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Proposed Work for Revolutionizing the Traffic Control System Using Internet of Things

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ABSTRACT

The Internet of Things (IoT) is able to integrate a huge number of heterogeneous objects, in order to offer a plethora of services. Thus, constructing an all-purpose structure for IoT is an intricate task due to the presence of varied devices, technologies, and the services they provide. In this paper, our work focuses on the urban transportation system which needs to be altered to some extent. The work focuses on the architecture, protocols required, and technologies to be embedded in the system. The amplification in the number of vehicles on the road demands an effective infrastructure to balance the coordination amongst the private and emergency vehicles like ambulance, fire brigade and police van. In order to achieve this vision, there arises a need of a technology that can uphold this collaboration amongst the vehicles on the road. At this point, Internet of things comes into picture due to its capability of linking the objects and allowing interaction between them. This paper presents an infrastructure in which the common vehicles and the emergency vehicles can interact with each other through sensors and network. This infrastructure would help in transforming the traffic conditions in India resulting in the saving of time, resources and life.

Keywords: Server Simulator, Intelligent Traffic, Internet-of-Things(IOT), RFID, Wireless Sensor Networks

1. INTRODUCTION

In today's era there has been a vast development in the domain of wireless sensor networks, which acts as a backbone for the growth of Internet of things. The term IOT incorporates smart development of transportation system, smart city, smart grid etc. The condition that is mandatory for implementing this new exemplar is the introduction of smart objects [1].Smart objects are the objects that have an "identity" in the network and are able to communicate, process, and interact with others in the environment. Powered by the alteration of numerous devices such as embedding of sensors in the device, huge data storage capacity etc, IoT has carved out its path towards revolutionizing the present transportation system into a smart and competent one. Wireless sensor networks, impeccably assimilates into urban infrastructure and digitizes it. The generated information is shared across varied platforms and applications to develop a single face of the city form all the angles.

With the overall development taking place, it is utmost important to comprehend the demand of good services to intensify the efficiency of city management. A good management of the city is possible only if all the major entities in the city are coped up with properly. A huge amount of money is incurred due to traffic congestion every year. If by any means a smart transportation system is implemented then a good fraction of expenditure can be reduced. Constructing a smart and proficient traffic system based on IoT has number of pros associated with it such as decrease in the traffic jams, progress in traffic conditions, save the time, betterment in management costs, ease of movement in the city etc.

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This research proposes to use IoT, RFID and other technologies for the betterment of the conditions of the traffic and relieving from the pressure imposed by poor traffic conditions. Information produced and assimilated by the traffic IoT, can be imparted to the travelers so that they become aware of the traffic conditions and plan their travel accordingly. The major motive behind this work is to put forward a framework for managing and controlling real time traffic information using IoT. The principal attribute of the proposed framework is its competency of combining varied technologies with the prevailing setup of communication. The collected information is analyzed and using a prediction scheme the congestion in the traffic is predicted. Our main work deals with carving of the path for emergency vehicles such as ambulance, police van and fire brigades. In India it has been observed that that these emergency vehicles are stuck in the traffic and no one takes initiative to allow these vehicles to move out first. As a result many a times they become late and the situation calling tem worsens. Thus this research focuses on finding a solution to this highly complex problem.

The rest of this paper is organized as follows: Section II discusses about the literature survey . Internet of Things, RFID, artificial intelligence, the description of problem and the architecture of the proposed work are discussed in Section III. The algorithm of the proposed work is presented in section IV. Conclusion and the future scope is given in Section V.

2. LITERATURE SURVEY

The highlighted problem in India is the congestion caused by the traffic which indirectly leads to heavy losses to our country's economy. India is counted as one of the growing country in terms of economy and population. The growth in the population has also raised the number of vehicles on the road. This increase in the number of vehicles has resulted in congestion on the roads. The present infrastructure of India regarding the traffic is very poor and unsystematic.

The implication of internet of things (IoT) has been in the market for around last 7 years [11]. By employing sensors and wireless sensor networks, a lot of information regarding objects and their surroundings can be collected and analyzed [7]. In today's scenario of internet where various ideas are springing up like mushrooms daily, things have turned out to be very easy and efficient. All the ideas that are generated are based on the things. Thus here comes in the use of Internet of Things. These days a technology called RFID is being used that uses the sensors embedded in the objects, to track them without any human intervention [2]. Applications employing IoT depends on the amalgamation of RFID systems, wireless sensor networks and other technologies etc. objects such as sensors, devices, actuators, readers , embedded chips are incorporated into the network and communicate using unique addressing [10]. The other important components include huge servers in form of cloud, data processing, sensing, modeling and communication [12]. Many researches have also focused on intelligent traffic monitoring and controlling. This resulted in the development of different approaches. The concept of prediction using fuzzy logic was used by [13]. [9] used agent based fuzzy logic for predicting the traffic flow employing multiple approaches and movements of the vehicle. Although a lot of mechanisms dealt with data collection and analysis, some flaws regarding the security of data were recorded. The paradigm of research then shifted towards the employment of encryption mechanism to apprehend security in traffic control. The process of abstraction for hiding the voice and data of the user is simple. The main task is to authenticate the session and turn on the encryption using algorithm such as A5.

The A5 encryption algorithm converts the user data amidst the handset and the base station into a haphazard form to incorporate security. The implementation of the A5 algorithm is done on both the mobile node and the BSS [3]. A5 has five versions. Some of them are discussed here as A5/0 offers no encryption, A5/1 has a low strength of encrypted key and can be decrypted soon, A5/2 can also be decrypted in less time, thus a weaker version. A5/3 acts as a substitute to A5/1.Some researches have also been done where

the present traffic system is monitored and the optimal route is found using agent technology [5]. [6] Devised a framework combining cloud computing and concept of agents to develop distributed smart objects.

3. PROPOSED WORK

3.1. Radio Frequency Identification (RFID)

The system that uses radio waves transmitted by an object to identify it is called RFID (Radio Frequency Identification) [3]. A tag, antenna, controller, server, reader are the main components that constitute RFID. The technology can be bifurcated into three main types, on the basis of the power supplied to the tags. These are Active, Passive and Semi Passive RFID. This technology is of great use as it helps in the identification of objects in a cost effective manner [5]. The properties that enhance the utility of RFID are its reliability, efficiency, security and accuracy [4]

3.2. Artificial Intelligence (AI)

It refers to the technique where an electronic environment can sense and response to the presence of the people. It has the following characteristics associated with it.

Adaptive: they have the capability of self-adjusting themselves according to the change in the environment.

Anticipatory: they can interpret the outcomes from the situation.

Embedded: the environment consists of the sensory nodes embedded in the devices.

Context aware: the can interpret the contextual situations.

Personalized: they can be customized as needed.

3.3. Internet of Things (IOT)

These days as the focus is being shifting towards saving of cost and resources the upcoming technology in the market known as Internet of Things is gaining importance. The major reason for this growth of IoT is its capabilities and features that help an object to become a smart object. These objects can then be identified

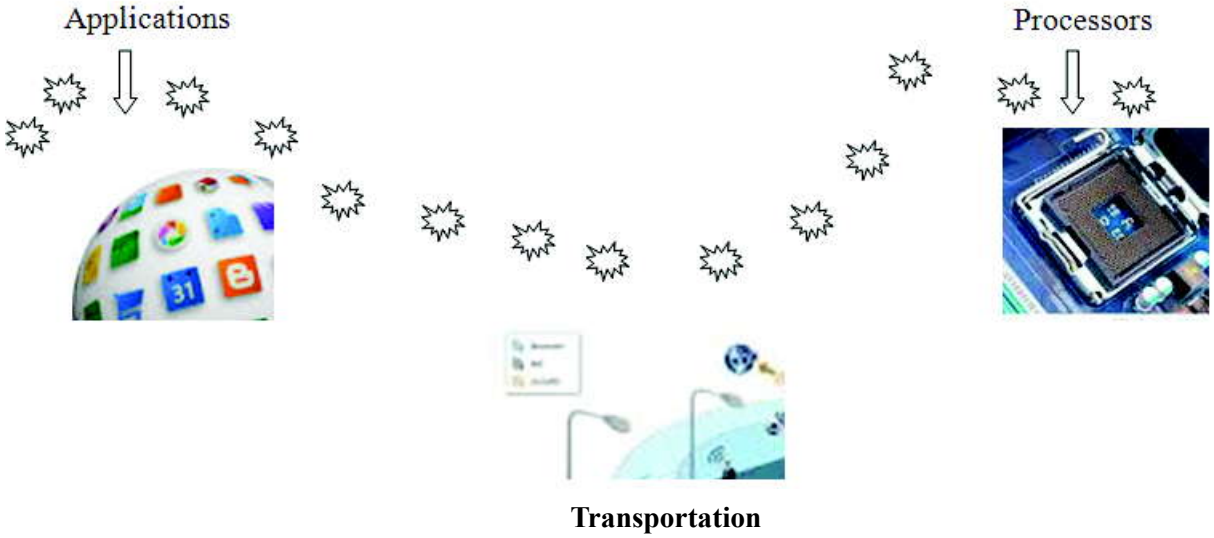

Figure 1: IoT Architecture for smart transportation

using a unique identity and can communicate with their environment [8]. The interaction involving smart objects can be from things-to-things, human-to-human, human-to-things. The internet of things can thus be described as an open and wide-ranging linkage of intelligent objects using *RFID* and *AI* that can organize themselves, share the information, and act as needed. IoT can be and has been implemented in many fields such as agriculture, smart cities, health and medical, satellite communication, and transportation etc. The fig 1 shown below depicts the IoT architecture for implementing smart transportation.

3.4. Problem Description

The main idea for selecting this problem of congestion in transportation came from a scene visualized by us on road while stuck in traffic. In this traffic, an ambulance with a critical patient was trapped very badly. Since the road was very crowded it took a lot of time by the ambulance to move out from there. Although this case is common in every country but in India due to lack of traffic rules and civic sense, the emergency vehicles like ambulance, police van and fire brigade face a lot of problem. Thus, in order to cope up with this situation, we have proposed this work that would help to revolutionize the traffic system in India.

Figure 2: Traffic Jam Problem

Figure 3: Orientation of the vehicles carving out the path for ambulance after the implementation of the proposed work

3.4. Architecture

The architecture for our work is similar to that proposed by International Telecommunication Union (ITU).The layered structure that is used for our work is shown in the figure 4. The structure consists of 5 layers. The tasks are divided into different layers. The first layer, the physical layer is responsible for collecting and sensing the data. Here the data is the information collected from the vehicles. The data collected from the vehicle is transferred to MAC layer, where addressing and quality of service is monitored. The next layer is network layer whose main work is processing, addressing and providing quality of service of data. The Transport layer which incorporates cloud computing and computation analysis helps in managing and processing the data. The topmost layer is the Application layer where the data gathered from the user is interpreted and results in intelligent transportation.

3.5. Framework and Algorithm

This section deals with the framework for the proposed system which states the methodology for dealing with the traffic congestion. The figure 5 shows the manner in which the vehicles moving on the road will be managed. The process will start with two main motives of

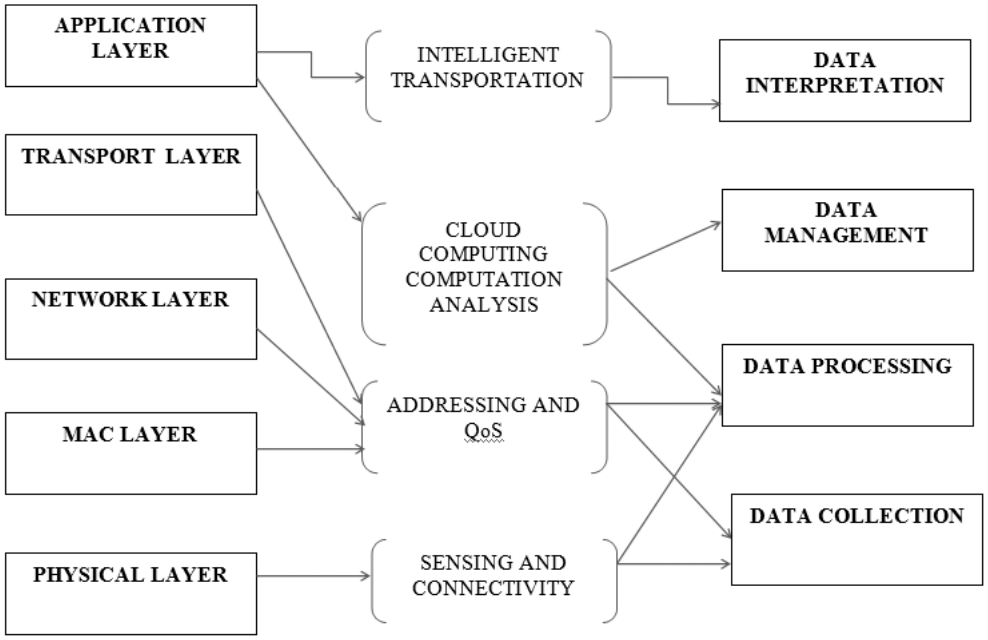

Figure 4: The Layered Architecture for Implementing Intelligent Transportation for Traffic Control

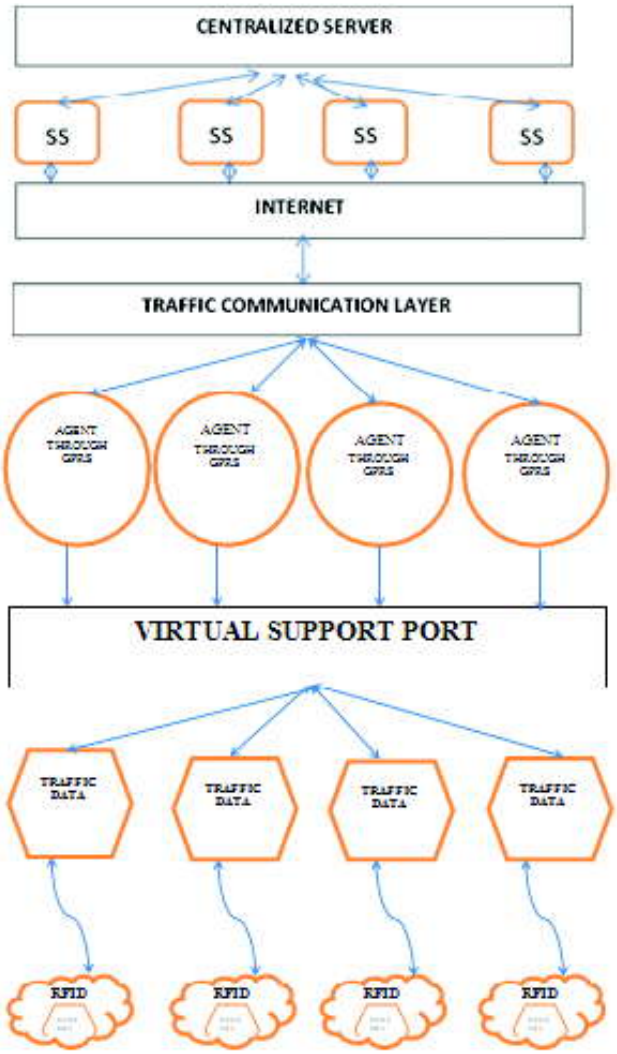

Figure 5: Working Protocol for Transportation through IoT.

a) Alarming the vehicles moving on the route about the congestion and the presence of emergency vehicles.

b) Carving out the path for emergency vehicles to move on the road without any hindrance.

The ALGORITHM used for the work is stated below

STEP 1 Data of vehicles travelling on the road is collected using RFID Tags.

STEP 2 The Traffic data is accumulated and forwarded to virtual sensing part

STEP 3 The virtual sensing part receives the traffic data

STEP 4 Data from all virtual sensing port are collected and sent to Agent Connected through GPRS

STEP 5 Data will be handled by the Traffic Communication Layer using Internet of Things

STEP 6 Server simulator bridges the gap between TCL and centralized server.

STEP 7 Centralized servers use prediction algorithm to predict the condition of traffic and controls by sending the information back to the vehicles using the same hierarchy downwards.

Once the above algorithm is executed the tracking of the vehicles will be done in the subsequent way. One prerequisite for this implementation involves embedding GPRS in the vehicles. Since there is a need of identifying the vehicles uniquely, each vehicle will be assigned a unique IP address. These IP addresses will be generated using IPv6 since IP addresses using IPv4 will soon be exhausted. The information will be collected and accumulated using sensors, RFID tag and cameras from the vehicles. The assimilated data will be used for prediction of path to be followed by the vehicles. This data will then be sent back to the vehicles so that the vehicles opt different routes to avoid congestion. For example, in case, if an ambulance needs to travel from source to a destination, then ambulance needs to enter the location of source and destination. The proposed algorithm will discover out a path with shortest distance and least congestion. As the ambulance will move on the path, all the vehicles 1 km ahead will be alarmed of the presence of the ambulance. These vehicles can then vacant out the path for the ambulance and other emergency vehicles. In a certain case if this ambulance reaches a traffic signal post then, the switching of the traffic signal will be done allowing the ambulance to move out first. This algorithm will also work for the vehicles moving behind ambulance on the road informing them of the congestion that may occur ahead due to figuring out the path for ambulance. In order to implement security we will use A5 security algorithm.

4. CONCLUSION

In this paper, we have proposed architecture for controlling the traffic in order to reduce the congestion of traffic. This methodology involves Internet of Thing, RFID tag, sensors and simulators. The stated algorithm highlights the manner in which the data will be collected and predicted to frame out a path for the vehicles. It will provide a novel method for monitoring the traffic and improving the road conditions. Although this technique will prove very beneficial to the society, security needs to being implemented very cautiously. Our future work will deal with the implementation of our proposed work. We have already started our implementation using NS2 tool simulating the real time data obtained from the internet. We will also be using algorithm A3, A5 and A8 in our work. Our next work will definitely show that how the path is framed for emergency vehicles.

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