ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 11, November 2018

Proposed IoT Approach to Ameliorate Traffic Conditions

Shubham Deshpande[1], Revati Ganorkar[1], Mayur Giri[1], Gaurang Suki[1], Araddhana Deshmukh[2]

Student, Department of Computer Science, S.K.N.C.O.E, Pune, India[1]

Asst. Professor, Department of Computer Science, S.K.N.C.O.E, Pune, India [2]

ABSTRACT: Road Traffic Accidents and Congestion has increased drastically in India. The reasons are poor traffic management, bad road condition, improper road structure, poor street lighting, drowsiness etc. To solve this problem, we need to improve the existing systems and provide better and efficient solution. Hence to tackle this problem we have proposed a smart vehicular system using IoT approach. System uses MQTT (Message Queue Telemetry Transport) protocol. System aims to reduce the road congestion and prevent accidents to a certain extent. The model consists of advanced vehicle monitoring and tracking system to monitor the vehicle and the driver to prevent road accidents as well as to reduce traffic congestion. The system makes use of different sensor which works in connection with each other to keep the driver updated about traffic and alert in case of probable road accidents.

KEYWORDS: MQTT, Road Accident, Road Traffic Congestion.

I. INTRODUCTION

The invention of vehicle has been a boon to the mankind ever since it's discovery. But as every invention has it's advantages it also has some cons. The reasons for road accidents mainly are bad road conditions, over speeding, poor street lighting,due to road rage, drunk driving and improper road structure. India comes on top if one consults the statistics. According to WHO more than 1.25 million people die each year because of road traffic crashes [12]. Road traffic injuries are the leading cause of death among people aged between 15 and 29 years which includes the youth [12]. Without sustained action, road traffic crashes are predicted to become the seventh leading cause of death by 2030. [12]Also, traffic congestion posses a great threat to the ecosystem because of the toxic gases that most vehicles emit. The delay which is caused due to traffic jams are incomprehensible. Even emergency vehicles like ambulance become immobile at times due to traffic congestion.

Thus, the road traffic issues are major concern and needs a pragmatic solution to alleviate the problems caused and lives lost. In the past few years attempts have been made to solve these problems with the help of Internet of Things(IoT) which are discussed in the section previous work. The Internet of Things (IOT) is nothing but an interconnection of uniquely identifiable embedded computing devices like sensors within the existing Internet infrastructure. Many researchers and cars manufacturers are taking efforts to find a feasible solution to solve the problem.

The earlier systems have some drawbacks explained further in Gap Analysis .Considering the drawbacks of the previous system ,in this paper we will try to overcome the drawback with a more efficient system.The proposed system consists of different sensor embedded in the vehicle which will communicate to cloud and with each other through MQTT(Message Queue Telemetry Transport) protocol.MQTT protocol is a IoT protocol used for real time applications.Then the data acquired will be analysed and further used to solve traffic problems which will be explained in the proposed model.The different sensors used will be collision detection ,temperature detection ,alcohol detection etc which will monitor the vehicle as well as the driver..The working of the system is explained in the proposed model.

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 11, November 2018

II. RELATED WORK

Following table shows various proposed systems for smart traffic management.

REFERENCE	PROPOSED SYSTEM	TECHNOLOGY USED
[1]	The authors designed a safety driving system system based on V2V and V2I communications.The approach is based on DSRC(Direct short Range Communication) based V2V communications.The main aim of the system was to alert drivers and recommend the proper speeds for vehicles that are approaching a hazardous zone due to for example low visibility region.	V2I,V2V,DSRC
[2]	The authors proposed a system which includes GPS and GSM for vehicle tracking and monitoring purpose using SIM800 module.GPRS sends the tracking information to the server and thus an alert message generated is transmitted to the owner of the vehicle.If the driver drives the vehicle on the wrong path and if the driver feels drowsy or drunk then an alert message will be sent from the proposed system to the vehicles owner's mobile.The vehicle engine is monitored with the help of temperature sensor.	GPS ,GSM,GPRS,Alcohol senor,temperature sensor
[3]	The Author proposed an approach to reducing road accidents caused by mobile phone use is presented. Furthermore , a novel approach to smart road safety using IoT, micro-location and geo-fencing is proposed which discourages mobile phone use.	Geo-fencing , micro-location
[4]	This paper provides an Eye Blink Monitoring System (EBM) that alerts the subject during state of drowsiness. The eye blinking is monitored by using an infrared sensor and accelerometer. A normal eye blink rate has no effect on the output of the system. However, if subject is in sleepy state, then IR sensor receives abnormal eye blinking rate an alarm is initiated to wake the subject.	Infrared sensor , accelerometer
[5]	This paper conveys IoT system which instantly notifies the PSO(Public Safety Organization) headquarter whenever an accident takes place and pinpoints its geographic coordinates on the map using an algorithm.The accident is detected using a shock sensor.	Shock sensor
[6]	The Authors proposed a method using support vector machine(SVM) for early car accident detection in VANET.Once any dangerous situation is predicted, immediately the endangered driver gets an alert along with a suggestion to avoid danger.	VANET,Support Vector Machine(SVM) algorithm
[7]	This paper describes how smartphones, can automatically detect traffic accidents using accelerometers and acoustic data, by immediately notifying a central emergency dispatch server after an accident, and provide situational awareness through photographs, GPS coordinates, VOIP communication channels, and accident data recording.	Smartphone sensors
[8]	The authors performed an abnormal driving behavior monitoring using smartphone sensors .Support Vector Machine(SVM) is used to detect the abnormal driving behavior.The abnormal driving behavior includes Weaving, Swerving, Sideslipping, Fast Uturn, Turning with a wide radius and Sudden braking.	Support Vector Machine (SVM),Smart Phone Sensors
[9]	A proposed system to controll the traffic congestion. System consists of 3 main components RSU, JU and Mobile Unit. Mobile Unit has a RFID tag and RSU and JU has RFID reader. RFID tag is read by this reader and data collected is send to cloud .By Analysing this data the controll actions are taken.	RFID (IEEE 802.15.4 protocol) tags ,readers, GSM and GPRS
[10]	In this author has developed an algorithm which monitors traffic and alerts police in case of traffic congestion	Raspberry Pi, routers , Ultrasonic sensors
[11]	System is generated which is to provide climate updates to users and it is also used to controller trafic congestion. It also gives information about pollution at particular area. It uses Camera to monitor the road traffic. Using this is takes suitable action to controll and alert the user.	PIC controller, Temperature and pollution sensors and camera

Fig.1: Previous proposed models

Fig.1 given above summarizes survey of the papers related to the use of Internet of Things techniques for the control and management of traffic. One of the most trending technology is Vehicular Ad-hoc Network(VANET) that has emerged in the last. Not only this but Machine Learning algorithms are also being used for smart traffic control.

III. GAP ANALYSIS

Despite of Internet of Things is transforming the automotive world by developing connected car technologies to reduce traffic congestion, fuel consumption, emissions and most importantly road accidents, it has several challenges. Many systems related to smart traffic management and accident prevention using IoT were proposed but these systems were specific to topic. Most systems used RFID systems for communication which causes problem of data security. RFID have high range of communication which becomes issue for security.

The earlier models didn't contain methods to track the driver's behaviour. Not only monitoring the vehicle but also the driver with the help of different sensors is also a necessity as accidents can be prevented before they happen. Some systems were proposed with outdated sensors. Even though the earlier systems solved certain issues, but they did not give viable solution to all problems. In our system rather than waiting for an accident to take place, safety and security measures to prevent accidents are discussed beforehand and the driver is also monitored along with the vehicle.

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 11, November 2018

IV. PROPOSED MODEL

Identifying the problems in traffic management, we have proposed a system utilizing the connected cars technology to efficiently manage the traffic and help prevent road accidents. The system integrates many modules and these modules work cooperatively to form a smart traffic congestion management system. The system not only performs traffic primitives but also maintains some safety aspects regarding the safety of people and tries to avoid road accidents.
The modules of the system are: -

1. Collision detector
2. Traffic manager
3. Traffic monitor
4. Route manager
5. Car manager
6. Driver safety manager

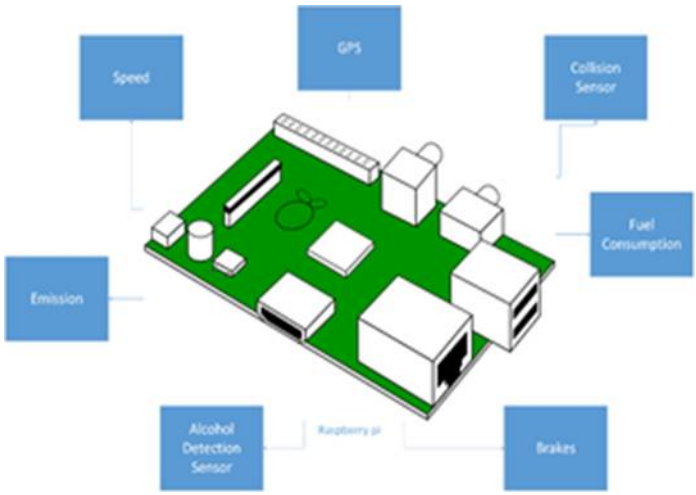

Fig. 1: Sensors used in the system.

Different Sensors are embedded are -

- Speed Detection.
- Global Positioning System.
- Collision Sensor.
- Fuel Consumption detection.
- Alcohol Detection Sensor.
- Ultrasonic Sensor.

Connected cars are embedded with different sensors such as collision detection, speed detector, GPS, fuel consumption sensor, alcohol sensor. These sensors collect the data from the car. Collected information is then transferred to cloud using MQTT protocol.
MQTT protocol is widely used in IoT application while working with real time data. MQTT is very lightweight and efficient protocol for IoT which is popularly referred as 'Backbone of IoT'. It uses very less energy hence useful is saving battery life. The MQTT consists of a server with is mainly referred as a broker or agent. Many companies provide brokers.

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 11, November 2018

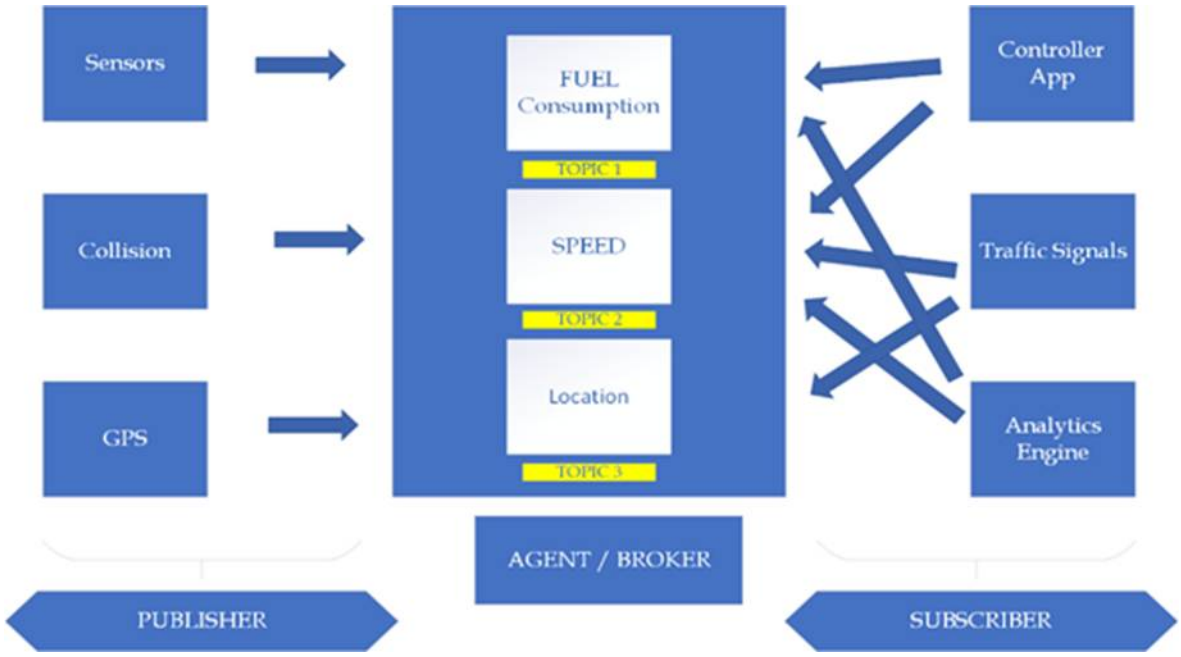

Fig.2:Data Publishing using MQTT

The protocol consists of publishers and subscribers. The publishers in our model are different sensors, GPS module etc and the duty of the publishers is to send the data over the network. The data can be speed of the vehicle, fuel consumption, current location of the vehicle etc. The subscribers in the model are Controller App, Traffic Signals. Analytics Engine etc. which subscribes to the data published by the publishers. All the publishers and subscribers are connected to the same broker and can exchange data and they are collectively called as clients. For example, the Traffic Signal subscribes to the GPS module and will continuously get the data from GPS and no other extra data will be sent to traffic signal which it hasn't subscribed.

The vehicle contains controller which constantly monitors the data coming from sensors and uploads it to the broker. Broker contains topics name by their services. Subscriber entities collect the data from the broker. This data will be displayed on the smartphone application to get the status of all the sensors. Even if any sensor stops working it will be notified to the user by “Will message” in the MQTT protocol. Same data can be monitored by traffic signals and analytics engine. Traffic signal can analyse this data to efficiently manage the traffic i.e. the traffic route having no vehicles can have green signal for very short period and traffic route having high number of vehicles can have green signal for more time. Thus, this approach try to improve traffic condition using IoT approach. Fig. 3 given below also summarizes this with the help of graphical architecture and implementation tools.

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 11, November 2018

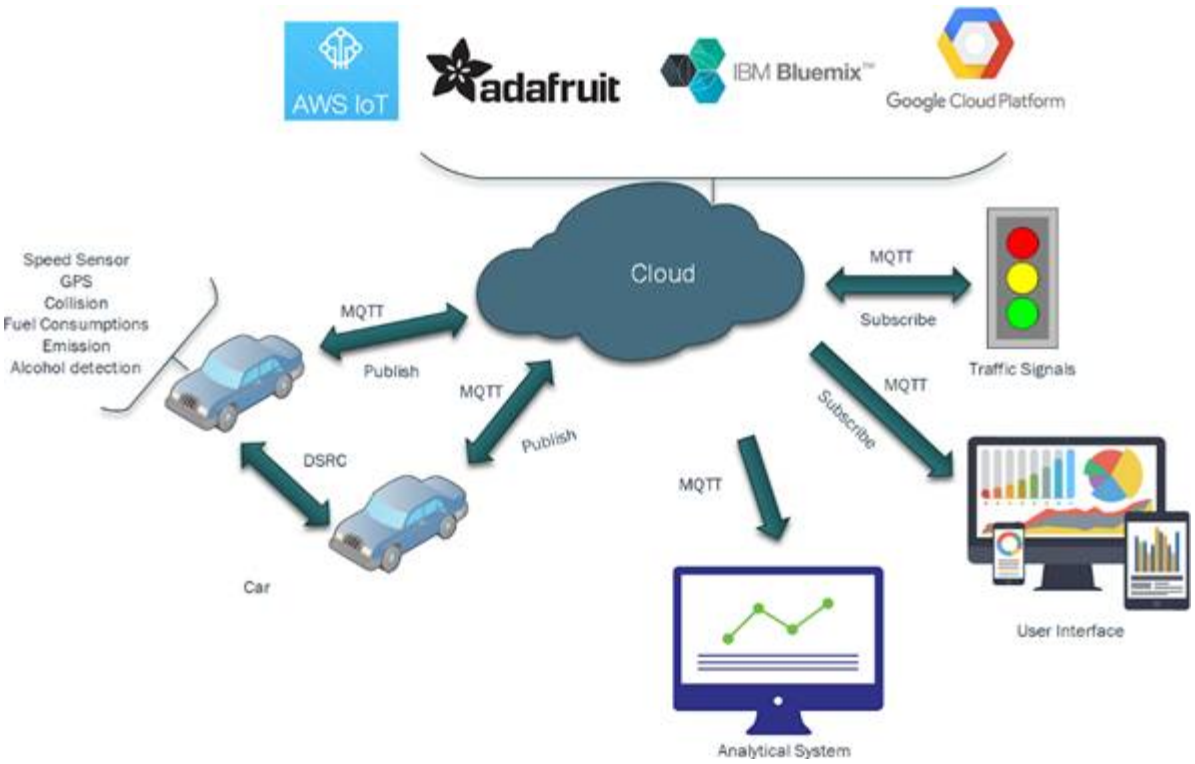

Fig.3: Proposed System

Features of Proposed System

Following the features of this system. It provides solution to the problems caused because of road hazards and traffic congestion.

- Exact location of the car can be detected using GPS.
- Real time traffic data is analysed and based on that traffic lights are controlled.
- After collision detection, SMS/Email will be send to Emergency contacts.
- If alcohol detected inside vehicle then automatic brake lock is applied.
- Steering patterns are monitored to detect drowsiness of driver.
- Speed Recommendation to minimize waiting time.

Dynamic low-time route based on Density based approach.

V. PROPOSED ALGORITHMS

1. *Smart Alcohol Detection System* -

A. If alcohol sensed value > threshold =>
alert driver's emergency contact about situation and automatic brakes are applied.
B. If alcohol sensed value < threshold => allow driver to drive the car.

2. *.Engine temperature Detection* -

A. If Temperature sense value >threshold =>
alert driver that the engine temperature is increasing and needs attention.
B. If Temperature sense value < threshold => allow driver to drive the car

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 11, November 2018

3. Infrared sensor to detect driver's drowsiness-

A. The Eye Blinking rate is monitor using Infrared(IR) transmitter and receiver.
B. The IR transmitter is used to transmit infrared in our eye and IR receiver is used to receive reflected IR rays from Eye. If output is low means Eye is open and output is high means eye is closed.
C. The rate at which eye opens and closes is monitored and if the blinking rate is low that means the driver is feeling sleepy and the and alert is sent to the driver or a buzzer is used to wake the driver up.

4. *Density based approach to find dynamic low-time route -*

A. Set the source and destination location.
B. Find all the possible routes from source to destination and enter length of each route in the DALT (Density and Length Table).
C. Find out density of vehicles in all stations from source to destination.
D. Calculate average density for each route and enter it into DALT.
E. Determine the score for each route.
F. Select the tuple with lowest score.
G. This tuple contains the shortest path with comparatively lower density which means lower traffic.

VI. FUTURE SCOPE

Internet of Things has changed the transportation sector into intelligent transportation system that helps smart traffic management, driver assistance, crash protection etc. There are still some issues which need to be addressed in the future. Efficient Security Protocols need to be developed.

1. Data Privacy issues.
2. Data collected must be stored and maintained properly.
3. Efficient algorithm to monitor real time traffic and alert driver accordingly.
4. Better Connectivity for efficient communication.
5. Making Internet available everywhere as it plays a vital role in working of IoT devices.
6. Different protocols can be used for strong connectivity.
7. Moving from Centralised to Decentralised System. IoT is Centralised System; all data is stored on cloud/server. To utilise the whole power decentralised system is necessary.

VII. CONCLUSION

The IoT and Connected car approach will be beneficial in reducing the number of road accidents soon. Monitoring the vehicle as well as the driver with the help of sensors like alcohol, infrared and temperature sensor will help in detecting the abnormalities in the driver as well as vehicles. If any abnormality is detected, then the vehicle will be slowed down automatically, or the driver will be alerted with the help of message or alarm and hence the probability of accidents will get decreased to a large extent. Use of system in congestion control and accident prevention had a huge impact which resulted in controlled traffic, less accidents and efficient fuel consumption leading to less pollution. It also reduces waiting time between source and destination location. Thus, the system has a great impact in transportation which solves many problems.

REFERENCES

1. Fatma Outay, FaouziKammoun, Florent Kaisser, Mohammed Atiquzzaman (2017, March). Towards Safer Roads through Cooperative Hazard Awareness and Avoidance in Connected Vehicles. In Advanced Information Networking and Applications Workshops (WAINA),2017 31st International conference on IEEE.
2. A. Anusha, Syed Musthak Ahmed (2017, Dec). Vehicle tracking and monitoring system to Enhance the safety and security driving using IOT. In Recent Trends in Electrical, Electronics and Computing Technologies (ICRTEECT), 2017 International Conference on IEEE.
3. Ali Raza (2018, Feb). Road safety in the age of mobile phones: IoT and Milgram. In Internet of Things (iThings) and IEEE Green Computing and Communications (GreenCom) and IEEE Cyber, Physical and Social Computing (CPSCom) and IEEE Smart Data (SmartData), 2017 IEEE International Conference on IEEE.

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 11, November 2018

4Aishwarya S.R, Ashish Rai, Charitha1, Prasanth M.A, Savitha S.C (2015, April).An IoT Based Accident Prevention Tracking System for Night Drivers. In International Joural of Innovation Research in Computer and Communication Engineering Vol.3, Issue April 2015.
5. Elie Nasr, Elie Kfoury, David Khoury (2016, Dec). An IoT Approach to Vehicle Accident Detection, Reporting, and Navigation.In Multidisciplinary Conference on Engineering Technology (IMCET), IEEE International.
6. Qiong WU, Lucas C.K. Hui, C.Y. Yeung (2016, April). Early car collision prediction in VANET. In Connected Vehicles and Expo (ICCVE), 2015 International Conference on IEEE.
7. JulesWhite, Chris Thompson, Hamilton Turner, Brian Dougherty, Douglas C. Schmidt (2011, March). WreckWatch: Automatic Traffic Accident Detection and Notification with Smartphones.In Mobile Netw Appl. (2011) on Springer.
8. Zhongyang Chen, Jiadi Yu, Yanmin Zhu, Yingying Chen and Minglu Li (2015, Nov). Abnormal Driving Behaviors Detection and Identification Using Smartphone Sensors. Sensing, Communication, and Networking (SECON), 2015 12th Annual IEEE International Conference on IEEE.
9. Anurag Saikar, Mihir Parulekar, Aditya Badve, Sagar Thakkar, Aaradhana Deshmukh. (February, 2017) TrafficIntel: Smart traffic management for smart cities. In 2017 International Conference on Emerging Trends & Innovation in ICT (ICEI). IEEE
10. Bilal Ghazal, Khaled ElKhatib, Khaled Chahine, Mohamad Kherfan. (April, 2016).Smart traffic light control system. In, 2016 Third International Conference on Electrical, Electronics, Computer Engineering and their Applications (EECEA). IEEE
11. Neha G. Gupta, Rajesh D. Thakre, Yogesh A. Suryawanshi (December 2017). VANET based prototype vehicles model for vehicle to vehicle communication. In 2017 International conference of Electronics, Communication and Aerospace Technology (ICECA). IEEE
12. Road traffic injuries – [http://www.who.int/mediacentre/factsheets/fs358/en/].