International Journal of Electrical, Electronics and Computers
Vol-6, Issue-5 | Sep-Oct, 2021
Available: https://aipublications.com/ijeec/
Peer-Reviewed Journal

# An IOT based Smart Traffic Management System

Pratik Prakash, Aadarsh Singh, Aayush Parasrampuria, Gargi Sharma

Department of Electronics and Communication Engineering, Swami Keshvanand Institute of Technology,Management & Gramothan, Jaipur, Rajasthan (INDIA)

Received: 20 Jul 2021; Accepted: 02 Sep 2021; Date of Publication: 14 Sep 2021


***Abstract***— *A smart traffic management is a wide topic of research. Many modifications can be made to make the urban traffic flow smoothly on the roads. The increasing utilization of private vehicles and public transportation due to advancement of technology causes hectic traffic complexities for the civilians across the globe. The problem of traffic congestion is an everyday problem for human resource and therefore hinders the growth of the country by affecting its productivity as well as economy. Moreover, the traffic signaling systems have predetermined fixed operational time which fails to manage the traffic density changing with time and thus, long traffic queues are formed at the road crossings resulting in increased pollution and waiting time. In this paper, we tried to provide solution to reduce the waiting time at road crossings while keeping in mind the importance of time of the citizens as well as the emergency service providers (such as EMS i.e. Emergency Medical Services, Fire and Rescue Services, etc.). The presented system in this paper is based on smart traffic congestion control system that will automatically set the signal time based on the measured values of vehicle density on road lanes. However, the manual changes can also be made to traffic signals for efficient traffic management in case of emergencies. This paper presents an idea of traffic management using internet of things (IOT). The Internet of Things (IoT) refers to a system of internet-connected objects that are able to collect and transfer data over a wireless network without human intervention. This technology provides an effective communication between different signals and helps in collection of data thereby providing an IoT based smart traffic management system in terms of its automated tracking, monitoring and controlling of vehicles and its data processing.*

***Keywords***— ***Traffic management, Traffic Congestion, Internet of Things (IOT), congestion control.***

## I. INTRODUCTION

In a world with growing population and increasing transportation needs, the cities need an intelligent traffic management system (ITS) which works based on traffic concentration on different lanes [1]. This system will be created to reduce waiting time at lanes and let the citizens travel to their homes, offices, schools and other destinations more quickly. The problem of unnecessarily waiting at signal, while other roads are empty is the cause of delay for people to reach their destinations. This problem is addressed here. The citizens will not be stuck in traffic for too long.

There is no live traffic monitoring developed for the citizens to be able to view the traffic status from anywhere. This system aims to provide the users with facility (maybe a website or an app) to view the actual traffic density and traffic status, like is there is no traffic, light traffic or very high traffic. This will help the people to decide on their path from whichever location they are current at. This will help them to avoid traffic and or pass through light traffic in order to get to their destinations.

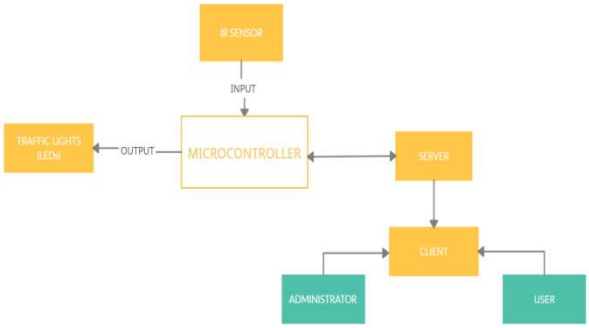
An emergency service has a very crucial role in people's life. In India, people always complain about the not getting ambulance, police, fire brigades and other lifesaving services on time. This system addresses this issue and gives the traffic control center people and authorities with a facility to manually control the traffic so that the citizens can get easy and fast access to the emergency services be it medical necessity, crime prevention measure or rescue services [2].

The project is an application of IOT. This system will reduce the waiting time of citizens at road crossings. It will allow users to monitor the traffic from anywhere in the world [3]. The user can monitor the traffic status from a website and chose the best path to take in order to reach his/her destination. It also aims to provide the citizens with emergency services more quickly by giving the manual control to authorities at traffic control station.

In this system, the idea is to make a three dimensional prototype model of a traffic signal system made on a solid cardboard. The LEDs representing traffic signal lights are placed at each intersection of a four lane road. The dividers placed beside each lane are mounted with IR sensors. The data from sensors will reach to the Control Centre (microcontroller), made nearby to road, and controls traffic lights (LEDs) accordingly. The Control Centre will automatically send live traffic data to users via website for monitoring. The authorized person will be able to change the green signal for emergencies

## II. LITERATURE REVIEW AND FINDINGS

The Internet of Things is a novel paradigm shift in IT arena. The Internet is a global system of interconnected computer networks that use the standard Internet protocol suite (TCP/IP) to serve billions of users worldwide. It is a




network of networks that consists of millions of private, public, academic, business, and government networks, of local to global scope, that are linked by a broad array of electronic, wireless and optical networking technologies.

*Fig.1: System implementation block diagram*

According to Internet World Statistics, as of Dec. 31, 2011, 32.7% of the world's total population is using Internet.

In conclusion, the best definition for the Internet of Things would be: "An open and comprehensive network of intelligent objects that have the capacity to auto-organize, share information, data and resources, reacting and acting in face of situations and changes in the environment" [4].

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards. It is developed by Labcenter Electronics.

Web development is the building and maintenance of websites; it's the work that happens behind the scenes to make a website look great, work fast and perform well with a seamless user experience. The field of web development is generally broken down into front-end (the user-facing side) and back-end (the server side) [5].

A front-end development takes care of layout, design and interactivity using HTML, CSS and JavaScript. They take an idea from the drawing board and turn it into reality. The backend development uses computer programmes to ensure that the server, the application and the database run smoothly together. This type of development need to analyse what exactly the user needs are and provide efficient programming solutions. To do all this, developers use a variety of server-side languages, like PHP, Ruby, Python and Java.

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards [6]. The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

## III. IMPLEMENTATION

The vehicle concentration or density will be detected by the IR LEDs and photodiodes. The controller will take the data from IR communication taking place in between IR Transmitter and IR Receiver. The microcontroller arduino nano will process this received data and show the signals through red, yellow and green LED's along with that controller will also ensure the delivery of the sensor data to users in form of a user friendly website where the people could watch the live traffic status.

For the manual control operation, the authorized person will send the request to the server with the login data i.e. the username and password. The server will match the user entered data with the pre-stored values, after successful

matching the server will open the page from which the user can set the direction in which he/she wants to display the green signal light.

The user after entering on the control page will be asked which mode of operation he/she would like to keep for the traffic. There are two options being provided one manual and the other is automatic. First, he/she have to select the manual mode and then as the user will click on opening a specific lane i.e. turning the green signal for that specific lane, the microcontroller will stop taking the data from IR Communication and will open the requested lane by showing the green signal in twenty seconds. When the authorized person is done its work, he/she will again have to set the control to automatic mode for the proper functioning of traffic. Then he/she can log out by clicking on the log out button, the server will redirect to the monitoring page.

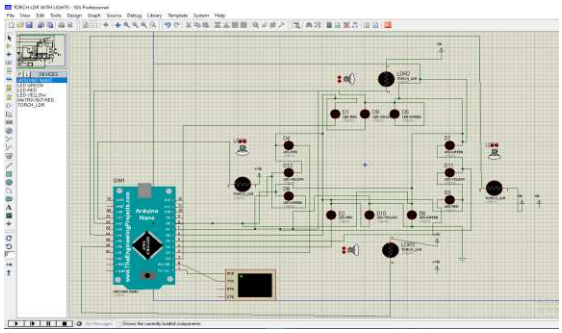


*Fig.2: Circuit design on proteus simulation software*

The circuit has been designed and configured with the help of Proteus Design Suite. The LEDs; red, yellow and green, are connected in the matrix of $4 \times 3$ where 4 represent the number of lanes and 3 represent respective LEDs. For the purpose of simulation and circuit design torch ldr is used as input collecting device. In the implementation of hardware the torch ldr's will be replaced by IR sensor (transmitter and receiver). The controller is also connected with virtual terminal which is acting as an IOT server. Just as how the user sends the request to server when once connected to web, we are also sending the request to virtual terminal and the virtual terminal it sends the response to user by displaying the messages on terminal.

## IV. OPERATIONS OF THE PROJECT

The project as is an application based project, it has three major operations.

**Automated Traffic Control-**

This system works on the basis of traffic concentrations, the concentrations are divided into three levels, absolute no traffic, middle level of traffic, high density traffic. Broadly these three can be classified as follows:

**Level 1:** The absolute no traffic or zero traffic on road is known as level 1 traffic.

**Level 2:** The middle level traffic, i.e. the kind of traffic that ranges from one to five kilometres on road is known as level 2 traffic.

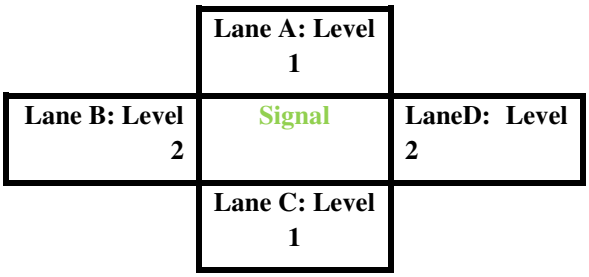
**Level 3:** The ranges higher than five kilometres come under level 3 traffic.

**Operation on A four lane intersection road**

**Case 1: When there's Level 1 traffic, Level 2 traffic or Level 3 traffic on every road.**

In such a case, the signal will run according to conventional sixty second fixed operational time. As the vehicle come on any one lane, it will show green second with in twenty seconds of time.

**Case 2: When there's Level 1 traffic on lane A & C and Level 2 traffic on Lane B & D**




In Such a case the signal will work according to sixty second rule on lane B & lane C and the lane A & lane C will always show red signal until level 2 traffic develop on these lanes. After the level 2 of lane B converts to level 1, and the lane A & C are still same, the green signal will only be shown on lane C, meanwhile, if traffic of level 2 develops on either lane A or C or on both, all the level 2 lanes will work according to sixty second rule until any of them reaches level 1 traffic.

**Case 3: When there's Level 1 traffic on lane A, Level 2 traffic on Lane B & lane C, Level 3.**

In this case the red signal will be shown on Lane A, until it reaches the level 2 traffic. Lane B, lane C and lane D will show green signal according to a fixed sequence of sixty second. If level 3 traffic develops on lane C, then also the traffic signal will show green signal to each of lane B, C and D at the interval of sixty seconds. In case lane A gets

level 2 traffic, all the four lanes will show green signal at the time interval of sixty seconds.

**Live Traffic Monitoring**

Any user with internet access will be able to view the traffic status of selected location through a website. The user will be able to monitor the category of traffic at specific area i.e. is the traffic density at that specific area is of level 1 type, level 2 type or level 3 type.

**Authorized Manual Control**


*Fig.3: Live monitoring*

The Traffic Management authority or any other authorised person will be able to login to the website as shown in figure 20. If any unauthorised person will try to login with

| | | |
|---|---|---|
| | **Lane A: Level 1** | |
| **Lane B: Level 2** | **Signal** | **LaneD: Level 3** |
| | **Lane C: Level 2** | |

a fake username or password, the server will not open the control panel on the website page and will show an error message to the person. In case of only authorized login, the website will open the control panel and give control to the authorised person. The authorised person will get to open the lane of any specific lane i.e. he/she can turn green signal on for any one the of four lanes on a four-lane intersection road, in spite of the traffic density present there. This control section is being created for emergency purposes only.


*Fig.4: Click on login to control*


*Fig.5: Input data will be checked from database and will be given access to valid login only.*

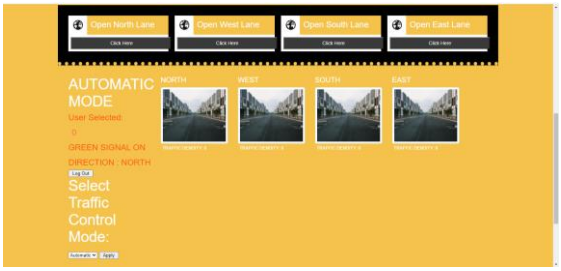



*Fig.5: Authorised login will show this screen to manually operate the traffic.*

## V. RESULTS

The simulation shows all the three objectives, which were aimed to be developed, these includes:

1. **Automated traffic control according to density and monitoring**

The torch ldr will take input values and the microcontroller will fetch this data. Since, there are four direction and four torch ldrs, the direction in which the torch level is closest to the ldr, the green led will be shown by the last row of matrix, this will happen after the yellow light which is in the second row led will glow for the five seconds. The data will also be shown on virtual terminal, telling if the "lane number ('1','2','3' or '4')" , the signal is "yellow" and will also tell when the signal is "green".

2. **Manual traffic control according to density and monitoring**

Here, on the virtual terminal, by typing 'm', the controller takes input from the terminal only and not from the torch level. The user will press '1','2','3' or '4' and the light on matrix led of first row there will be three dots, showing the red LEDs, any one of the current three LED's the one will move towards second row and at the same the one led which was on the third row will move on the first row. The LED on second row shows yellow time which will move to the third row showing green signal of the selected lane number. This data will be shown on virtual terminal.

ISSN: 2456-2319
https://dx.doi.org/10.22161/eec.65.2

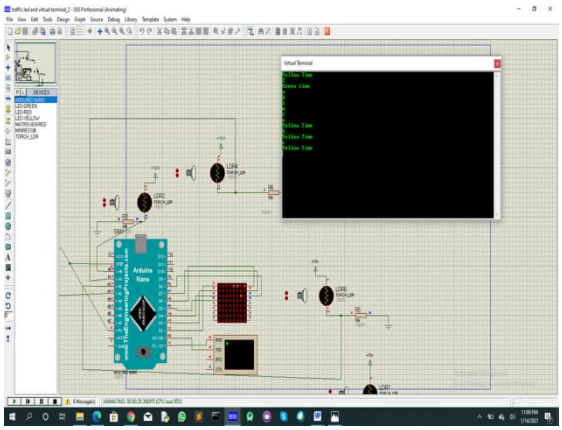


*Fig.6: The final simulation result*

The final hardware project also shows the three objectives that were aimed to be developed, these include:

**1. Automated traffic control according to density**

If the vehicles were placed on the roads as shown in the figure 7, the lane with the highest traffic density will get the priority and the green signal will be shown on that. If there are two lanes with middle range and high range traffic, both the lanes will be shown green signal one by one in the fixed interval of sixty seconds. In case of high range traffic, middle range traffic and low/ no traffic, all the signal will show green signal one by one for the duration of sixty seconds each.

**2. Monitoring of the live traffic**

The traffic can be monitored with globally accessible website on the internet with the name www.tlms.atwebpages.com. The website to monitor traffic is shown in figure 48 on page 46.The website shows on which dire the green signal is currently on. It also shows the density level of the traffic signal i.e. it shows whether the signal has no traffic, middle level traffic or high traffic on each of the directions; North, South, East and West.

**3. Manual controlling of the live traffic**

The user with the registered username and password will be able to log in to the same website as described in above point. The user can open any lane i.e. turn on green signal for any of the four directions. This is only for the cases of emergencies.

*Fig.7: The final system*

## VI. FUTURE SCOPE

Though the prototype model worked very efficiently with remarkable outputs, the real life situation is going to be way more challenging and demanding. Few of the challenges that should be taken into account are listed as follows

1. Low range IR sensors may not be an answer for long range signalling system. We may resort to ultrasound, radar techniques or digital image processing technology for large scale set-ups.

2. Next is the influence of stray signals that may alter the reading of sensor receptors and lead to conveying false information to the microcontroller.

3. Periodic checking of the accuracy and precision is a must for efficacious operation

## VII. CONCLUSION

Traffic management is one of the biggest infrastructure hurdles faced by developing countries like India today. There is an exigent need of efficient traffic management system in our country, as almost every indian waste their precious time getting stuck in traffic. To reduce this congestion and unwanted time delay in traffic, an advanced system is designed here in this project. With field application of the IOT technology, the maddening chaos of traffic can be effectively channelized by distributing the time slots based on the merit of the vehicle load in certain lanes of multi junction crossing. We have successfully implemented the prototype at laboratory scale with remarkable outcomes.

With this project, the idea is spread to set green signals in accordance with the type of traffic concentration; this would save the time of common people and some of health issues like headaches because of the noises being generated on the roads when stuck in traffic. People keep on banging their cars and other vehicles horns. This project emphasizes the importance of IoT based congestion control, live traffic monitoring as well as the controlling of the traffic manually.

ISSN: 2456-2319
https://dx.doi.org/10.22161/eec.65.2

The next step forward is to implement this schema is real life scenario. We believe that this may bring a revolutionary change in traffic management system on its application in actual field environment.

## REFERENCES

[1] Janahan, Senthil Kumar & Murugappan, Veeramanickam & Sahayadhas, Arun & Narayanan, Kumar & R, Anandan & Shaik, Javed. (2018). IoT based smart traffic signal monitoring system using vehicles counts. International Journal of Engineering & Technology.7.309.10.14419/ijet.v7i2.21.1238.

[2] Trivedi, Janak & Sarada Devi, Mandalapu & Dhara, Dave. (2017). Review Paper on Intelligent Traffic Control system using Computer Vision for Smart City. International Journal of Scientific and Engineering Research. 8. 14-17.

[3] Lianos, M. and Douglas, M. (2000) Dangerization and the End of Deviance: The Institutional Environment. British Journal of Criminology, 40, 261-278. http://dx.doi.org/10.1093/bjc/40.2.261

[4] D. Minoli, K. Sohraby and B. Occhiogrosso, "IoT Considerations, Requirements, and Architectures for Smart Buildings—Energy Optimization and Next-Generation Building Management Systems," in IEEE Internet of Things Journal, vol. 4, no. 1, pp. 269-283, Feb. 2017, doi: 10.1109/JIOT.2017.2647881.

[5] M. Rahman, Z. I. A. Khalib, R. B. Ahmad and S. M. Asi, "Web-Based Portable Network Traffic Monitoring System Based on Embedded Linux and SBC," 2009 International Conference on Future Computer and Communication, 2009, pp. 310-313, doi: 10.1109/ICFCC.2009.14.

[6] Abdulrazak, Lway. (2018). Practical implementation of IOT using Arduino. 10.13140/RG.2.2.36624.30723.