Perspectives in Communication, Embedded-Systems and Signal-Processing (PiCES) – An International Journal
ISSN: 2566-932X, Vol. 4, Issue 7, October 2020
Part of the Proceedings of the 1st All India Paper writing Competition on Emerging Research - PaCER 2020

IoT Deployed Automatic Movable Smart Road Divider to Avoid Traffic Problems

Venkatesh P
Student, Department of ECE, East West Institute of Technology, Bangalore, India,
venkateshpunith1998@gmail.com

Santhosh R
Student, Department of ECE, East West Institute of Technology, Bangalore, India,
santoshramachandran5@gmail.com

Subramanya K
Student, Department of ECE, East West Institute of Technology, Bangalore, India,
subramanya.kalyan7@gmail.com

Sudheera
Student, Department of ECE, East West Institute of Technology, Bangalore, India,
sudheeranaik98@gmail.com

Namratha Naikar
Assistant Professor, Department of ECE, East West Institute of Technology, Bangalore, India,
namri4u@gmail.com

Abstract: Nowadays, the drastic increase in road traffic congestion has led to severe consequences on individuals, economy and environment, especially in urban areas in most of big cities worldwide. The purpose of using road divider is to separate the incoming and ongoing of traffic vehicles in the traffic. With increasing population, the vehicles are increasing, but there is limited resources which leads to more number of vehicles on roads The main aim of the project to use every second efficiently to save a human life while travelling in an ambulance. This can be achieved with a Movable road divider. In the proposed model, we are not using a machine and operating it manually rather operating it automatically with the help of IoT and sensors.

Keywords: IoT; Movable road divider; Raspberry pi; IR sensor; Ultrasonic sensor; Ubidots

I. INTRODUCTION

Road traffic congestion is among the most challenging issues that current road traffic authorities as well as peoples are facing due to its compelling impacts. Among all these impacts, the delay of emergency services delivery to the emergency location is the most critical due to the incurred cost in terms of deaths, injuries and financial losses in case of fires, car crashes, terrorist attacks, etc. It is nothing surprising ,because the conditions of roads in many cities across the globe have been the same for decades. There is no significant development or technological adaptation in the way road transportation has evolved.

In many situations we see that there will be huge traffic on one side of divider of a road and there will be no traffic on the other side. In this kind of situations, it is possible to control the divider position automatically which reduces the traffic problems. Also using the movement of divider, we can give traffic clearance for the ambulance when required.

In this paper, we design a movable road divider which moves depending on the flow of traffic. The IoT compiles the real-time data of vehicular traffic that finds out the current traffic operation and traffic flow conditions. The sensors will be connected with each other and to every parts of the divider.

So towards this some amount of research work has been carried out by employing Information and communication Technologies for regulating the traffic signaling system. The remaining part of the paper is organized such that Section II discusses the Literature Analysis, Section III explains the Implementation, Section IV discusses the Result followed by a conclusion in Section V.

II. LITERATURE ANALYSIS

A study was conducted on Western express road close to Goregaon, Mumbai, in Reference [1], a 10 lane road was chosen once noting the congestion points. The western express highway was so selected to understand the current traffic scenario for long distances. A survey was carried out for a span of 7.00 am to 9.00 pm ,data collected from the survey was no. of vehicle passing a point, speed of vehicle and concluded by saying speed of the vehicle reduces significantly during the peak hours.

Reference [2],suggests an approach to reduce traffic density by making use of two dividers namely normal and extended. The author has shown the results through one way of traffic using ultrasonic sensors, but in real time traffic congestion can be in more than one direction.

In Reference [3], a survey was conducted consisting of the traffic volume of Wagholi chowk in Pune- Nagar highway and shows the major traffic problem of that area.

In Reference [4] a review was given on cost efficiency in implementing movable divider. The cost of congestion was marked on the basis of fuel burned productive loss by including working hours of a person, the opportunity loss pollution and human loss occurred annually by showing the data of year 2018.

An algorithm was developed for function of IoT Traffic Signaling System based on Traffic Density in reference[5],but the drawback here was traffic density information was not secured while transmitting the information for controlling the traffic signal.

Reference [6] has a proposal that uses IoT based approach to analyze the traffic density in a particular lane. The images are captured using the traditional camera and are analyzed using a cloud-based approach. The model was implemented using this approach uses raspberry pi and servo motors however the practicality of this approach is a serious concern due to the cost of its implementation.

Reference [7] suggested using a smart temporary divider which will curl in and out of the road. This approach uses RFID based ambulance detection and after being identified clears the lanes for an emergency vehicle. This approach seems to be more appealing due to its practical applications. But implementing this is very difficult.

III. IMPLEMENTATION

In this proposed system, a module has been developed that consists of an IR sensor which is used for measuring the traffic density. As the vehicle passes through these IR sensors, the IR sensor will detect the vehicle and will send the information to the raspberry pi. A reference is set by a variable resistance according to required range of sensing, counting this change of events from LOW to HIGH indicating passing of a vehicle. Based on this percentage of traffic density is determined on either side of the divider. If the traffic density is high then the movable divider moves appropriately by displaying the percentage of traffic on right and left lanes on LCD display. The direction in which the divider moves is also displayed. During the movement of the divider if any obstacle is detected, during this course of time movement of the divider is halted and continued only if this obstacle is cleared. If the traffic density is normal then no type of action is taken. If any emergency vehicle is detected red light present on the traffic light turns green. Based on the destination paths of the emergency vehicle red LEDs either on the divider side or at the extreme ends of the lanes turn ON which indicates the other vehicles have to clear the lane for emergency vehicle.

A. Measuring traffic density using IR sensor

IR sensors are fixed to the divider facing to either sides of the road. They are used to take the readings of the traffic density on either sides in terms of percentage. The IR sensors take readings for a fixed amount of time and records the time for which the infrared rays are being reflected. The reflection of infrared rays indicates the vehicles passing by the road and the reflection time is proportional to the number of vehicles, velocity of the vehicles and the number of lanes. The readings of reflection time obtained from either side of the road are converted into percentage with respect to the total time of readings taken. These two percentages are used to determine the high density of traffic relative to each other and the divider is then moved towards lower density side of the road providing an extra lane to higher density side. The movement of the divider on either sides of the road is noticed in prior to the travelling vehicles using LCD display screen to clear the lane for the divider movement.

B. Fixing the Inconsistencies in the Data

It is observed that there is an inconsistency of traffic density on each side of the street. During certain times of the day, the traffic is asymmetric on either side of the street. During the early hours of the day, the side of the streets towards the commercial areas of the city will be more congested than the other side. During the later hours of the day, from evening till night, the opposite which goes towards the residential blocks will be more congested. This causes a lot of free space on the other sides of the lanes. This free space can be used to clear the traffic at the appropriate times of the day.

According to the traffic density, we decide one of 3 things:

1) Do not move the divider (ideal situation).

2) Move the divider x lanes to the left.

3) Move the divider x lanes to the right.

This process will be repeated. In an ideal situation, the divider movements to be as minimum as possible during a given day. We do not want to overwork the mechanism to change lanes every time there is such inconsistency.

C. Processing the data to move the barrier

In order to move barrier along the lane, the program determines which side of the divider has more number of vehicles see fig 3. By observing the percentage of vehicles density on either side of the road, the program first displays traffic density of the left and the right side of the divider on the LCD display as shown in fig 4,then based on this traffic density divider moving direction is displayed as shown in fig 5. The divider is incorporated with a ultrasonic sensor which is used to caution the program if there is any vehicle in its path and move it as safely as possible.

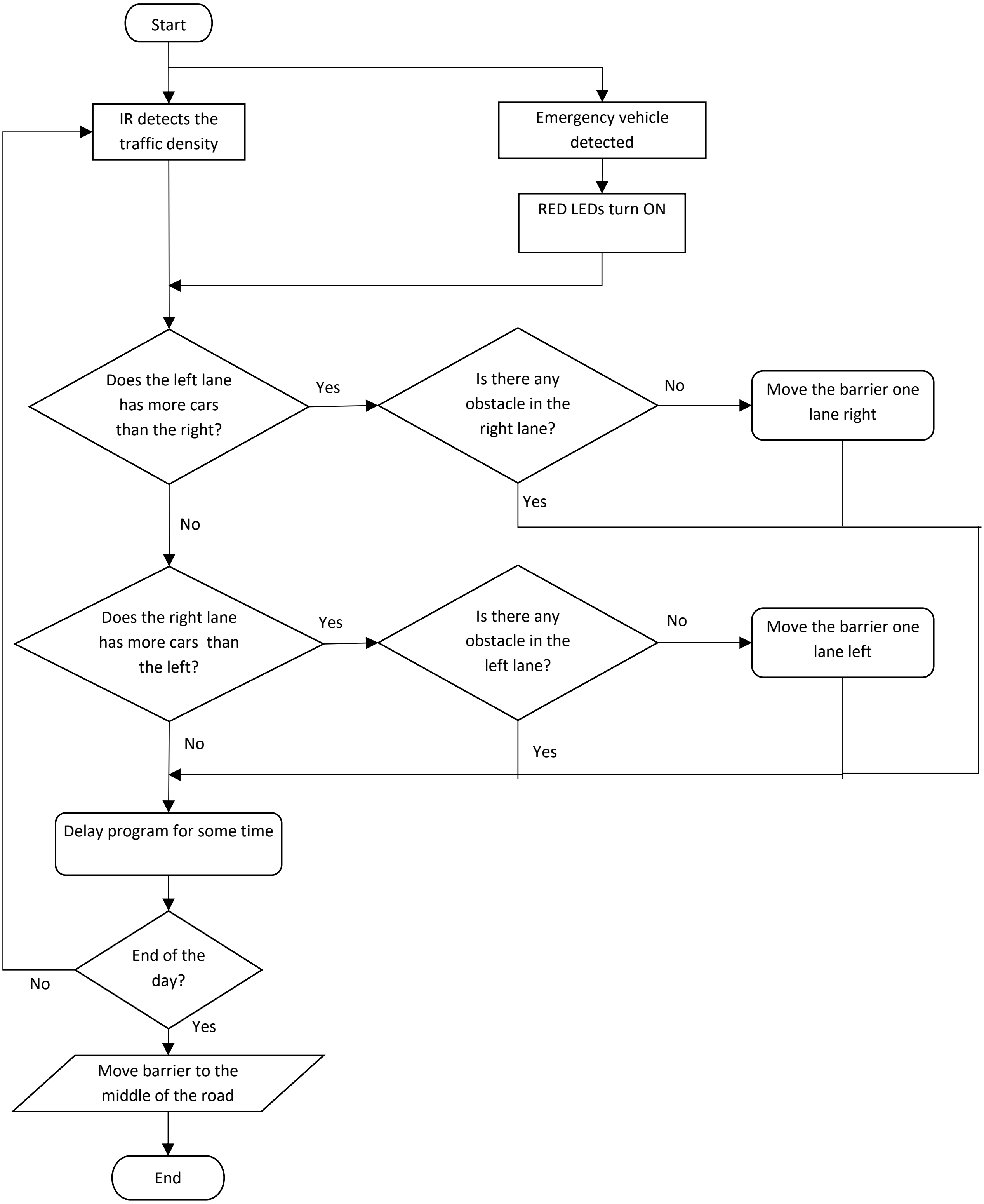

Fig 1. A flowchart representing the algorithm of the program.

Once the divider has moved completely and locked in place the program halts as shown in fig 6. Further movement of the divider is made after specific delay by monitoring the traffic. If there is more traffic on the left side of the lane, the divider can now move to the middle or to the right lanes of the roads. It repeats the same procedure to move to the middle or the rightmost lane.

This process repeats several times throughout the day and as long as there is congestion on either sides of the lane.

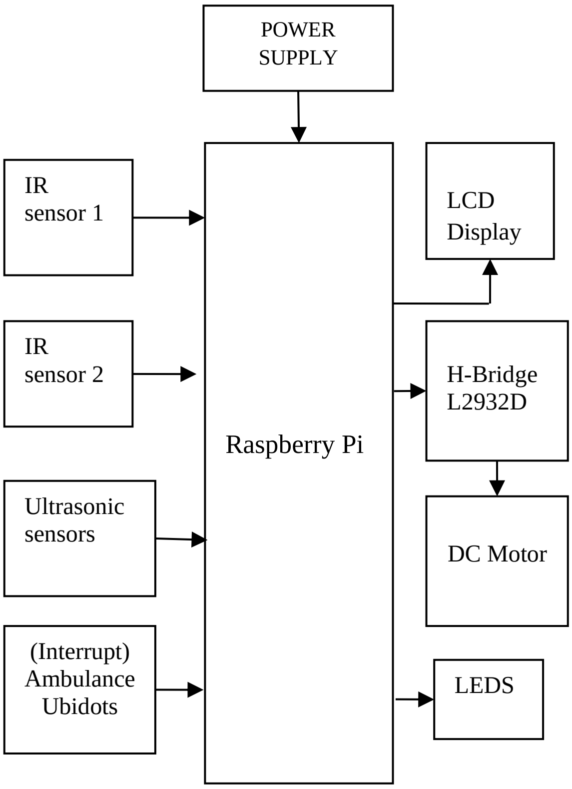

Fig 2. Block diagram of proposed system

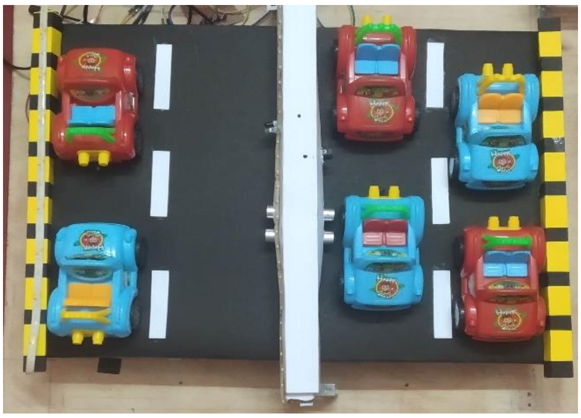

Fig 3. Right side of the divider has more vehicles compared to left

Fig 4. Density displayed on LCD display

Fig 5. Divider moving direction

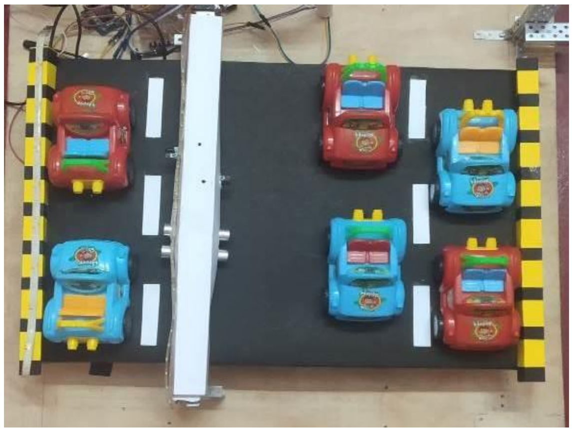

Fig 6. Final divider position

D. Detecting obstacles while moving the divider using ultrasonic sensors

Once the percentage of traffic density on either sides of the road is obtained and divider starts to move accordingly, it is necessary to know if there is any obstacle in the path of divider movement. The obstacles are generally the vehicles moving along the lane next to the divider. We use ultrasonic sensor to detect the vehicles in the path of divider movement and measure their distance to determine if they obstruct the movement of the divider. If the vehicle is close enough to obstruct the divider movement, the divider immediately stops moving and indicates the vehicles to clear the lane using a beep sounding system. As the vehicles clear the lane, the divider continues to move along its path until the lane is occupied by the divider.

E. Emergency vehicle detection

When the ambulance reaches certain distance before the traffic signal the ambulance driver changes the traffic signal from red to green by pressing a button developed in Ubidots application as shown in Fig 7and Fig 8.

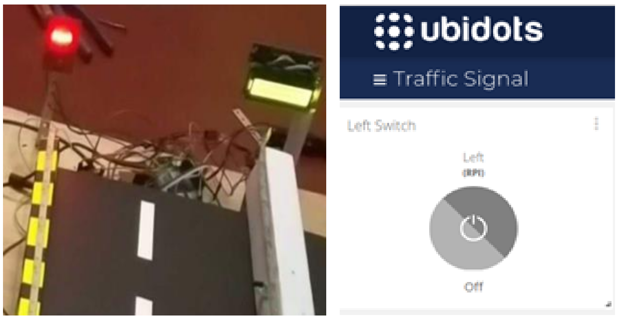

Fig 7. Red signal in traffic and button in OFF status

Fig 8. Green signal in traffic and button in ON status

Depending on the destination paths of the emergency vehicle red LEDs either on the divider side or towards the extreme ends of the lanes turn ON indicating that particular lane to be cleared for the emergency vehicle as shown in Fig 9.

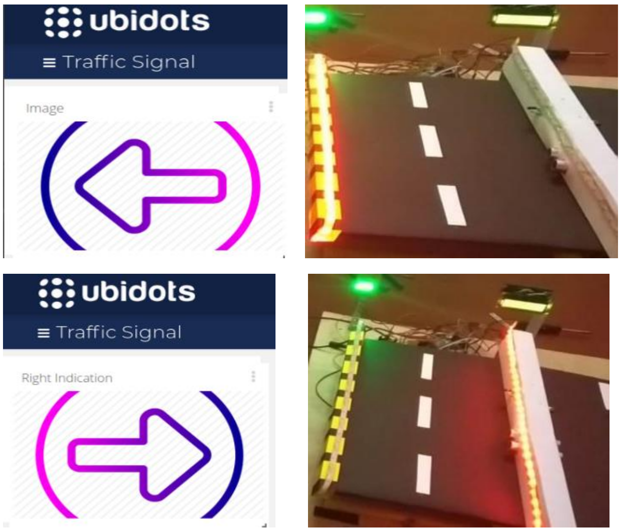

Fig 9. Indication of emergency vehicle

Vehicles in the congestion will know the arrival of emergency vehicle and they can clear the congestion my moving away from red light which in turn gives a way for the emergency vehicle. The traffic signal stays to green as long as the emergency vehicle is waiting in the traffic junction. The signal turns to red, only after the emergency vehicle passes.

IV. RESULT

MORNING		Timings:9:00 AM		
Time in sec	**Number of vehicles in right lane**	**Right lane traffic density percentage**	**Number of vehicles in left lane**	**Left lane traffic density percentage**
0-20	14	72.3%	3	20.2%
20-40	15	62.5%	4	32.6%
40-60	16	82.2%	3	28.2%
60-80	15	67.9%	2	14.8%
80-100	14	65.7%	1	7.3%
100-120	14	66.8%	4	29.5%

Table 1. Distribution of vehicles during morning

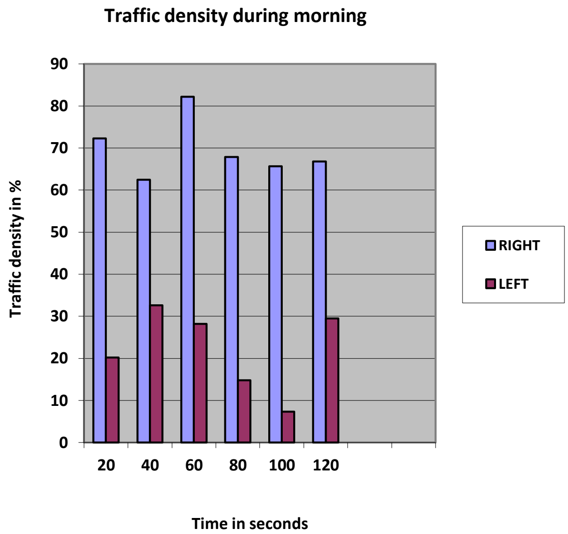

Fig 10. Traffic density per unit time during morning

AFTERNOON		Timings:1:00 PM		
Time in sec	**Number of vehicles in right lane**	**Right lane traffic density percentage**	**Number of vehicles in left lane**	**Left lane traffic density percentage**
0-20	6	40.2%	7	42.5%
20-40	7	42.7%	6	40.8%
40-60	8	47.3%	8	45.8%
60-80	8	46.8%	10	50.2%
80-100	10	52.3%	9	47.6%
100-120	9	48.6%	11	51.5%

Table 2. Distribution of vehicles during afternoon

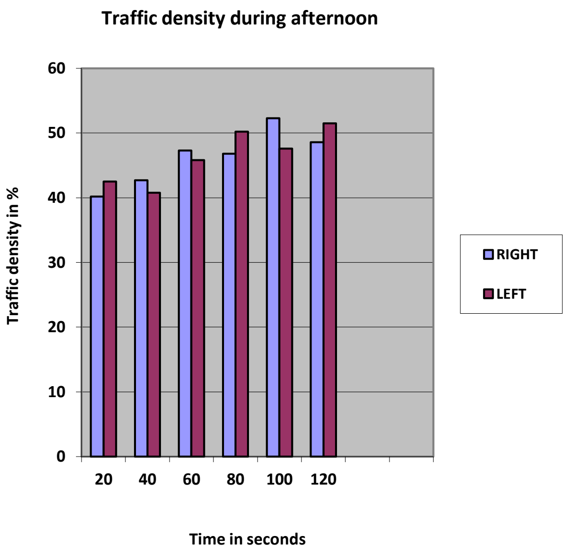

Fig 11. Traffic density per unit time during afternoon

EVENING			Timings:6:00 PM	
Time in sec	**Number of vehicles in right lane**	**Right lane traffic density percentage**	**Number of vehicles in left lane**	**Left lane traffic density percentage**
0-20	3	23.4%	16	80.2%
20-40	3	22.6%	16	79.8%
40-60	2	14.2%	15	75.6%
60-80	5	35.2%	17	82.6%
80-100	3	28.2%	16	78.4%
100-120	3	25.3%	15	75.0%

Table 3. Distribution of vehicles during evening

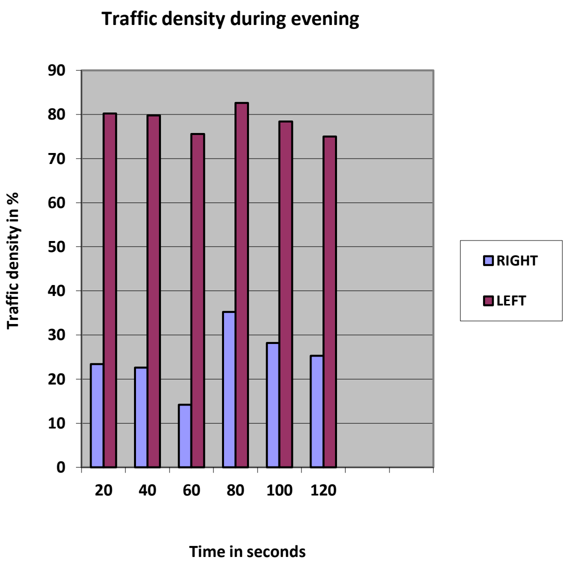

Fig 12. Traffic density per unit time during evening

According to the survey result, we see that the traffic density on one side is higher during morning and in the evening. This causes congestion on one side of the divider. Due to this throughput (speed of the vehicle) decreases at these times of the day. However, the presence of movable road divider makes traffic to spread out evenly throughout the day.

V. CONCLUSION

In this paper, we have successfully designed and developed a demo model ‘ IoT deployed automatic movable smart road divider’ ,in which the results are satisfactory. The implementation of the automatic movable road divider describes a simple method, which uses IoT device. By using this movable road divider we reduce one sided traffic during peak hours. The proposed structure helps to reduce the chances of traffic jams and to provide clearance of road for the emergency vehicles to an extent. Emergency vehicles are allocated undisturbed route which can possibly save a life. Once this is deployed it will have a great revolutionary in the field of emergency.

REFERENCES

[1] B Durga Sri, K Nirosha, Sheik Gouse, “Design and Implementation of Smart Movable Road Divider using IOT”, International Conference on Intelligent Sustainable Systems, ICISS, 2017, pp 1145–1148

[2] Ch V A Satwik, L Pavan Kumar, K Vineeth and Kavitha N Pillai, “Intelligent Road Management System for Daily Transit”, International Conference on Communication and Signal Processing, City of Conference, ICCSP, 2018, pp 0523–0526

[3] Advait Kawle, Dhruv Shah, Kavin Doshi, Manish Bakhtiani, Yash Gajja, Pratibha Singh, “Movable Traffic Divider:A Congestion Release Strategy,”ISSN, vol. 5, pp. 2347- 2812, 2017.

[4] S.Jyothirmayee, G.Vamshi Krishna, J.Nanditha, B.Shashank Yadav, “Controlling Of Traffic Using Movable Road Dividers,” IJAERD-2018, vol. 5, issue.4, pp.2348-4470, IJAERD. April, 2018.

[5] Pallavi Kharat, Kapil Jadhav, Sanket Kamble, Ramdas Labade, Sanjay Labade, “Traffic management system with the Movable divider and automatic barrier for Wagholi road,” IJSDR, vol. 3,issue.6, pp. 2455-2631, IJSDR. June, 2018.

[6] Prof. Raju Bondre, Nikhil Vaidya, Prathamesh Rao, Gaurav Kapse, Viplav Chaudhary, Aniket, Shingne, “A Review Paper on Movable Divider and Cost Efficiency,” IRJET, vol. 7, issue. 2, pp.2395-0056, IRJET. Feb, 2020.

[7] P.Prasanna Kumari ,E.Sweety ,Md.Hussain , K.Raju , G.Mamatha, “Iot Based On Traffic Light Controller With Adaptive Traffice Density Monitoring System,”IJECEC, vol. 4,issue. 2, pp. 2533-8945, IJECEC.June,2018