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IoT Based Intelligent Traffic Information System with the integration of SCOOT Control and Secured Automotive Communication System : A brief Analysis

Shyamu
Research Scholar, Department of Computer Science, Bharathiar University, Tamilnadu, India
Dr.P.Raviraj,
Professor, Dept.of CSE,
GSSS Institute of Engineering & Technology for Women, Mysuru-570016

ABSTRACT*: 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. In this paper, we focus on to an IoT system that is used to build intelligent transportation system (ITS). The proposed idea is to integrate an adaptive system called as Split Cycle Offset Optimization Technique (SCOOT) and Secured automotive communication. This proposed idea responds automatically to traffic fluctuations. The Prime objective of this is to minimize the sum of the average queues in the area. It is an elastic coordination plan that can be stretched or shrunk to match the latest traffic situation. It also helps the future traffic system with respect to their security against various malicious attacks. After a brief description of the most well-known and established vehicular communication systems, we present feasible attacks and potential exposures for these automotive networks. We also provide an approach for secured automotive communication*

Keywords—IoT, SCOOT, Intelligent traffic system (ITS); Agent Technology

I. INTRODUCTION

In recent years quality of personal motorized vehicles is obtaining urban traffic additional and additional crowded. As result traffic watching is turning into one amongst vital issues in massive smart-city infrastructure everywhere the globe. A number of these considerations square measure traffic jam and accidents that sometimes cause a big waste of your time, property harm and environmental pollution. Any sort of congestion on roads ultimately results in monetary losses. Therefore, there's AN imperative have to be compelled to improve traffic management. The looks of the net of Things (IoT) provides a replacement trend for intelligent traffic development.

This analysis proposes to use the IoT, agent and alternative technologies to boost traffic conditions and relieve the traffic pressure. Info generated by traffic IoT and picked up on all roads is given to travelers and alternative users. Through collected period traffic information, the system will acknowledge current traffic operation, traffic flow conditions and might predict the longer term traffic flow. The system could issue some latest period traffic info that helps drivers selecting optimum routes. Therefore, the system will exactly care, monitor and management moving vehicles. Constructing AN intelligent traffic system supported IoT contains a range of advantages such improvement of traffic conditions, reduction the hold up and management prices, high responsibility, traffic safety and independence of climatic conditions [1, 2].

Such traffic IoT should embrace each part of traffic reminiscent of roads, bridges, tunnels, traffic signals, vehicles, and even drivers. Of these things are connected to the net for convenient identification and management through device devices, reminiscent of RFID devices, infrared sensors, world positioning systems, optical device scanners, etc.

Traffic needs appropriate information concerning services and provision on the market on the road and thus the system will become additional self-reliable and intelligent. With variety of WSN and device enabled communications, AN IoT of knowledge traffic are going to be generated. This traffic

observation applications have to be compelled to be protected to stop any security attack frequent in urban cities. Few such prototypes implementations is found in [3, 4] and also the sensible Santander EU project [5].

The aim of this paper is to gift a framework for time period traffic info acquisition and observance design supported the IoT utilizing good traffic control and secured automotive communications. The first characteristic of the projected traffic info infrastructure is its capability of group action totally different technologies with the prevailing communication infrastructures. The projected design permits gathering time period traffic knowledge generated by sensory units and observance the traffic flow victimization multi-agent based mostly system. Agents will perform specific tasks with a degree of intelligence and autonomy, and act with their surroundings in an exceedingly helpful means while not human intervention therefore decreasing network load, facilitating heterogeneous IoT devices, providing support for collaboration and ability in IoT and programmable RFID and WSN, overcoming network latency, and asynchronous and autonomous execution. This system will continuously measures traffic volumes on all approaches of intersections in the network and changes the signal timings to minimize a Performance Index (PI) which is a composite measure of delay, queue length and stops in the network using the SCOOT control system and secured automotive system

II. RELATED WORK

A number of researchers have dealt with the problem of intelligent traffic monitoring and controlling, and as a result of their efforts several different approaches have been developed. Pang et al. [15] proposed a traffic flow prediction mechanism based on a fuzzy neural network model in chaotic traffic flow time series. Bhadra et al. [16] applied agent-based fuzzy logic technology for traffic control situations involving multiple approaches and vehicle movements. In [17] the authors developed strategies to integrate different dynamic data into Intelligent Transportation Systems. Patrick et al. [18] proposed a service-oriented architecture (SOA) for an effective integration of IoT in enterprise services.

Recently researchers shifted their attention to revolutionizing paradigm of the net of Things, that resulted in constructing of a additional convenient surroundings composed of varied intelligent systems in several domains akin to intelligence business inventories, health care, intelligent home, sensible surroundings, sensible metering, offer chain supply, retail, sensible agriculture, observation electrical instrumentality, etc.. Agent technology has been enforced in several aspects of the traffic systems akin to handling hold up by observation the present hold up and providing the best route for a vehicle [18].

III. FRAMEWORK STRUCTURE OF PROPOSED SYSTEM

The major tasks of the projected system square measure police investigation mobile objects and their location, distinctive mobile objects and sending no heritable knowledge to the watching and dominant center for process.

The application layer includes the subsequent subsystems:

- Intelligent Driver Management Subsystem: drivers will acquire period of time traffic data with minimum delay.
- Vehicle steerage and Road data Management Subsystem: observance range of auto on one road, pursuit vehicle's violation, causing warning massages, guide drivers to avoid doable huddled sections supported the prediction of the traffic network, period of time traffic navigation, etc.
- Intelligent Traffic Management Subsystem: the traffic system information contains knowledge from vehicle sensors, weather data from environmental sensors, and data on traffic flows. The system processes received data and shares it through the interface with different subsystems. It permits tracing the placement of a vehicle quick and correct and optimizing traffic programing.
- Information assortment and observance Subsystem: period distribution the data of road conditions, weather data, accident observance, etc. The system merges knowledge from completely different subsystems and provides it to finish users in a very appropriate format.
- Information Service Subsystem: performs on-line vehicle data question and dynamic datum analysis of period traffic flow, tracks a selected vehicle and generates reports for traffic management department.
- Split Cycle Offset Optimization Technique (SCOOT) : The SCOOT traffic signal control system

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is to react to changes in observed average traffic demands by making frequent, but small, adjustments to the signal cycle time, green allocation, and offset of every controlled intersection. For each coordinated area, the system evaluates every 5 minutes, or 2.5 minutes if appropriate, whether the common cycle time in operation at all intersections within the area should be changed to keep the degree of saturation of the most heavily loaded intersection at or below 90%. In normal operation SCOOT estimates whether any advantage is to be gained by altering the timings.

- Secured Automotive Communications: Modern communication security mechanisms provide secrecy, manipulation prevention and authentication based on cryptographic algorithms and protocols, to solve most of the vehicle security problems. The uncontrolled interference of the vehicle communications networks can be prevented by a series of measurements.

The network layer, conjointly referred to as transport layer, is accepted by all types of non-public networks, Internet, wired and wireless communication networks, network management system, world positioning system(GPS), wireless general packet radio service (GPRS), worldwide ability for microwave access (WiMAX), Wi-Fi, Ethernet, and company non-public networks. It accountable for transmittal information with high irresponsibleness and security, and process the knowledge coming back from acquisition layer. GPRS provides high-speed wireless information processing services for mobile users and totally supports the TCP/IP. The wireless communication channels employed by the devices might embrace any of the prevailing standards similar to IEEE 802.11, ZigBee or Bluetooth, etc.

Acquisition layer is accepted by all types of sensing elements and sensor gateways similar to RFID, WSN, cameras, intelligent terminals to transmit information of mobile objects and alternative sensors wont to collect period of time traffic and object identification data. It is a supply of every kind of knowledge (for example, known objects, traffic flow, etc.) collected from the physical world. Its main functions square measure to gather period of time data from Iota sensors, monitor objects and transfer information to the network layer.

The system utilizes wireless sensors to get period of time traffic data, similar to traffic condition on every road, variety of vehicles, average speed, and then forth. Utilization of wireless sensors is incredibly acceptable because of their low power consumption, low cost, distributed process and self-organization. So as to realize large-scale network layout the system uses wireless cluster sensing element network. Every cluster contains a set of wireless sensors and every set is drawn by the pinnacle node. Information at the pinnacle nodes square measure delivered to the backend system by a mobile agent.

IV. SYSTEM ARCHITECTURE

The proposed System include the SCOOT Control system architecture which is a method of coordination that adjusts the signal timings in frequent, small increments to match the latest traffic situation. This architecture has been working on both Arterial Streets and Grid Networks. The schematic overview and its detectors are given in the Fig-1 & Fig-2 as follows. SCOOT works on networks from <10 intersections to >1000

– Cambridge (UK) - 9 nodes initially

– Sao Paulo (Brazil) >1000 nodes

- The vehicle detectors are placed at the upstream of the stop-line;
- The detectors are located as far upstream as possible from the stop-line;
- Normally, the distance between detector and stop-line is larger than the maximum potential queue length.

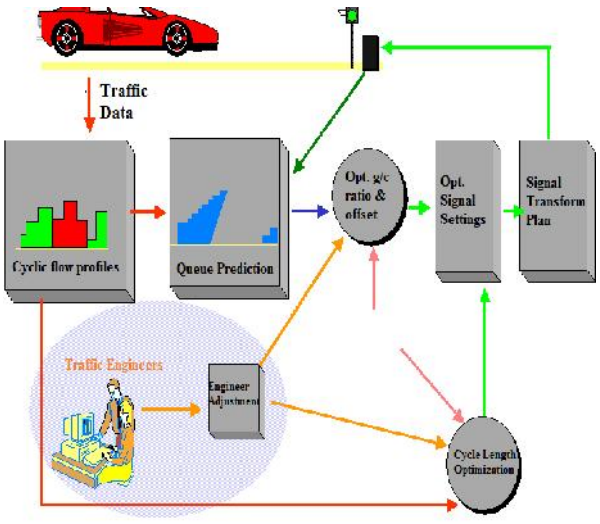

Fig-1: SCOOT Schematic Overview

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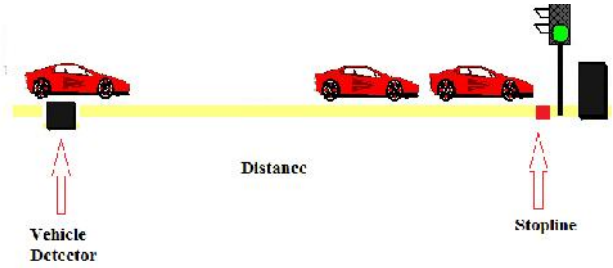

Fig-2: SCOOT Vehicle Detectors

Cyclic Flow Profiles (CFP)

- The data from detectors are stored in the SCOOT system as the form of "Cyclic Flow Profiles".
- The profile patterns tend to be repeated and coupled with new data in a cyclic sequence to avoid large random fluctuation in the profile.
- The cycle flow profiles contain the information needed to decide how best to coordinate adjacent pair of signals and cause the signal optimizer to search for a new best timing.

If the actual queue length is larger than the distance, then the system would get the warning of congestion, and the corresponding function would be effective; for the specific bus priority control, a set of bus detectors should be installed.

V. DEVELOPMENT OF AN AGENT-BASED INTELLIGENT TRAFFIC INFORMATION SYSTEM

There are an oversized range of heterogonous devices among the traffic watching system victimization IoT. Among challenges of full readying IoT is creating complete ability of those heterogeneous interconnected devices that need adaptation and autonomous behavior. The foremost issue in IoT is that the ability between totally different standards, knowledge formats, heterogeneous hardware, protocols, resources varieties, software package and information systems. An agent is embedded among every device and every device supports all agent functions appreciate migration, execution. Whole system may be controlled by the precise application written for every device's mobile agent process however it ought to behave and act showing intelligence. Mobile agents among the network migrate from one node to a different permitting the devices to pass info to others, retrieve info and find out offered resources.

Main IoT Traffic agents:

Traffic Mobile Agent: Transmits/receives differing types of data to/from different objects the Internet; interprets the info coming back from different objects (RFID, sensors, users), and provides a unified read of the context; communicates with different agents within the network to accomplish a selected task. All messages sent from this agent are going to be transferred to the traffic management system and communicate directly with a static agent of the meant application of the traffic management system mentioned higher than.

User Agent: provides users with time period data of entities residing within the system. The user agent could be a static agent that interacts with the user. It's expected to coordinate with mobile agents.

Monitor Agent: monitors the system to discover contingency things and triggers some actions to react to some tag reading events on behalf of a sensible traffic object, as an example in emergency cases.

RFID Agent: liable for reading or writing RFID tags. Once reading a tag, per the info retrieved from it, this agent performs applicable operations in handling one task on behalf of a sensible object of the associated RFID and to migrate to completely different platforms at run time.

Sensor Agent: receives, processes information that are scan from the associated sensing element and saves (or send it somewhere).

Traffic Light Agent: detects irregular traffic conditions and changes the control directions quickly.

Camera Agent: is liable for image grouping. All communications between camera agent and video net server square measure conducted via the network layer. Camera agent will takes advantage of the present infrastructure of the camera-based traffic observation systems that already obtainable in several cities.

When a vehicle with associate RFID tag passes through every observance station on the road, the RFID browser at those points can mechanically read the tag information concerning the vehicle and its owner and transmit to the wireless sensing element active nodes. These nodes send accumulated information to the cluster head node. At an equivalent time, a GPS receiver put in at the observance station will communicate with GPS satellites to get its position data that's taken as a grip parameter of the vehicle. Finally the measures of the

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Traffic behavior will be done as per the steps given in Fig-3

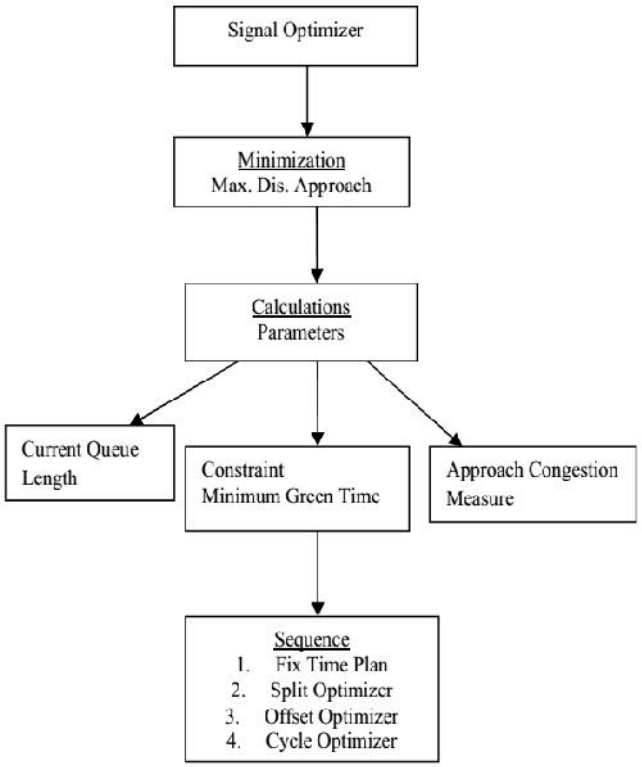

Fig-3: Measures of Traffic Behavior

The whole traffic IoT network is divided into dynamic overlapped sections, and a simulation processor is mapped to every section. every simulation are going to be provided with time period knowledge from close RFIDs and sensors and enabled to run unendingly. The general distributed simulation consists of a set of such section simulations wherever every tiny section of the general traffic IoT network is sculpturesque supported native criteria. Every simulation section is working in Associate in nursing asynchronous mode that means every machine executes severally of different simulators and therefore the simulation server as shown in Fig-4. The current large-scale distributed simulation methodologies need tremendous network information measure and big quantity of computation by every machine host. Mobile agent's area unit won't to cut back the communications hundreds placed within the network. Agents communicate with a selected simulation section, providing all of the state info that was sent to the machine server.

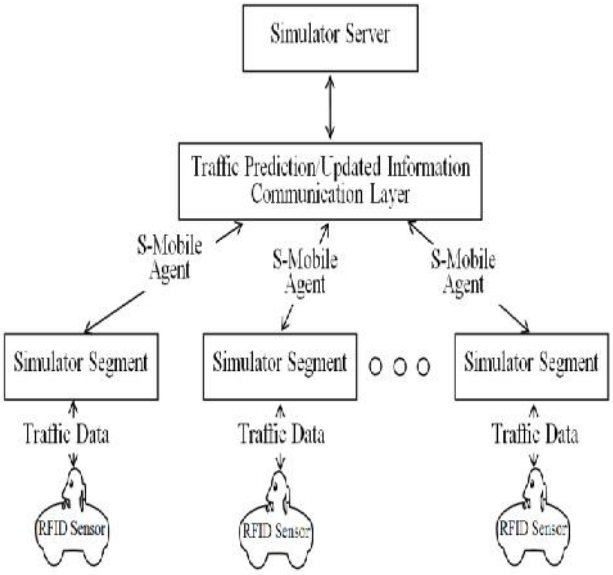

Fig.4. RFID-based sensor network

Net Logo machine has been used for modeling a set of adjacent intersections. Static and mobile agents represent totally different options of the network. Motorcars are sculptural one by one among Net Logo victimization mobile agents. Simulation is run on many computers. Net Logo permits giving directions to sizable amount of freelance agents that might all operate at identical time? During this cause the Net Logo model runs in an exceedingly single machine computing setting, however it is extended to run on cluster of computers.

VII. RESULTS & CONCLUSIONS

The planned design employs key technologies: Innet of Things, RFID, wireless detector network (WSN),GPS, cloud computing, agent and alternative advanced technologies like SCOOT Control system And Secured automotive communications to gather, store, manage and supervise traffic data. Additionally, transport administration department, victimization period of time traffic observance data, will in time discover doubtless dangerous things and take necessary actions to stop tie up and minimize range of accidents so guaranteeing safety of road traffic. In general, the IoT can play a crucial role within the traffic management enhancing the potency of knowledge transmission, up traffic conditions and management potency, traffic safety, and reducing management prices. The simulations results have been shown in Fig-5 & Fig-6

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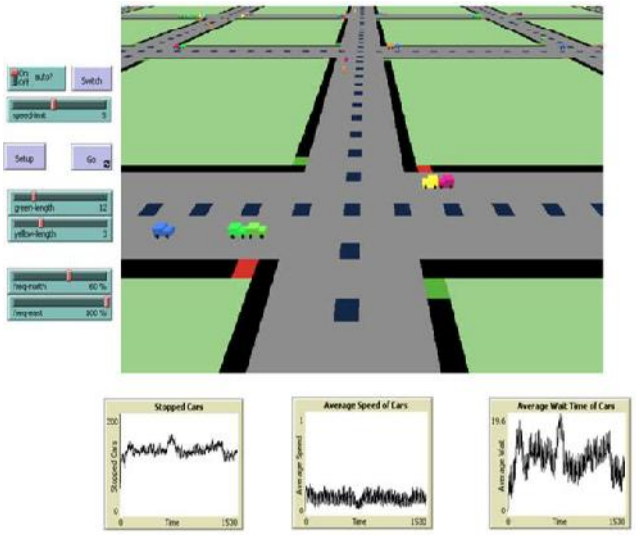

Fig.5. Interface and performance evaluation of the simulation results

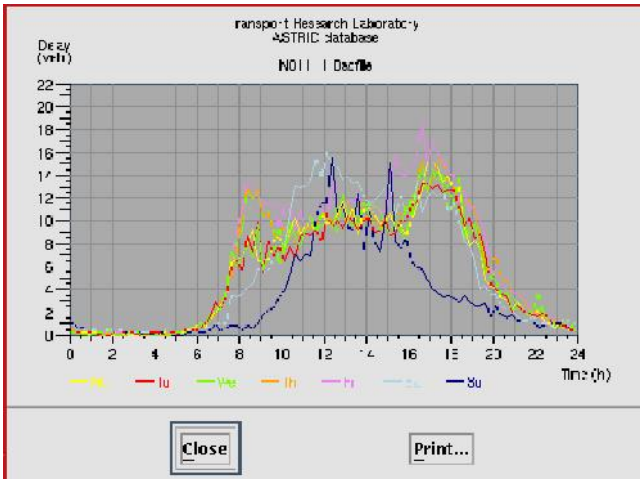

Fig-6: Historic database of key link and detector based values Generated by SCOOT

However, the planned traffic system supported some important following features using SCOOT and Secured Automotive Communications. Those features are as follows

- Second by second system, with timing algorithms in central

Processor

- Local controller deals with clearance and minimums
- Local vehicle actuation determined by traffic engineering

Priorities

- Hierarchical transmission system with flexibility to suit local

Traffic control needs

In future days, IoT needs modification of network property models and readiness for large increase in quantity of period of time data. to realize that, interaction communication models should be redesigned to incorporate machine to machine and folks to machine communications. Another analysis space is process and analytics of huge volumes of disparate knowledge from Traffic IoT system to make applications that improve the flow of vehicles throughout town.

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