

Smart Traffic Signal Management for Emergency Vehicles Using FOG Computing

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Abstract - Traditional Automated traffic signal control systems normally schedule the vehicles at intersection in a pre-timed slot manner. This pre-timed controller approach fails to minimize the waiting time of vehicles at the traffic intersection since it does not consider the emergency conditions. Delays due to traffic congestion affects efficiency and response time. Emergency vehicle service is one of the major services which get affected by traffic jams. Proposed system is, once vehicles enter into the vicinity of traffic signal area, the vehicles continuously send their positional information to the centrally located fog node on traffic signal and accordingly traffic signal is monitored. The basic idea is to minimize the waiting time of ambulance, Fire Brigades and Police Vans using Fog Computing.

Keywords - Cloud database, Fog server, Traffic signal control, Smart cities and smart traffic lights, Traffic congestion control, Real-time traffic management system, Smart transportation

1. Introduction

The motto behind the paper is to provide a smooth flow for the emergency vehicles to reach the destination in time and thereby minimizing the delay caused by traffic congestion. The centrally located fog server at traffic signal is used to alter traffic lights when emergency vehicles arrive in the vicinity of traffic light junction. Fog computing also known as fogging is a decentralized computing infrastructure in which data, compute, storage and applications are distributed in most logical, efficient place between the data source and cloud. Fog computing [6] extends cloud computing and services to the edge of the network. The goal of fogging is to improve efficiency and reduce the amount of data transported to the cloud for processing, analysis and storage. In case of network failure, the cloud takes the whole control. In this paper we have considered Ambulance as emergency vehicle. This paper is of great help to make free flow of

ambulance without getting stuck into the traffic. In the current situation itself, transportation of a patient to hospital in emergency conditions seems quite simple but in actual it is very difficult during peak hours. Moreover, the situation gets worse when emergency vehicles have to wait for other vehicles to give way at intersections with traffic signals. As per the survey done 95% of the heart attack cases can be treated, if the ambulance can reach hospital on time without getting stuck into the traffic. In future it may get even worse. Proposed system will help to reduce blockage of emergency vehicles in traffic and helps to provide immediate recovery.

2. Related Work

Many systems are being developed keeping in mind the traffic congestions and critical conditions. The work has already started. The already existing systems are being

reviewed and more accurate and time efficient systems are developed.

The already existing system [1] creates an android app that connects both the ambulance and the traffic signal station using cloud network. This system makes uses RFID (radio frequency identification) technology to implement the intelligent traffic signal control. This system focuses on ambulance as an emergency vehicle. When ambulance halts on way due to traffic signal , RFID installed traffic signal tracks the RFID tagged ambulance and sends the data to the cloud.

Traffic Congestion Detection and Control using RFID Technology [2] detects and controls congestion by using a decision making algorithm which determines how the traffic light operates based on the information collected from RFID devices.

Smart Traffic Light Control System [4] presents PIC microcontroller that evaluates the traffic density using IR sensors and achieves dynamic timing slots with different levels.

[3] Develops real-time monitoring system for a patient who enters in ambulance in an emergency condition and an intelligent traffic system for efficient transport of ambulance for saving the life.

[5] This project is to provide communication between ambulance and various devices such as traffic signals and computers at hospitals so that the possibility for saving the life of the injured person will get increased.

3. Proposed Work

In our proposed system, we are trying to develop a Smart traffic control system that consists of:

- **Fog Server-** It is centrally located microcontroller that will monitor traffic signal activities according to vehicle arrival. It will also check the priority(emergency) of vehicle in case two vehicles arrive from opposite directions. Raspberry Pi is used for this.
- **Cloud Server-** In case of failure of fog node cloud will take initiative and will work according to fog.
- **Android App-** It is designed to set the priority of the ambulance according to the criticality of patient. It is set by doctor. It is also used to set destination address and accordingly route is decided.

- **GPS-** Mobile GPS is used by the driver of the emergency vehicle to see the route.

4. Implementation

This Project focuses on improving the traffic congestion control problems.

Algorithm-

1. Start
2. Take input credentials from ambulance
3. Current and destination location
4. Processing at fog node
5. Signal monitoring
6. Successful Passage of ambulance
7. End

Fog Installation-

Fog server version- 1.4.4

Operating System- Ubuntu 16.04

In our proposed system fog node is centrally located and it is installed on Raspberry Pi. Driver of the ambulance will set the destination address and the priority will be set by the doctor based on severity of case. This communication is done by Android App. The route will be suggested by Mobile GPS. When ambulance comes in the vicinity of traffic signal then the signal will be monitored accordingly. When two ambulances come from opposite sides then the ambulance with highest priority will be sent first. The priority will be set based on severity of patient by Doctor. After passage of ambulance the previous instance will be continued.

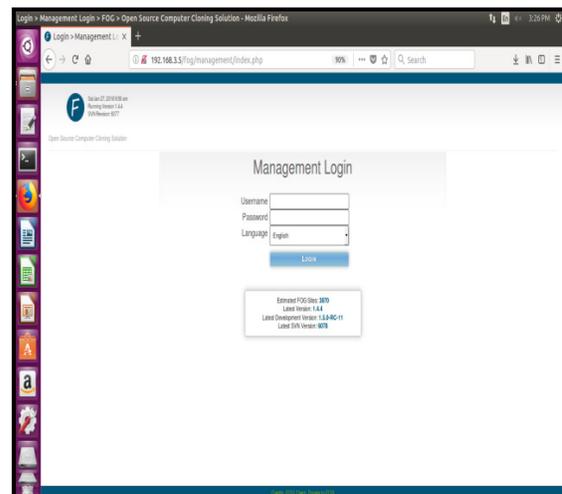


Fig.1. Fog Management Portal

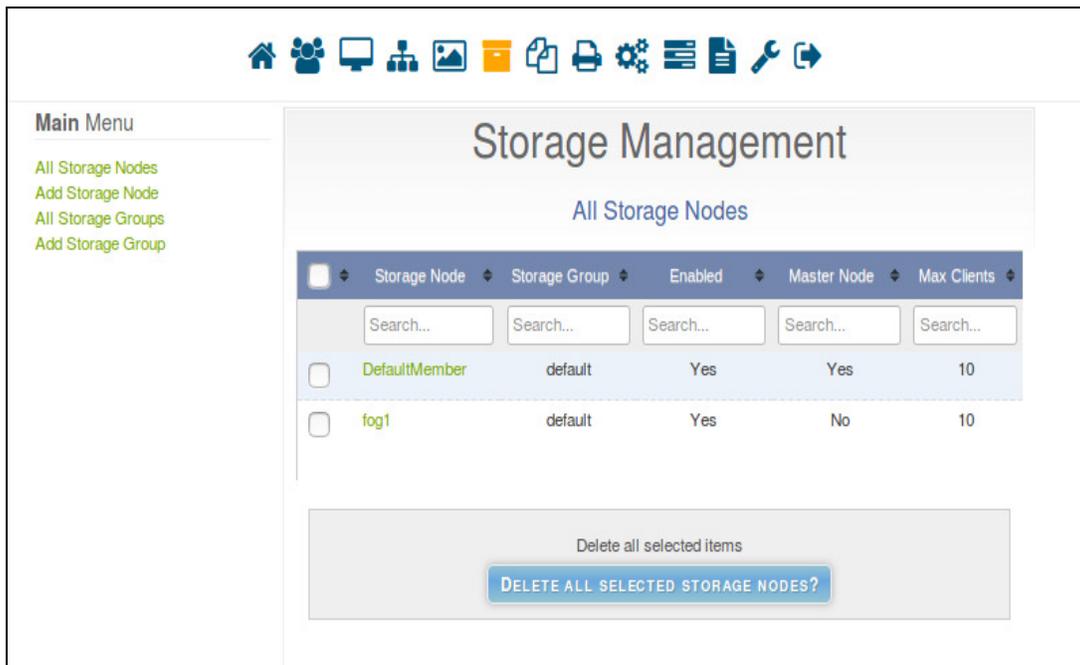


Fig.2. Adding Storage Node in Fog

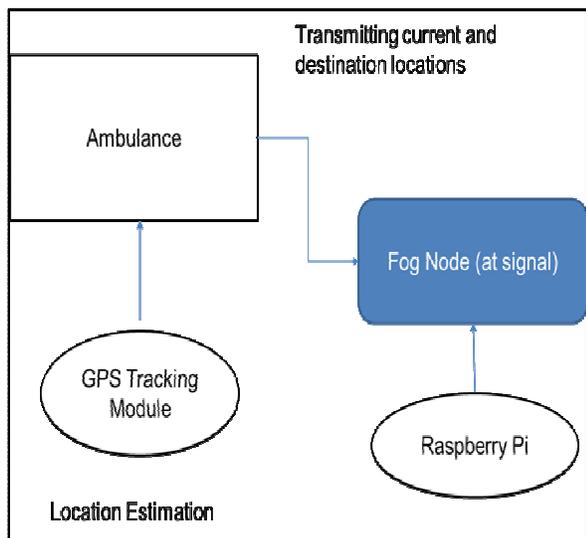


Fig.3. System Flow

5. Conclusion

Human life is very precious. Little delay in reaching hospital may prove fatal to patient's health and may also increase criticality.

So to reduce this delay in our proposed system, the ambulance is controlled by the fog server. The Mobile GPS which suggests the most scant route to the

emergency vehicles. Fog server also controls the traffic light according to the ambulance location and thus reaching the hospital safely. Using fog computing reduces delay hence helps emergency vehicles reach faster to the destination. This system is cost effective and deployed using trending IOT ,which is more efficient.

6. Future Scope

In our research attempt, we have focused on the traffic management for ambulance, fire brigade and police vans using fog computing. However the traffic conditions in India are getting worse day by day. Thus, our future work would be to manage traffic for all the vehicles using fog computing.

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