Internet of Things for Automatic Traffic Control for Smart City

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Abstract— Sensors and Wireless Sensor Networks (WSN) are being deployed around the world, capturing various physical quantities, measuring local and global environmental conditions. Parking meters, information signs, CCTV, traffic signals almost everywhere that you look in a smart city, there is a microchip embedded device, connecting to the all-encompassing Internet of Things (IoT). The Internet of Things can play major role in automatic traffic control in a smart city. In this paper, we propose a framework for automatic traffic control system which is based on the novel IDMR algorithm. The proposed IDMR algorithm is a blend of image processing, data mining and wireless sensor network routing protocol. LEACH algorithm has been used to improve the life of wireless sensor networks.

Key words: IoT, Wireless Sensor Networks, Smart City

I. INTRODUCTION

Traffic congestion on city road networks is one of the main issues to be addressed by today's traffic management system. We are known to the fact that, number of vehicles is increasing exponentially. There are various traffic management systems existing such as Simple Traffic Management Systems, Intelligent Traffic Management System based on Image Processing, Intelligent Traffic Management System using Wireless Technologies, and Intelligent Traffic Management System using Wireless Technologies [5]. Traffic management system is the crucial task in today's world. Due to increase in population number of vechlies are increased. The data from different sensors and cameras have been captured and stored at central server. The database from central server is used to manage the traffic flow on road. Basically a traffic management system gives advice to the command-control and signalling system which leads to provide the current situation of traffic and also predict future demandmulti-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create the traffic management system is based on RFID. This system includes intelligent traffic command or intelligent traffic management center system or intelligent traffic monitoring system and intelligent traffic charging system. It enhances the effective traffic management system function [2]. In our project smart traffic management system includes the cameras and sensor values. The sensors have been used for capturing the values from real time traffic system. Image processing techniques have been used to count the number of vehicles. Data mining Technique has been used for mining various kind of patterns. IDMR algorithm used for this purpose.

II. MOTIVATION

Traffic congestion in cities are very common problem in today's era. Traffic lights and traffic police are seems to be inefficient at certain point in metropolitan cities. As a result traffic has become one of most prominent problem in big cities in all over the world which have caused a huge waste of time, property damage and which eventually increases environmental pollution. Every person is busy doing their work and in a hurry to sustain in today's fast world and doing the work as early as possible. People like industrials, company workers, etc are in a hurry while travelling and due to congestion or lengthy and heavy traffic jams or conventional traffic systems everybody will reach late on work. To overcome all the traffic related problems IOT and RFID service has been introduced which provides us traffic information so that most of the traffic problems can solve.

III. RELATED WORK

To provide the traffic prediction model based on fuzzy logic which can be used for providing traffic control system on different types of roads and signal permutations[1].In Nigeria a fuzzy logic based design which consist of Structured Systems Analysis and Design Methodology (SSADM) and Fuzzy logic based Design methodology implemented at traffic oriented region[2].The ITS (Intelligent Transport System) which provides the advantages over other existing congestion management techniques[3].A traffic control system is implemented at the traffic congestion network assuming that cars are controlled by agents[4].To manage the congestion problem on road a weight based multi-objective algorithm has been proposed along with RFID (Radio Frequency Identification) which is easy to install and cheap to use.[5,6].RFID tag has been used on the vehicle to detect the flow of traffic on road in which sensors can be used to collect the information using Zigbee wireless network and data mining can be done using algorithm [7].The modules to control the traffic using intelligent agents which provides the real time traffic scenario on road and signal synchronization to avoid the traffic jams on road[9].

IV. SYSTEM SPECIFICATION

In Intelligent traffic monitoring/Controlling system, the traffic is monitored as well as controlled by using RFID tags. The RFID (Radio Frequency Identification) is the technology used to identify, trace and count any real life examples. RFID technology has been used in many areas and traffic management is one of the key area to be used. RFID tag has been installed on the vehicles to track the traffic on the road in specific pattern. So to make the prediction in specific area we can determine the specific patterns of vehicles. The information from the road can be collected from wireless sensors and then the data mining algorithm such as LEACH (Low-energy adaptive clustering hierarchy) algorithm has been applied on the collected data. It is integrated with simple routing protocol with clustering in wireless sensor network. LEACH algorithm has been used to consume less energy which automatically improves the life of wireless sensor network. It transmits the information to cluster heads and compress and forward it to base station.

Data mining refers to the mining or discovery of new information in terms of patterns or rules from vast amounts of data. It uses data analysis tools to discover previously unknown patterns and relationships in large amount data.

These tools may be statistical models, mathematical algorithms, and machine learning rules. Algorithms can be used to improve their performance automatically through experience. The main task of data mining is collecting and managing data along with the analysis and prediction. The WSN is built of "nodes" from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery. Data mining software is one of a number of analytical tools for analyzing data. It allows users to analyze data from many different dimensions or angles, categorize it, and summarize the relationships iden- tified. Technically, data mining is the process of finding correlations or patterns among dozens of fields in large relational databases.

V. SCOPE

The Scope of this tool is to use for intelligent Traffic Management and controlling which will provide the area which is less polluted and of less traffic. These measures may vary by source type, such as stationary or mobile, as well as by the traffic that is being targeted. The purpose of these measures is to achieve less congestion on road. LEACH algorithm is needed to improve the lifespan of nodes in wireless sensor network.If the battery dies then the network is of no use.So it allows to do minimum work for transmission of data.The LEACH algorithm is made up of nodes called cluster heads which can be used to collect data from the surrounding nodes and pass it to base station.The job of cluster heads can be changed so it is called as dynamic nodes. There are two ways of transmission. First is direct transmission and second is transmit to node with minimum energy required.It can be summarized as

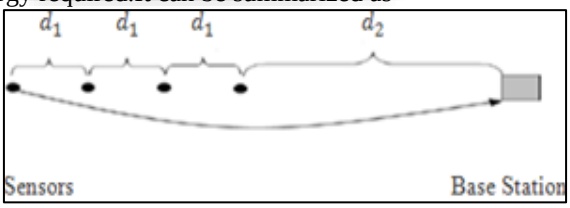

Fig. 1: Direct Transmission

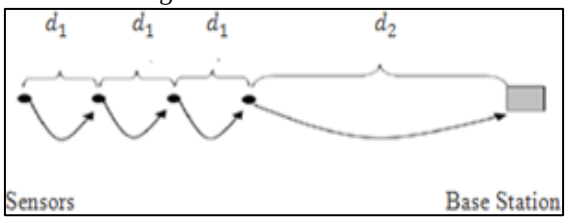

Fig. 2: Minimum Transaction Energy

For first direct transmission of energy, it can be formulized as €ampk$(3d_1 + d_2)^2$

For minimum transmission energy required to transmit €ampk $(3{d_1}^2 + {d_2}^2)$.

VI. SYSTEM ARCHITECTURE

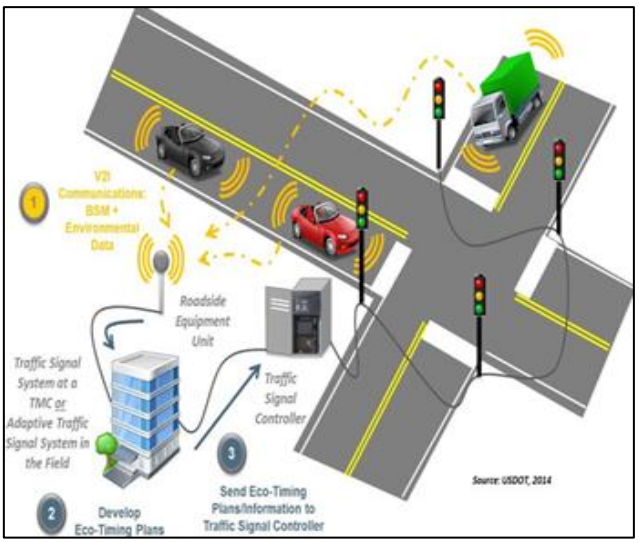

Fig.3: Intelligent Traffic Monitoring system

VII. ALGORITHM

A. Algorithm for Vehicle Count and Density of Traffic

The images of different background and vehicles are captured and converted to grayscale and they are compared to find the frame difference. The threshold value has been set to find the difference between two images. If the image is too small, it will produce a lot of false change points, and if the threshold choice is too large, it will reduce the scope of changes in movement.

1) Step 1: Start.
2) Step 2: Capture background image of the empty road.
3) Step 3: Capture the new image with vehicles on road.
4) Step 4: Convert the images to grayscale format using double precision.
5) Step 5: Find the width and height of the image.
6) Step 6: Set the threshold value as suitable.
7) Step 7: Find the difference between frames.
8) Step 8: If the frame difference is greater than the threshold, then retain that image else discard.
9) Step 9: Convert the image to a binary image

VIII. FUTURE WORK

There can be scope for future addition in our work. We have worked upon the pattern recognition based on traffic.We have captured the images from real time scenarios and apply data mining to the database to get the patterns related to time, season, day. According to the databases that we have collected we can predict the traffic in coming years.

IX. CONCLUSION

We can thus conclude from the obtained results that an intelligent traffic system that times the traffic light according to real-time scenarios and is based on patterns we get from data mining algorithm. Thus intelligent traffic systems smoothen the flow of traffic and reduce/completely remove unnecessary delays.

REFERENCES

[1] Sabhijiit Singh Sandhu1, Naman Jain2, Aditya Gaurav3 and N. Ch. Sriman Narayana Iyengar G. Eason, B. Noble, and I. N. Sneddon, ""Agent Based Intelligent Traffic Management System for Smart Cities" 2015
[2] Dian-xia Hu,Zhi-peng Zheng," International Journal of Smart Home" 2nd International Conference on Artificial Intelligence, Management Science and Electronic Commerce (AIMSEC),2011
[3] S. A. Mulay, C. S. Dhekne, R. M. Bapat, T. U. Budukh and S. D. Gadgil, "Intelligent City Traffic Management and Public Transportation System", IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 3, No 1, May 2013.
[4] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.
[5] Osigwe Uchenna Chinyere, Oladipo Onaolapo Francisca and Onibere Emmanuel Amano, "Design and Simulation of an Intelligent Traffic Control System", International Journal of Advances in Engineering & Technology, Nov 2011. Vol. 1, Issue 5, pp. 47-57.
[6] José A. Castán R., Salvador Ibarra M., Julio Laria M. and Emilio Castán R, "An Implementation of Case-based Reasoning to Control Traffic Light Signals", Proceedings of the World Congress on Engineering 2014 Vol I, WCE 2014, July 2 - 4, 2014, London, U.K.
[7] U. F. Eze, Igoh Emmanuel and Etim Stephen, "Fuzzy Logic Model for Traffic Congestion". IOSR Journal of Mobile Computing & Application (IOSR-JMCA) e-ISSN: 2394-0050, P-ISSN: 2394-0042.Volume 1, Issue 1 (May-June 2014), PP 15-20.

