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A Survey on IoT Based Intelligent Road Traffic and Transport Management Systems

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ABSTRACT: This project deals with an approach to overcome the present traffic management system. Nearly 1.26 million deaths related due to road traffic injuries has been estimated by the WHO organization. Lack of development in the transport system specifically in technology aspects accounts for 62% of the deaths. The conventional traffic control system has a major disadvantage where it lacks an adaptive nature for peak hour traffic. Preset data for signal control and lack of centralized entity are few factors which contribute to the chaos prevailing. Sometimes, one particular road may be crowded where the system fails to give priority to the demanding side. Another serious problem is, paving way for emergency vehicles and lane clearance. Hence, an adaptive intelligent traffic control system using IoT (Internet of Things) is proposed. The project overcomes various drawbacks in the current system and extensive data collected from the field conditions can be supportive in extending for future work. The work also incorporates existing protocols framed by different authorities and law enforcing agencies. Specific road standards has been referred for the design and development of the system. Such a kind of system helps in improving the future of transportation and the way people commute. Internet of Things has been pooled in to the system for enhancement of
Safety and security which also includes digitalization in the field.

KEYWORDS: Traffic Management; IoT; Intelligent Traffic control system; Digitalization.

I. INTRODUCTION

The **Traffic Management System** (TMS) field is a primary subfield within the Intelligent Transportation System (ITS) domain. The TMS 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, sensors, etc. flows into a Traffic Management Centre (TMC) where it is integrated and processed (e.g. for accident detection), and may result in actions taken (e.g. traffic routing and emergency dispatch) with the goal of improving traffic flow. The project defines the following primary goals and metrics for TMS:

- Increase transportation system efficiency
- Enhance mobility
- Improve safety
- Reduce fuel consumption and environmental cost
- Increase economic productivity and
- Create an environment for Traffic Management System using Futuristic Internet of Things

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II. EXISTING SYSTEM

The existing Intelligent Transportation System includes various features like Real Time Traffic Monitoring, Incident Monitoring, Automated Warning Systems, Weather Information Reports, etc. But all these lack in common is adaptive demand responsive nature during peak time and emergency situations. A traffic control system needs to be demand-responsive to current traffic states. Such characteristics of a system include

1. Adaptability to current traffic conditions
2. Responsibility for a target and adjacent intersections
3. Unrestricted control periods of varying length
4. Able to update signal plans frequently and
5. Completely on-line operations

III. PROPOSED SYSTEM

The adaptive traffic light problem uses sensors located at the traffic junctions to send real-time traffic data to the Traffic Management Centre (TMC). Special sensors are mounted within the **raised pavement markers** customized for Traffic Management System purpose. These markers are made up of special type of plastic, thermo plastics or metal and encapsulates multiple sensors for performing operations. The system performs four tasks data acquisition, traffic evaluation, traffic prediction and traffic control during traffic movement through these **rumble strips.** During the movement of the traffic, the following working modes are considered for an Intelligent Transportation System.

1) Heavy Traffic Jams

With increasing number of vehicles on road, heavy traffic congestion has substantially increased in major cities. This take place usually at the main junctions commonly in the morning, during peak hours. The main effect of this matter is increased time wasted by the people on the road. The solution for this problem is by developing the program which has different setting delays for different junctions. The delay for junctions that have high volume of traffic should be set longer than the delay for the junction that has low traffic. This operation is calling Normal Mode.

2) No traffic, but still needs patience

At certain junctions, people have to wait even traffic is immaterial. Because the traffic light remains red for the pre-set time period, the road users should wait until the light to turn green. They are forced for signal skipping during such times and are prone to the chaos. The solution for this problem is by developing a system which detects traffic flow on each road and set timing for signals accordingly. Moreover, synchronization of traffic signals in adjacent junctions is also essential. The signals shall be back to their normal operation once the incoming traffic is available and thereby resetting the system. The TMC has a bird's eye view on the traffic conditions for a system override in case of emergency.

3) Special vehicle treatment during traffic

Usually, during traffic jam emergency vehicles such as ambulance, fire brigade and police will be stuck in the traffic junction. They also need to be held up until the signal is open for the traffic. This is very precarious problem because it can cause the emergency case complicated and life threatening.

4) Lack of Traffic Information to users

Present traffic systems fail to provide traffic information including congested roads and alternate routes available in case of congestion. If this information is available to the users, then it can alone avoid nearly 50% of the traffic

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congestion. When such data is available to the users, they can make alternate arrangements for their trip and avoiding more congestion during peak times.

IV. FEATURES

It can interconnect adjacent traffic signal controllers to construct a small-scale control cluster and implement traffic control when the connections between controllers and control centre are interrupted. Status monitoring and exception handling procedures which monitor the software and hardware prevent unstable execution. These procedures keep the system operational for ideal traffic control. It reports malfunctions to control centre and alerts may be issued for the execution of software system and the operation of hardware.

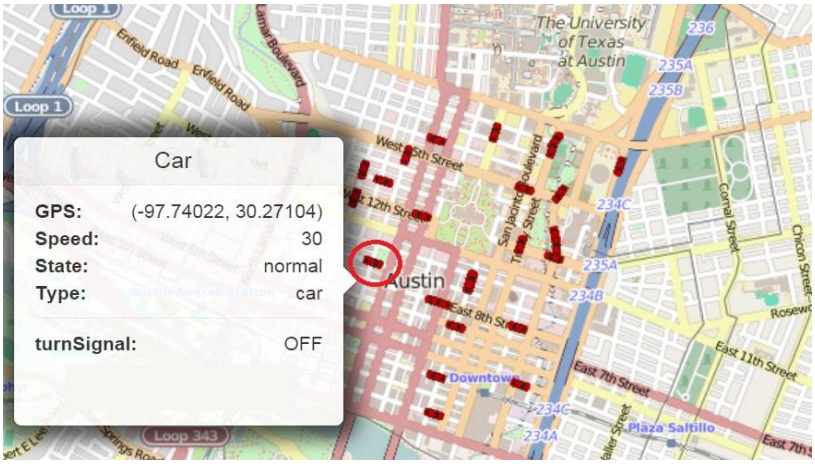

Figure showing an integrated connected grid network (Courtesy: IBM)

STAGE 1:- (SIGNAL CO-ORDINATION)

SECTION 1:- (TRAFFIC MONITORING AND DETECTION)

The module consists of one sensor section and laser network which is used for monitoring and detection purpose. This module is placed exactly near the STOP line. There will be two laser sections where one is placed exactly one meter before the stop line and another laser section is placed one meter after the stop line. During STOP signal a vehicle needs to stop before the STOP line, so when a vehicle crosses the first laser section processing unit will sense the presence of a vehicle on the road. If a vehicle jumps the STOP line, it will cross the second laser section and the processing unit will sense this and capture the image of the respective vehicle with a camera placed on the traffic signal. There are 4 IR sensors placed along with the laser sections in the rumble line. This is used to identify whether a vehicle is moving in the straight direction or free left direction. One section of IR sensor is placed for the detection of free left turn and three IR sensors for detection of straight travel direction. If a vehicle is taking a free left turn and crosses the STOP line and two laser sections processing unit along with IR sensors will detect this and will allow the vehicle to pass through .If a vehicle is jumping a signal by crossing the STOP line and two laser sections the processing unit and 3 IR sensors will detect this and capture the image of the vehicle with a speed cam.

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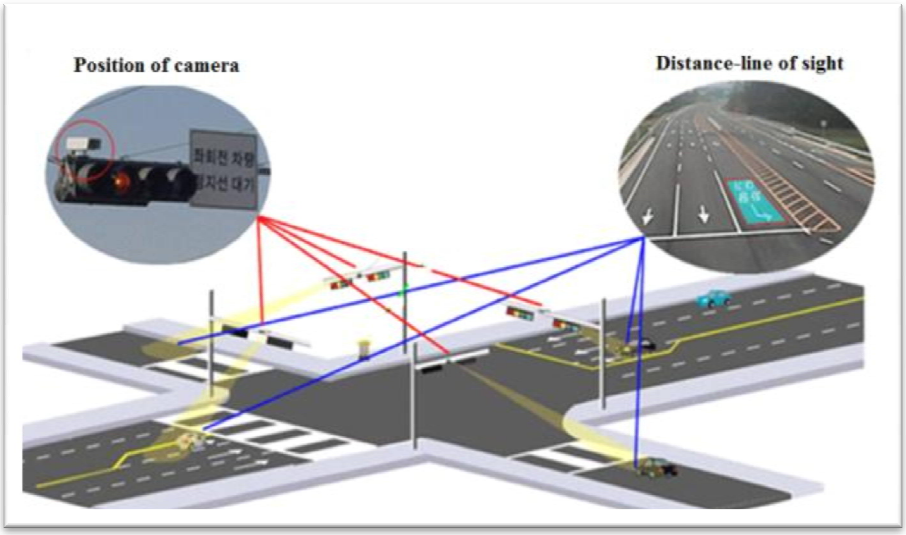
SECTION 2 :-(PEDESTRIAN CROSSING MONITORING AND DETECTION)

PIR sensor is used here for monitoring and detection of human movement and traffic control. When a person is crossing the road through pedestrian crossing, PIR will keep on monitoring and the processing unit will not release the traffic until all the persons have crossed the road. If a person is crossing the road and is standing mid-way without any further movement, the PIR will detect this and will inform the processing unit which in turn will alert the command center. The command center will analyze the situation through the camera present. In case the law enforcer is standing on the midway of the road for inspection purpose, the PIR sensor will detect this and will intimate the processing unit which will inform the command center. The command center will verify the situation with the help of the camera and give an instruction to the processing unit or a given time out instruction which will be executed.



STAGE 2:- (TRAFFIC MANAGEMENT)

SECTION 1:- (MOTION DETECTION)

A laser section alone is placed at a distance of 25 m or 50 m depending upon the traffic density of the road. This is used for continuous monitoring of the traffic on roads at any point. When the laser beam flicker's continuously or it doesn't flicker continuously we can assume that there is continuous movement of vehicles or there is no movement at all. The presence of vehicle can be detected by the module present in this stage. This module can be applied at any point on the road. This laser section consists of an RFID reader.

SECTION 2:- (EMERGENCY VEHICLE CLEARANCE)

When an emergency vehicle crosses the laser beam section the RFID will read the RFID tag placed on the vehicle. The processing unit will immediately identify this and stop the traffic and allows only the required road section for free and safe travel of the emergency vehicle. All the signals covered in the course of the emergency vehicle follows the same procedure.

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SECTION 3:- (BUS RAPID MANAGEMENT SYSTEM - FUTURE WORK)

The RFID reader is also used for Metropolitan Transport Corporation (MTC) digitalization. Every MTC bus will be tagged a separate RFID tag based on the route they cover. The RFID reader will read and inform the nearest bus station about the incoming bus. This data can be fed directly into cloud. A mobile application can be developed which can be used by the user for better knowledge on the running status of the desired bus service in his/her route.

SECTION 4 :- (VEHICLE THEFT AND MANAGEMENT SYSTEM – FUTURE WORK)

Upon special requests users can also enroll their vehicle by the RFID tagging for individual attention like vehicle monitoring and theft prevention. The users tag will be included in the central center for monitoring for special practices or for safety. This brings in a large database of vehicles in the city or entering or leaving the city. Emergency requests are also handled by the center if an assistance signal is sent out.

V. CONCLUSION AND FUTURE SCOPE

The above proposed system ensures smart control of traffic system and manages the traffic blockage. Theoutcome is as we expected. By this proposed system time management for signal lights is done by means effective detection of traffic volume in every junction which will reduce the traffic congestion problem. The system is designed to be pedestrian friendly and safeguard the life of pedestrian crossers, avoids accidents in major junctions. Clearance of traffic for emergency automobile is successfully implemented. Hence, many precious life would be saved. And the system has automatic and manual operation. All the system control and detection are possible by sensors and cameras placed the junctions. And at present we have implemented the design for only traffic regulation, reduction of accidents and vehicle clearance in case of emergency. In future this can be extended to tracking of stolen automobile which can be easy and fast,when lost vehicle is identified an email may be dropped. An 'app' can be designed which uses traffic status at different location from the control station database to display so that it helps normal people. Hence common people can know the status of the traffic at any junction. Further the same design can be added with accident message alert system.

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