not a requirement, they can be used to improve network capacity, providing better management and Internet access, and different communication technologies such as 4G and long-term evolution (LTE).

However, concentrating in dealing with the traffic congestion origin and in addressing its related problems, several TMSs have been proposed focusing on adjusting the speed of the vehicles in order to reduce the time spent in traffic lights, detect and prevent traffic congestion and suggest alternative routes to the vehicles. Succinctly, as traffic congestion is a daily concern, researchers from different areas have been attracted to develop TMS to deal with it. However, there are still challenges to be faced. In this way, this article focuses on presenting a study which can provide detailed information to researchers for understanding the main fundamentals and challenges related to TMS, covering different topics from communication to applications. Therefore, the main contributions of this article include a comprehensive overview of the state of the art in TMS, an in-depth classification, review, and qualitative analysis of some TMS applications, and the main challenges and future perspectives.

Traffic congestion problems are commonly encountered in our daily life. Congestion may occur due to various conditions such as inadequate number of lanes, rough road surface and poor road visibility. The consequences of traffic congestion are known to be rather expensive. By improving road conditions, traffic congestion problems can be solved to get smooth traffic flow on roads. Traditionally road conditions are improved on the basis of experience of transportation experts. Considerable work is done on delay estimation, using traffic signalling techniques and traffic management techniques. However, there is still a great deal of research effort required on improvement of traffic conditions. In this research we propose a method for identifying roads which need to be improved as well as the conditions required to improve those roads. In this way traffic management authorities are made capable of improving conditions in a systematic manner. To develop our proposed system we have floated the concepts of threshold capacity, current flow

and tendency of flow. Threshold capacity refers to amount of space on a road that allows a specific number of vehicles to pass. Current flow means the number of vehicles which are currently running over a road in time 1. Tendency of flow means the trend of dispersion of vehicles at intersections in different directions. The system proposed in our study is an innovative idea since current literature lacks research on improvements of traffic conditions and their effects on other roads. The designed system is an automated system that helps the traffic management authorities to identify road segments for improvement and the conditions to improve them. The proposed system also identifies the effects of improvements on other roads. The system can be integrated with other measures of fighting traffic related issues like traffic signalling and delay estimation etc.

2. LITERATURE SURVEY

RFID and GSM based system manage the traffic signal dynamically according to the average speed of vehicles. They required large energy because RFID tag continuous read the values. The maintain ace of that system also tedious and system have some problem like installation problem and cost. They are not cost effective than our system. But our system mange traffic according to the density of vehicles and also monitoring the air quality, so minimize the air pollution and save human life. RFID identifies larger object easily but small vehicles cannot easily identify. There are some problems like Heavy Traffic Jams, No traffic, but still need to wait and Lack of Traffic Information to users. This density based system have based on the image processing. The cameras are placed at the lanes on the roads. They have captured the images of vehicle from the different lane side. And captured images have sent to the server for processing purpose. The image processing techniques are applied on that images and manually count the vehicles from that processed images. They required more time to capture images, send to server, process images and count vehicles from those images, and then adjust traffic signal according to the vehicle count. Changing in lighting condition and weather conditions the images are not clearly captured by the cameras so that traffic will be large on that road(rain). Digital image processing use the wider range of algorithm to process images so large time required for the processing images. Efficient traffic management techniques are needed to reduce waiting and travelling times, save fuel and money. In order to alleviate the problem, Due to the fixed time intervals of green, orange and red signals the waiting time is more and car uses more fuel.

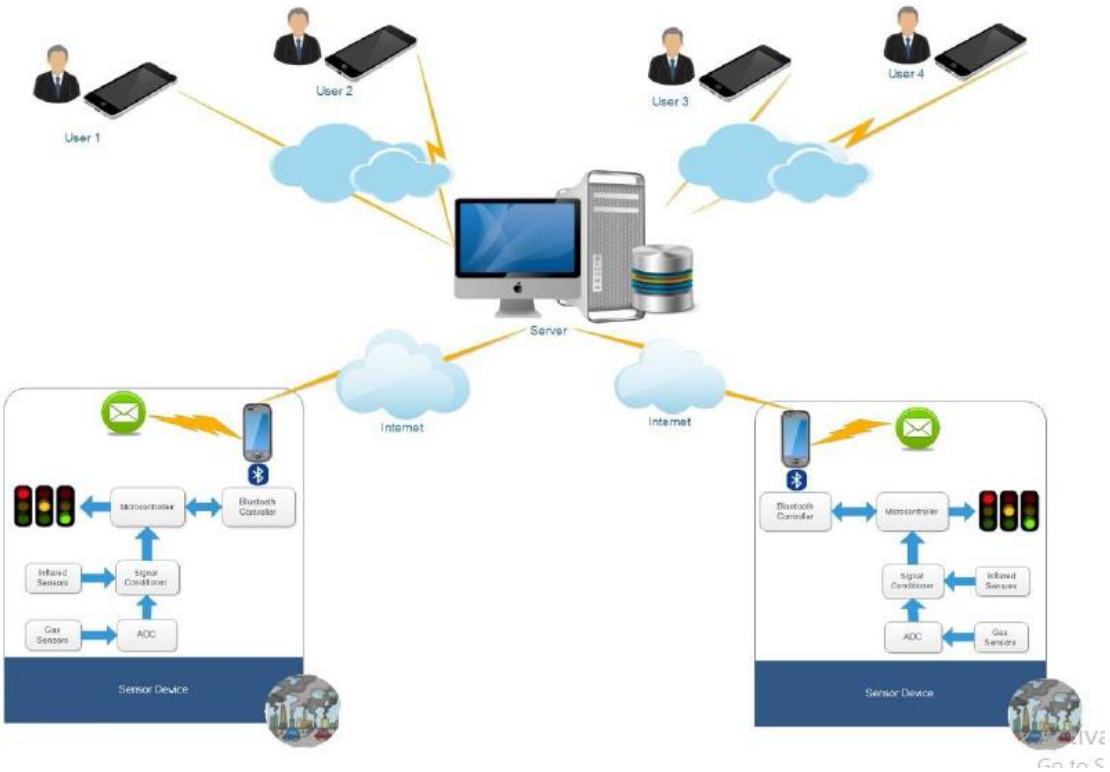
The system based on the micro-controller and micro-controller placed on the board in which contain display unit. The traffic signal adjusts on the board. This system is use fix time of interval for each signal. They are no remotely services provided to the user only provided to that location. It uses predefined hardware and functionality according to program .Due to fixed signal time vehicles emits more fuel, so the more chances of air pollution on that location which effect on the human health. This system is not providing recent data to the user. The micro controller light control signal uses conventional light signal red, amber and green. Red for stop the vehicle, amber for readiness to stop and green means now move. Software embedded controller system has developed. Dynamic change of state using background differentiating method was successfully in solving of fixed timing of controller in control traffic and minimizes congestion. Real time data obtained by image processing serve as input to traffic controller.

Monitoring the PM concentration at a fine grained resolution is important for accurate estimation and use in health related research, such as for asthma research. They examined the effect of supplementing existing high-precision PM10 sensors with low-precision simulated sensors. The number of additional sensor nodes that need to be deployed to obtain a given estimation accuracy also analysed. They have analysed the maximum error that can be tolerated in the low precision sensors to achieve a given level of overall PM10 estimation accuracy. It is indoor climate quality monitoring system. In which the indoor gases only monitor .This system concentrate CO2 gas only and uses adaptive approaches. This system required large energy and concentrate only indoor gases. It is not providing the reliable services for user and multiple users cannot access information. System will not able to handle critical situation. In 2014 application of RFID Technology and the Maximum Spanning Tree Algorithm for Solving Vehicle Emissions in Cities on Internet of Things pollution control system for developed countries have discussed the system consist of RFID tag to which the lambda sensor is connected through analogue to digital converter. The lambda sensor mounted on exhaust pipe to measure air ratio when air ratio is less than one carbon monoxide and hydrocarbon emission will increased and when air ratio greater than one more nitrogen oxide will be produced. RFID reader read this value and transfer by 3G module to database server. The standards and received data from the vehicles are compared if the standards does not match with the data then message is generated and send to the vehicle owner. If pollution through vehicles crosses predefined standards then that system stops vehicle and message generated and sent to specific number which is stored in GSM module. Twitter is used to spread the news of traffic condition of particular location. Anyone user can be twit the current traffic condition of any location. In that System NLP used for extracting the information of traffic signal from twitted. If user give wrong condition of traffic condition on the social media like twitter, then it will be affected on the whole system ,so it gives the incorrect result and vehicles density of that road will be increases. Accessing information from twitter user required twitter account, get certain information that user need regarding the traffic, put those Information in the form template. It will not provide air quality information and not gives the alert to particular authority.

3. BRIEF ON SYSTEM

3.1. Proposed Approach

In this system, we are using Infra-red Sensors and Gas Sensors for sensing the surrounding environment. By using Infra-red Sensors we will get Vehicle count. We are also using MQ Series Gas Sensors which monitors air quality and gives the concentration of different gases. We are also using signal conditioner for amplifying signal and removing noise. Micro-controller helps in controlling Traffic Signal Lights, counting vehicle's and also used for transferring sensor data towards the communicating device via Bluetooth.

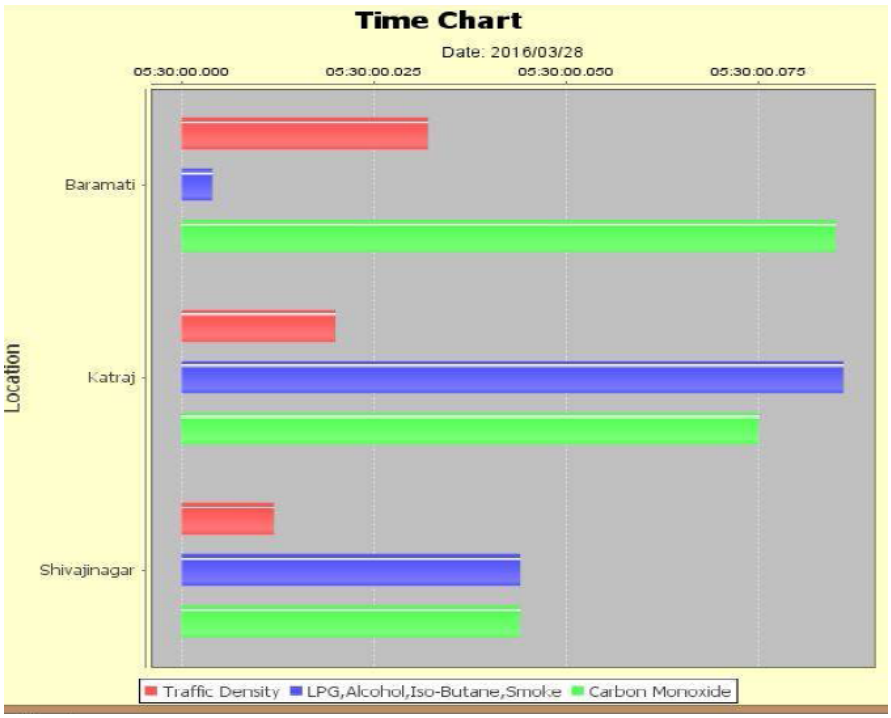


Here communicating device is a Smart Phone. It also sends alert email/sms, if the gas concentration in air reaches to dangerous level. After particular timespan it sends vehicle count and gas concentrations of different gases to the Server. Server receives data from different nodes and does processing on it. Air quality is directly stored in Repository for future use and on vehicle count we apply k-means clustering algorithm from which we get traffic density in the form of Low/Medium/High, which will later use displaying traffic density to user & from traffic density, we calculate Traffic Signal time and that time is send to the node to adjust Traffic Signal Time. Micro-

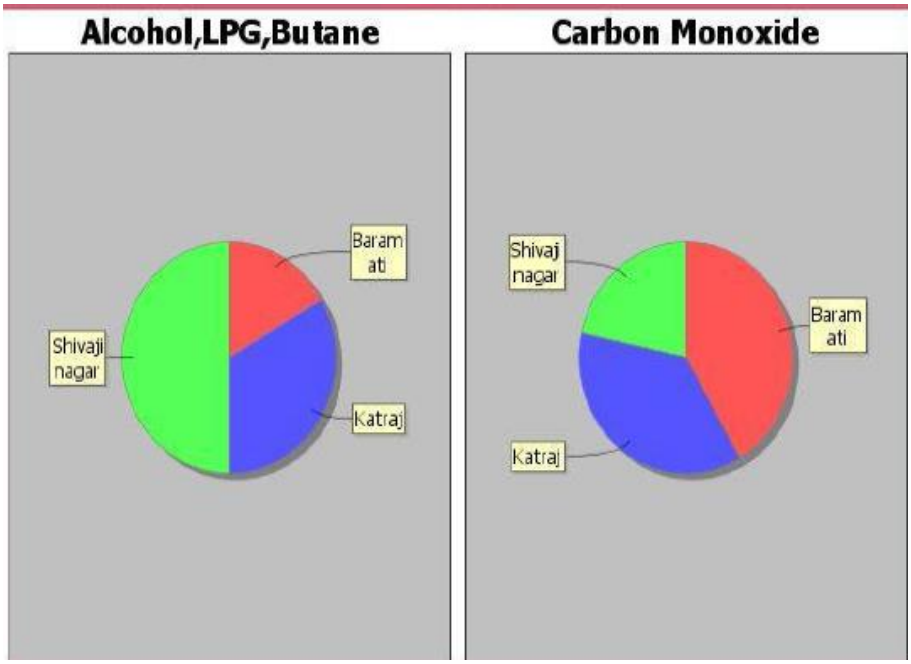
controller present in the node adjust the time according to received data. End user will interact with our System using Android Application. This application will communicate with the Server via Internet. End user will login to the System and provide location to which user want to see traffic density and air quality.

3.2. Simulation Results

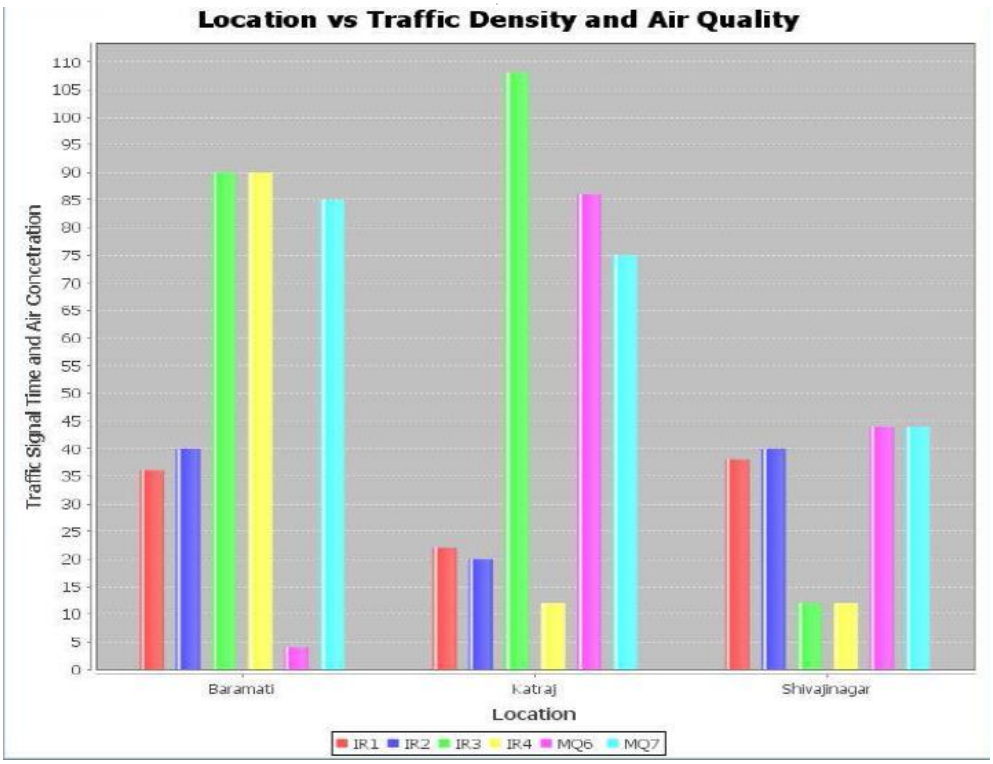
As we are taking vehicle count and from that we are deciding the time of traffic signal. Dynamic adjustment of Traffic Signal gives better result as compare to our static Traffic Signal System. The Traffic Signal time is dynamic, due to this according to traffic density the Traffic Signal cycle is completed in less time as compare to our regular Traffic Signal System. Due to this it reduces the unnecessary waiting time of vehicles, also it helps in reducing air pollution. Our system is helping to solve the traffic congestion problem, which is more frequently occurring in metropolitan cities.



The above figure shows us real time data. As it is time chart the values are continuously changing. Here we are showing the on instance. The above chart helps in analysing the how the flow of traffic is changing. We can observe the different locations on same road and from that we can understand from which location to which location traffic is more or less likewise. It also gives us idea about air pollution in different areas.



The above figure shows us the area wise pollution of the gases. This pie chart gives us clear idea about the pollution in different areas. We can easily compare the results from pie chart.



Traffic Density and Air Quality Location Wise Analysis

The above figure gives us daily report about the traffic density & air pollution of different locations.

3.3. Proposed Algorithm

For this system we have used 3 types of algorithm. Aim of these algorithms is to manage the Traffic Signal Effectively by calculating the Traffic Signal timings. The proposed algorithms are as follows:

1. K-Means
2. Effective Green Time Signal Algorithm
3. Traffic Signal Adjustment Algorithm

Let us see them one by one

1. K-Mean:

The K-means algorithm for partitioning where each cluster's centre represented by mean value of the objects in the cluster.

Input: K: the number of cluster, D: a data set containing n objects

Output: K clusters their Centroids

Method:

1. Arbitrarily choose k objects from D as initial cluster centres(centroids)
2. Repeat
3. (re) assign each object to cluster to which object is most similar based on mean value of the objects in cluster
4. Update the cluster means i.e. calculate the mean value for each cluster
5. Until no change (the centroids do not change or no object moves)

2. Effective Green Time Signal Algorithm:

Input: Centroid, Constants: min_veh_count, min_time_threshold, max_time_threshold

Output: Calculated Effective Green Time

Method:

1. Start
2. Effective Green Time = (centroid/min_veh_count*100) + min_time_threshold
3. If (Effective Green Time>max_time_threshold) then

Effective Green Time< -max_time_threshold

4. Stop

3. Traffic Signal Adjustment Algorithm:

Input: Initial Signal

Output: Adjusted Traffic Signal Lights& Completes Traffic Signal Cycle

Method:

1. If (Current signal)
2. Calculate Effective Green Time
3. Apply the time on signal lights
4. Make current signal ‘Green’ and all other signals ‘Red’
5. If (current time = = Orange_light_time)
6. off green light for current signal
7. Glow ‘Orange’ light
8. If (current time = = 0)
9. Reset IR count to zero
10. Current signal=next signal

Repeat step 1 to 10 until fatal error comes out or externally stops

4. CONCLUSIONS

4.1. Conclusion

This project is to design a system in which Traffic Signal Time will be adjusted dynamically, due to which Air Pollution get will reduce and also designed Gas Monitoring System for unhygienic Gases. It also generates the Alert for Unhygienic Gases if they exceeds their safe limit. There is two type of data is collected gas data and vehicle data. On the vehicle data clustering is applied to predict whether Traffic is more or not. If the Traffic is greater than instruction is passed to controller to adjust the timing of traffic signal. This manages traffic &avoiding congestion. Mobile users having internet can retrieve real time information for their use. End user or client can request to server via Android Application for knowing the real time situation about traffic & air quality of remote location. One of the technologies that gives Accurate reading for the estimation of vehicle count Ultrasonic waves sensors are little bit costly and robust for any medium through which waves can passed. For the further extension for more accuracy, there will be use of ultrasonic wave's sensors. As the RFID tag and Reader more reliable for the use of measuring vehicle density. In the smart city each vehicle having RFID tag and at the Traffic Signal reader would be more communicative in nature for exchanging their messages. On the basis of data for Vehicle density and air quality, there could be prediction for future using Various Predication Algorithm. That would be useful in taking future decision for reducing many problems.

4.2 Applications

This proposed system is an innovative idea to assist traffic management authorities. It will help them to improve the conditions where it is required. Importantly it tells the authorities about the effect of improvements in traffic conditions on other roads. These improvements will be effective in maintaining an appropriate and proper flow of traffic at different roads of a certain city.

The Advanced Traffic Management System (ATMS) field is a primary subfield within the Intelligent Transportation System (ITS) domain. The ATMS view is a top-down management perspective that integrates technology primarily to improve the flow of vehicle traffic and improve safety. Real-time traffic data from cameras, speed sensors, etc. flows into a Transportation Management Centre (TMC) where it is integrated and processed (e.g. for incident detection), and may result in actions taken (e.g. traffic routing, DMS messages) with the goal of improving traffic flow. The National ITS Architecture defines the following primary goals and metrics for ITS:

- Increase transportation system efficiency,
- Enhance mobility,
- Improve safety,
- Reduce fuel consumption and environmental cost,
- Increase economic productivity, and
- Create an environment for an ITS market.

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ACKNOWLEDGEMENT

I would like to place on record my deep sense of gratitude to Prof. Sanjay Kalyankar, HOD-Dept. of Computer Science and Engineering, Deogiri Institute of Engineering and management Studies Aurangabad, for his generous guidance, help and useful suggestions.

I express my sincere gratitude to Prof. Amruta Joshi, Dept. of Computer Science and Engineering, Deogiri Institute of Engineering and management Studies Aurangabad, for his stimulating guidance, continuous encouragement and supervision throughout the course of present work.

I am extremely thankful to Dr. Ulhas Shiurkar, Director, Deogiri Institute of Engineering and management Studies Aurangabad, for providing me infrastructural facilities to work in, without which this work would not have been possible.

Signature of Student

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