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Development of Cloud Based Adaptive Congestion Control Smart Traffic Management Systems

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Abstract: Today Bangalore is obviously one of the most sought after cities in the country what with the rapid growth in the IT industry and the rise in the number of job opportunities in the city. With the rising population in the city there is also a corresponding increase in the number of vehicles in the city and a huge increase in the demand on land. Rapid population growth because of IT and other associated industries in Bangalore led to an increase in the vehicular population to about 1.5 million, with an annual growth rate of 7-10%. With the increase in population and the expansion of the city, the problem of connectivity of the populace has arisen. Quite obviously personalized modes of transport have grown at a tremendous rate and two wheelers along with the cars almost comprise 90% of the total registered vehicular population in the city. Two wheelers constitute more than 70% of the total volume, while cars comprise 15%, autos 4% and the remaining 8% includes other vehicles such as buses, vans and tempos. Due to this and bad traffic management it is becoming increasingly difficult to commute in the city. Designing a promising traffic management system to provide smooth traffic flow in non-recursive congestion situation can be an interesting issue for future research.

Keywords: Real Time Traffic, Wireless Sensor Networks, Cloud Infrastructure, Edge clustering, Density learning

I. INTRODUCTION

Rapid population growth because of IT and other associated industries in Metropolitan cities like bengaluru led to an increase in the vehicular population to about 1.5 million, with an annual growth rate of 7-10%.With the increase in population and the expansion of the city, the problem of connectivity of the populace has arisen. Quite obviously personalized modes of transport have grown at a tremendous rate and two wheelers along with the cars almost comprise 90% of the total registered vehicular population in the city. Two wheelers constitute more than 70% of the total volume, while cars comprise 15%, autos 4% and the remaining 8% [1] includes other vehicles such as buses, vans and tempos. With affordability and higher purchasing power, it has become very easy for a common person to own a vehicle. The number of cars sold last year in India was few times more than cars sold 20 years back[2]. Though this has led to a comfortable lifestyle, it also creates a problem in terms of road congestion and traffic pile up around our cities. So how can we use data and information easy and smooth? Let us look at a scenario. Connecting Traffic Management System (Traffic signals and Traffic Command centers) with a GIS enabled digital road map [3] of the city and using the power of analytics is a key to smooth traffic management. Using real time analytics of data from these sources and linking them to some trends, we can manage traffic flow much better

II. LITERATURE SURVEY

Over the year 1996 the affordability and higher purchasing power, it has become very easy for a common person to own a vehicle [4]. The number of cars sold last year in India was few times more than cars sold 20 years back[5]. Also transformation and filtering has come in to play for a comfortable lifestyle, it also creates a problem in terms of road congestion and traffic pile up around our cities. So how can we use data and information easy and smooth? as present Connecting Traffic Management System (Traffic signals and Traffic Command centers) with a GIS enabled digital road map of the city[6] and using the power of analytics is a key to smooth traffic management. Using real time analytics of data from these sources and linking them to some trends, we can manage traffic flow much better. Imagine a car driver getting an SMS when he is driving towards the City Center, guiding him to roads which are less congested and helping to identify a parking slot.

By bringing all those scenarios agent is built for heavier interactions also Data analytics tools get data from the Traffic Management System, align this in real time with GIS mapping and parking management data provide information to the driver, thus help reducing traffic pile up[7]. Also, information from these systems are being projected in real time on digital screens installed at City Center entrances, guiding drivers to available parking slots and streets. This not only helps reduce congestion but also saves lot on time and fuel, thus making environment cleaner and better to live[8]. Hence, a smart living experience.

III. PROPOSED MODEL

Implementation of novel reinforcement learning based agent interaction by setting up the data centre to analyze and maintain data for efficient results.

Implementation of modeling and simulation for traffic flow for the prediction of traffic system.

Implementation of GPS based interaction for video surveillance and broadcast system.

Implementation of traffic matrix to improve traffic monitoring.

IV. CURRENT TRENDS IN TRAFFIC MONITORING

The system takes into account the organizational change in the transport administration implemented at the beginning of 2010, the national strategy for intelligent transport, and the current challenges in terms of transport system development. Based on primary customer needs and transport problems, [9] the strategy outlines the main anticipated impacts of traffic management services and functions in different parts of the road network.

As in the previous research with the number of traffic- control agents is the experiment takes 1,130 seconds. If we set the time threshold to 600 seconds, the maximum number of intersections in one experiment is only 12[10]. This is insufficient to handle model major urban areas such as Beijing, where the central area within the Second Ring Road intersection contains up to 119 intersections, scale of several hundreds of intersections [11].

V. PROPOSED WORK

The research has led to a novel system in which traffic signal controllers and the behaviour of car drivers are optimized using machine- learning methods: Suppose there are a number of cars with their destination address standing before a crossing. All vehicles communicate to the traffic signal sensor with their specific place in the queue and their destination address minimize the long-term average waiting time until all vehicles have arrived at their destination address. The learning traffic signal sensor controllers solve this problem by estimating how long it would take for a car to arrive at its destination address (for which the vehicle may need to pass many different traffic lights) when currently the light would be put on green, and how long it would take if the light would be put on red. To estimate the waiting times, we use 'reinforcement learning'. We solve the traffic sensor control problem by using a distributed multi-agent system, where cooperation and coordination are done by communication, learning, and voting mechanisms.

Task 1: How Smart Analytics can reduce Traffic Congestion on a busy road

- Sensors connected to traffic signal keep sending information to a central server on number of vehicles piling(Using IR sensors to Cloud Server)
- Analytics platform gets real-time data from sensors, traffic signals within 2km of intended junction & GPS mapping of roads (Through ARM processor & Arduino Board Kit)
- When a threshold is reached, analytics software send a message to traffic display 1km before the signal(GPS)
- Motorists driving towards signal are asked to divert to another road(LED Display on Traffic Signal)
- When number of vehicles at signal decrease below threshold, message flashed on display stops urging drivers to drive towards signal(LED Display on Traffic Signal)
- Installing similar system across city makes all signals congestion free

Task 2: How Smart Analytics can save life on road

Ambulance carrying a critical patient is driving at full speed towards hospital

Analytics platform gets real time data from sensors, traffic signals on the way to hospital and GPS mapping of all roads leading to hospital

A message is sent to the ambulance display panel in front of the driver informing him which the road to take (Using GSM)

A message is also sent to hospital system prompting them to be ready, including an auto message to the doctor's phone to rush back if he is out(GSM & CLOUD)

Task 3: How Smart Analytics help prevent and catch crime

A criminal places a suspicious bag near a road side bus stop

CCTV camera keeps recording all activities including this one (Video Surveillance)

All information from CCTV, sensors on the road, criminal database and information from Police command centre is continuously fed to analytics platform which keeps analyzing the information and takes decisions (Predictive Analysis & Reinforcement Algorithm)

Based on the analytics, a message is flashed to police command centre and nearest public display asking public to remain away from the site (LED Display)

Police squad is dispatched to site to check bag contents and take necessary action Video of person placing bag is flashed across police stations by command centre

VI. FUTURE WORK

When this project is delivered to the real world, traffic congestion may low and reaches accurate point since because we use predictive system which predicts present past a future[12] .The factors can be considered which tends to become low such time, delay number of shortest paths, average waiting time, video surveillance [13]**.** The research outcome promises to bring the traditional cloud model may be fine for real-time applications, but for real time transactions alternative is necessary, by doing localized hosting at the network edge can save resources such as money, systems and remove delays [14] .Also the sensor nodes can be replaced in case of failure as a maximum speed which will be taken care by agent [15].

The proposed work is very much essential for different stakeholders which includes Government/ PSU's/ Private Industry/ Academics/start-up's/ any end user to get the desired service from the deployment of the software in a system or in an environment.

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