ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

IJARCCE

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 5, April 2018

Smart Traffic Control System for Emergency Services & Stolen Vehicles

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Abstract: The objective of this project is to develop a system to flawless transport (emergency service) and track stolen vehicle. The main aim of this project is to develop such system that will automatically control the traffic signal once emergency service vehicle detected hence provide jam free road. The other part of this project is to track the route of the stolen vehicle. All the vehicle will have RFID tags, if the signal is RED and if RFID reader detects Emergency vehicle on that lane the automatically This signal will turn GREEN and all other signals will turn RED. If any registered stolen vehicle passes through that traffic signal, the RFID reader will detect it and track its route. The RFID reader will be installed at some distance from the traffic signal it will keep on reading the tag vehicles once it finds that the tagged vehicle is emergency vehicle the microcontroller will change the signal to green. Many life end due to emergency service vehicles not reaching on time for help. This system will help to provide flawless road so that emergency service would be right on time and some life gets saved.

Keywords: IoT; RFID; Smart; Traffic; Emergency; Vehicles; Tracking; Automation; Wireless; Ambulance; Police; Fire.

I. INTRODUCTION

Effectively controlling vehicular at intersections has always been a matter of concern for administrators in many cities around the world. Several attempts have been made to design efficient automated systems that solve this problem. Most present day systems that are in use in cities worldwide, use predetermined timing circuits that operate traffic signals. These predetermined timing circuits are not very efficient because by design, they cannot take into account the real time volume of traffic at the intersection on which they are deployed. It is often seen in today's automated traffic signal controlling systems that vehicles have to wait for the green signal at an intersection even though there is little or no traffic in the other direction. There are other problems too, like emergency services getting caught up by a red signal and end up wasting valuable time. Congestion is often translates into lost time, missed opportunities, and in cases of emergency vehicles, sometimes lost lives. Hence these systems must be not only automated, but also take into account real time data. Real time monitoring of intersections will help ease congestion as dynamically changing signals when the need arises is a huge step up. We are mainly focusing on the problem of Emergency Vehicles getting caught up by a red light at a traffic signal. The aim is to automate the process of switching the signal such that the emergency vehicles get the right of way automatically and do not have to waste precious time stuck at an intersection waiting for the red light to switch to green. To solve problem of Emergency vehicles a Smart traffic control system for emergency vehicles and stolen vehicles is proposed using Radio Frequency Identification (RFID). RFID is commonly used with vehicles today and hence is the ideal technology to help implement this system. Automating this system is crucial and this is where RFID comes in.

II. LITERATURE SURVEY

The issue of smartly controlling traffic was considered by many brilliant and many ideas were brought into the world. Intelligent Traffic Control System using RFID a was program designed in 2008 by A. Chattaraj and colleagues who were trying to proposed a system that will control the traffic signal system depending upon the count of the vehicles at the signal using RFID tag. A. Chattaraj further developed this concept and it is an inspiration for our proposed system. The same idea was purposed by many other authors like Zhiyi Li and his colleagues for optimizing traffic signal settings in smart cities in 2016. They uses bi-level optimization framework to settle the optimal traffic signal setting problem. Klaus Finkenzeller's excellent RFID handbook along with Patrick J Sweeny II's book RFID for Dummies were extremely helpful to us in understanding RFID and how to use it for our implementation. And lastly the ever popular Wikipedia was a resource for documentation relating to microcontrollers and device drivers needed for implementation.

III. PROPOSED SYSTEM ARCHITECTURE

Fig 1 describes a typical traffic signal where the proposed system is shown. In this system, there are RFID tag readers installed on each lane so that every vehicle on each road will be detected. Every vehicle will have an RFID tag whose

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data will be maintained on a centralized cloud database. The tag number or ID of every vehicle will be stored in the database. When the installed RFID reader reads a tag, the system will check the database, and if it is an emergency vehicle, system will control the signal and will turn GREEN for that lane where the emergency vehicle was detected.
The other part of this proposed system is that when the RFID reader detects a tag, it will also check in the database to check if it is a stolen vehicle. When a stolen vehicle is detected, the system will maintain a log where the location of the vehicle is detected. Here, a system admin will add and maintain vehicles in the database, where new vehicles can be added and stolen vehicles can be updated. The vehicles will be classified into multiple types, namely normal, emergency and stolen. It is this classifier which will be the key to what action is to be taken. In this system hardware to be used are RFID, Microcontroller, device drivers for controlling the signals, Bluetooth device. Due to reliability of custom made Bluetooth hardware being an issue, Android phones with built in Bluetooth functionality were used. They are connected to RFID readers and transmit data from the RFID reader to the server to process.

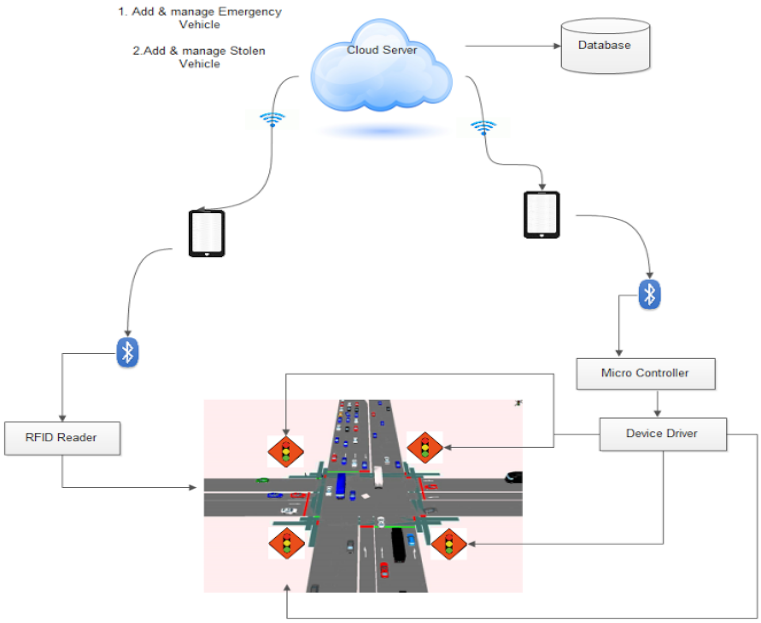

Fig. 1

IV. METHODOLOGY

To achieve our aim we use the divide and conquer methodology. The proposed system will be divided into different units and work on each part will be done and at the end all the unit will be combined to get the whole system. Follow fig shows how the system will be divided into units.

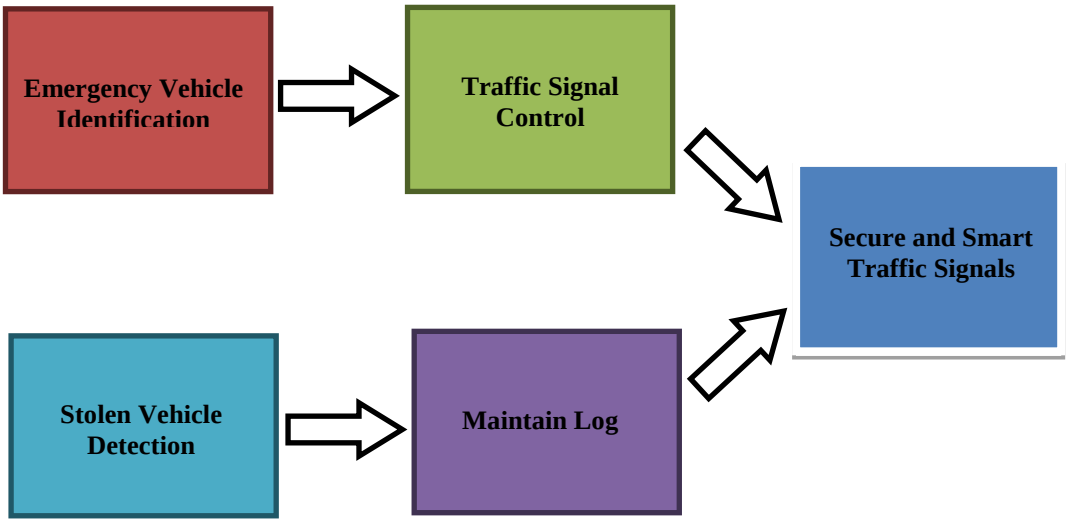

Fig 2

Fig 2, demonstrates the intended split-up of the system. While the implementation will very much be just one package, distributing the tasks makes managing the system much easier. The Emergency Vehicle Detection has only one

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functionality. That is to toggle the traffic signal to allow the said detected vehicle to pass an intersection as soon as possible. However, in case of stolen vehicle being detected at a reader, its location will be logged every time. Hence, there is no need to toggle the signals and a mere log will suffice to ease tracking these vehicles. These two functionalities depend on the same hardware, and mostly the same processes but server two completely different purposes. Hence the approach to divide them up before implementation. This way we can easily change one of the two systems without interrupting the functionality of the other, thus making it modular. But since both systems work simultaneously, they will not impede, but rather complement each other.

V. PARTIAL IMPLEMENTATION

Implementation phase of the project is in progress at the time of writing of this paper. The RFID technology to be used is under debate as the aim is to have a working active RFID system with this system. However, cost constraints prevent buying an active RFID reader off the shelf. The modules split up will be such that each intersection will have one central computer connected to RFID readers on the road scanning the vehicles. The RFID readers will be placed at a considerable distance before the intersection, so as to detect the vehicles in time so as to not cause any accidents. The database system will not be cloud based due to time constraints. Minimal hardware to demonstrate proof of concept on a mockup of a road intersection has been used. However the functionality of the software part of this system is very functional and most importantly easily scalable. A cloud based database system can easily replace the system that is made for demonstration. It will have a traffic signal toggle function for emergency vehicles when detected at the RFID reader before the intersection and a logging function for detected stolen vehicles. Logs will be used to trace the route the stolen vehicles took and hence help trace them easily. Using Android phones as a communication device enables us to log the GPS location for stolen vehicles, which makes it much easier to track them. Due to time and legal constraints of obtaining registration numbers and owner information of real vehicles from the Regional Transport Office, a mock list of vehicles has been created to speed up the process and RFID tags have been registered on the system. These tags will represent vehicles for demonstration purposes. A small mock intersection has been created where RFID tags represent cars. The RFID reader reads the tag, and communicates this data through the Android device to the centralized server. The server then analyses the data received, identifies the type of vehicle associated with the tag that was scanned or read, and takes appropriate action. As stated above, the vehicle type was the classifier for this step. The admin control panel has the functionality to not only add, manage but also remove not only vehicles, but also intersections themselves. This way the system remains modular and extremely scalable.

VI. RESULTS

After the above steps, if an emergency vehicle is detected, the way of right then belongs to the emergency vehicle, and the active signal is switched to the red and the signal where the emergency vehicle will approach will be turned to green, after a considerable delay between the switch, so as to not cause any disruptions at the intersection. When a RFID tag attached to a stolen vehicle is scanned, the GPS location of that intersection is stored in a database. There can be multiple entries of location of stolen vehicles with timestamps so that the path of these vehicles can be tracked too. All the above mentioned logs of stolen vehicles and their locations can be accessed from the admin panel which acts as a centralized hub for all components of the system. The mock system made for demonstration of proof of concept works as expected and proves that such a system can work in the real world environment with a little more work and time.

VII. CONCLUSION

An architecture for a smart traffic control system is proposed. The system is based on the simple principle of using RFID to track vehicles, to operate in real-time, improve the flow of traffic and increase safety. The system proposed is also designed to fully automate the process of controlling signals with minimal human interaction, thus saving authorities in charge of road safety very costly constant human involvement. The advantages that STCS can provide were demonstrated in detail and the demonstration provides proof that such a system will be extremely advantageous and reduce human efforts, and speed things up. The ability to automate this process, will save many lives as this system aims create a smooth congestion for emergency vehicles with minimal human involvement.

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