iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4 **Issue:** XI **Month of publication:** November 2016

DOI:

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Internet of Things Based Smart Transportation Systems

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Abstract- Internet of Things (IoT) links the objects of the real world to the virtual world, and enables anytime, anywhere connectivity for anything that has an ON and OFF switch. It constitutes to a world where physical objects and living beings, as well as virtual data and environments, interact with each other. Large amount of data is generated as large numbers of devices are connected to the internet. So this large amount of data has to be controlled and converted to useful information in order to develop efficient systems. In this paper, we focus on to an urban IoT system that is used to build intelligent transportation system (ITS). IoT based intelligent transportation systems are designed to support the Smart City vision, which aims at employing the advanced and powerful communication technologies for the administration of the city and the citizens.
Keywords: IoT, ITS, NFC, WSN.

I. INTRODUCTION

As the Wireless Sensor Networks have technologically developed more rapidly and more efficiently, they have become the key source for the development of IoT. They find application in almost all areas including smart grid, smart transportation systems, smart home, smart hospitals, and so on. The achievement of the above lead to the smart city development as mentioned by our Indian Prime Minister. The idea of internet of things (IoT) was developed in parallel to WSNs. The term internet of things was devised by Kevin Ashton and refers to uniquely identifiable objects and their virtual representations in an “internet-like” structure.
These objects may range from huge buildings, planes, cars, machines, any sort of goods, industries, to human beings, animals and plants and even their specific body parts. One of the major evolutions of WSNs will be after they are integrated with IoT. This paper aims to develop an intelligent transportation system.
The future roads will be able to manage traffic congestion much better than today's networks. It has been imagined that in a span of around 20 to 30 years the existing traffic system would improve to an extent where cars can communicate with each other without any human interaction to control the traffic. Hence travel could be made smoother and safer. Sensors would be fitted in cars and these cars will be placed on the roads. These would monitor traffic and send the information wirelessly to a "central traffic control system," a hub that compiles data to feed back the information to vehicles on the road. For instance if there's lots of traffic, the central traffic control system would be told over WiFi and they in turn react by imposing speed limits that have to be followed by the vehicles in that congestion area. Since millions of money is spent on traffic congestion every year, it has been estimated that, by the implementation of smart transportation systems, the money spent will get reduced by at least 15%. Additional benefits include parking guidance. Rather than driving around the whole area looking for space, the drivers would be told over the WiFi about the vacant spaces available near to their location. In addition to this, the drivers would be intimated with the shortest possible paths to reach the destination so that carbon dioxide emissions can be controlled. This system could even warn the drivers about school zone where there may be lots of children crossing the roads and the alternative route would also be suggested. In this technology the telecoms combine with WiFi thereby producing better efficiency for the customers as well as the consumers both in the work place and even out of it. The paper is organized as follows. Section II describes about the improvisations that has been done to the prevailing transportation system. Section III explains the results and analysis of the existing system and how efficient the proposed system will be and the results are compared. Section IV explains the drawbacks of the systems and the future enhancements that can be made to this system.

II. PROPOSED SYSTEM

The flow diagram of the proposed system is shown in fig.1. The cars entering and leaving the parking slots are taken into count. The information thus gathered is sent to the garage management systems. Two types of sensors are employed here, Parking sensors and roadway sensors. In a similar manner two meters are used such as, existing parking meters and new parking meters. The information obtained from the sensors is passed to the sensor management systems. Parking meters send their respective data to the meter management blocks. All the information obtained above is sent to the central data management system where they are being

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Volume 4 Issue XI, November 2016
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

collected and processed. They are in turn sent to the data warehouse for monitoring and storing. Hence this system helps the customers to make optimum use of the resources that are available for safer and smoother parking of their cars and vehicles. Hence there will be an orderly way of parking. Sensors identify the vacant parking spaces and send the information to the central server. On the other hand smart phone app requests for a parking space and the vehicle is directed to the available parking space. At the same time the parking fee is paid directly through the mobile app. This system can also be integrated to provide intelligent lighting of the streets. Here the street light is turned on when the street is being used by the vehicles and other times it remains switched off.

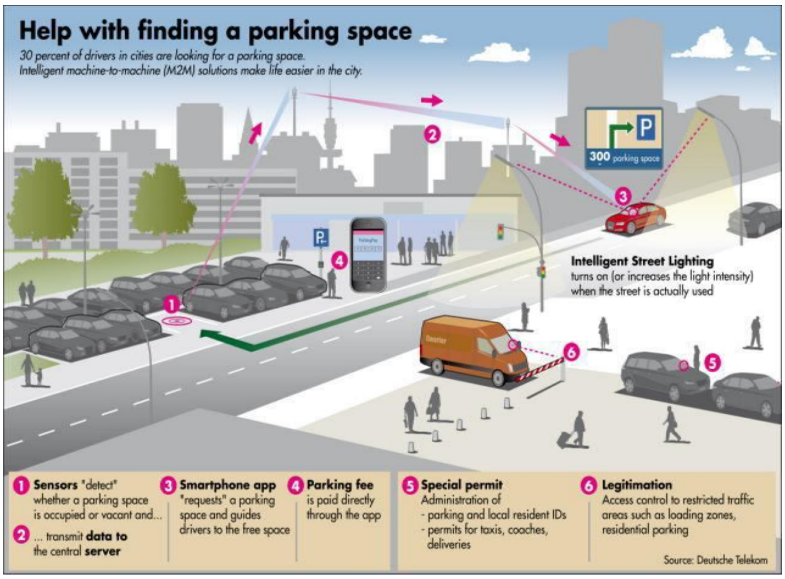

Fig.1- Data flow diagram of IoT based smart parking assistance.

The parking assistance is provided using the following steps. Sensors detect whether a parking space is occupied and transmit data to the central server. Smart phone app requests a parking space and guides the drivers to that free space. Parking fee is directly paid through the smart phone app. Access to loading zones and residential parking zones are restricted. IoT traffic architecture comprises of RFID, Wireless sensor technologies, Ad Hoc networking and internet based information systems. Intelligent traffic IoT is divided into three layers such as Application layer, Acquisition layer and Network layer. Application layer is responsible for intelligent traffic management, intelligent driver management, information collecting and monitoring and information services. Network layer makes use of WiFi, 3G/4G and WiMax or GPRS. Acquisition layer employs RFID, RFID reader, WSN, Intelligent terminals.

Table 1 Intelligent Traffic Management

Application layer	Intelligent Traffic Management	Intelligent Driver Management	information collecting
Network layer	Internet	WiFi, 3G/4G	WiMax
Acquisition layer	RFID	RFID reader	WSN

The system makes use of wireless sensors to obtain real-time traffic information, such as traffic condition on each road, number of vehicles, and average speed. Utilization of wireless sensors is much appropriate due to their low power consumption and low cost. In order to achieve large-scale network layout, the system uses wireless cluster sensor network. Each cluster has a set of wireless sensors and each set is represented by the head node. Data at the head nodes are delivered to the backend system by means of a mobile agent. Already some new vehicles have been equipped with GPS and sensors capable of receiving and sending driving information. This information is sent to the monitor and control centre trough satellite communication facilities. GPS is connected to the wireless sensor networks which can be used for measuring driving speed and driving direction. The traditional traffic monitoring system based on image-processing technology has many limitations. The weather conditions have serious impact on this method. During heavy rain and thick fog the license plate is not clearly visible and hence the image cannot be captured. The development of

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e-plate based on RFID provides a better opportunity for intelligent traffic monitoring for identifying and tracking the vehicle. RFID can be used as a transponder in license plate equipped with a RFID tag and sensors. Here each car can get data it needs from the spot and deliver the data to assigned destination. The vehicle RFID tag stores information about the vehicle and the owner. Parameters such as vehicle plate number, vehicle type, speed of the vehicle, license number, the travelling location of the car are monitored and stored. This knowledge of information from every vehicle helps in estimating the number of vehicles on the road, average speed of the vehicles and the density of the vehicles on the road. The data from each vehicle is gathered or collected by means of a fixed or mobile RFID reader at each monitoring. Finally the information is sent to the central server for collecting, processing and storing. Once system connects to the internet, all information of vehicles on each road segment is immediately saved in database and can be used for any purpose and application. When a vehicle with an RFID tag passes through each monitoring station along the road, the RFID reader at those points will automatically read the tag data related to the vehicle and its owner and transmit to the wireless sensor active nodes. These nodes send accumulated data to the cluster head node. At the same time, a GPS receiver installed at the monitoring station can communicate with GPS satellites to obtain its position information that is taken as a position parameter of the vehicle. Then the data is transmitted using GPRS scheme to the real-time central database where the data is constantly updated to ensure data reliability.

III. RESULTS AND DISCUSSIONS

This section describes the results obtained in the existing system. The survey is conducted for about 15 Km around Ooty. Here the location information is sent to the database every five minutes due to memory considerations and this can even be reduced. Processing system converted this raw information to meaningful data as shown in figure 2. The proposed system can function with less memory constraints and can send the location information continuously. The proposed system even provides parking assistance to the drivers on the road.

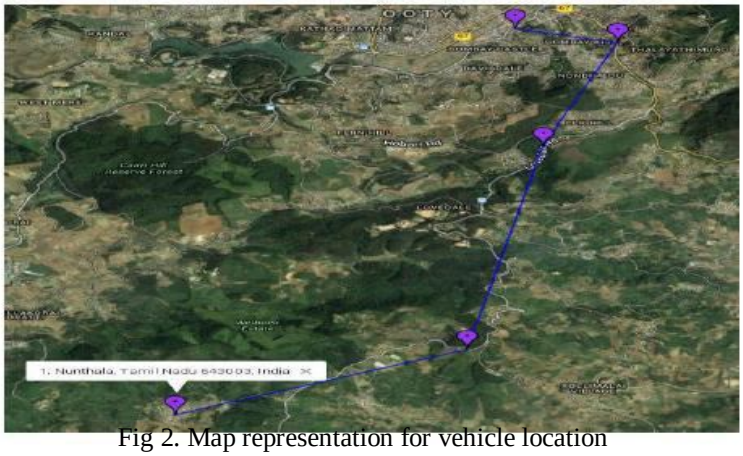

Fig 2. Map representation for vehicle location

IV. CONCLUSION

This paper presents a real time traffic monitoring system to solve the problem of real time traffic controlling and monitoring. The proposed system provides a new way of traffic control by the better utilization of resources. The traffic administration department can use this real time traffic monitoring information to detect the dangerous situations on the road and thereby react by imposing immediate actions. On the whole IoT will play an important role in traffic monitoring by improving the efficiency of traffic safety and travelling costs.

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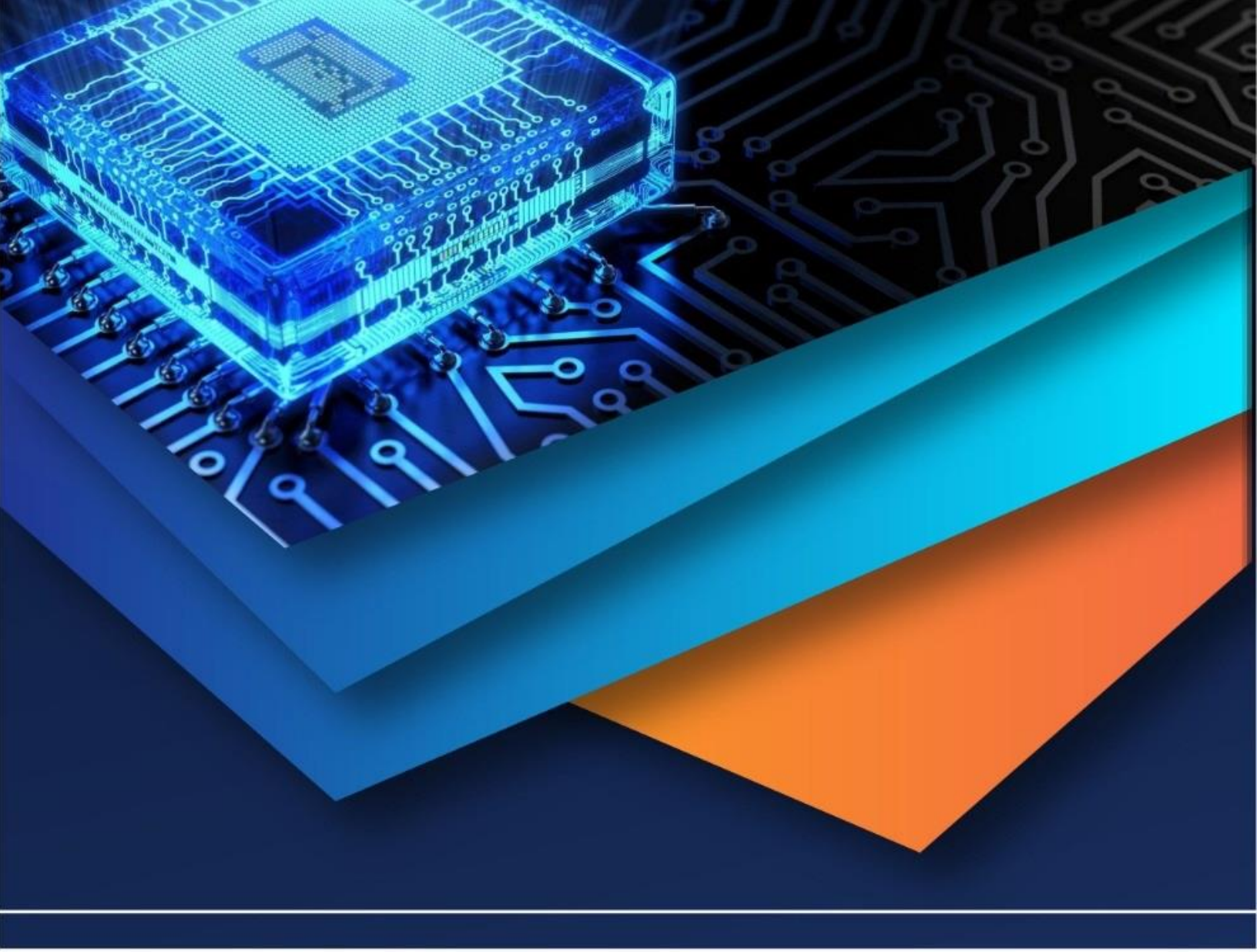

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