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Automated Emergency System in Ambulance to Control Traffic Signals using IoT

Dr. A. Balamurugan[1], G. Navin Siva Kumar[2], S. Raj Thilak[3], P. Selvakumar[4]

[1] HOD, Professor, Sri Krishna College of Technology, Coimbatore – 42, Tamilnadu, India
[1]a.balamurugan@skct.edu.in

[2,3,4] UG Student , Sri Krishna College of Technology, Coimbatore -42, Tamilnadu, India
[2]nskgovindharasu@gmail.com,
[3]sparowthilak@gmail.com,
[4]selvapsamy@gmail.com

Abstract: ***Traffic congestion has become a major problem in this technical era. There are various reasons for this traffic congestion. One of these is the rapid growth of the population. As a result of this, the number of cars is increasing annually. The increase in the number of trucks and commercial vehicles also causes traffic congestion. This causes problems for the ambulance to reach the hospital on the right time. As the result of the rapid growth of technology and engineering field the life of the mankind has got automated. This automation is the process of making the electronic device to communicate between themselves to serve the purpose of the human. The one of the major field that concentrate on the automation is Internet of Things creatively called as IoT. This project is based on the IoT and cloud to save the human life at critical situation. This project is to establish the communication between the traffic signals and the ambulance so that the traffic signal can respond to the arrival of the ambulance and respond according to that. When the traffic signals are changes its states according to the position of the ambulance it can able to make a free way for the ambulance. Thus this project will act as a life saver.***

Keywords: Eclipse ADT, Eclipse SDK, Google Cloud App Engine, App Engine SDK, IoT, Cloud, GPS, apphost.

1. Introduction

Recent advancements in the communications and technology area undoubtedly include Cloud Computing and Internet of Things (IoT).The cloud is a large group of interconnected computers. IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications (M2M) and covers a variety of protocols, domains, and applications. The **Internet of Things** (**IoT**) is the interconnection of uniquely identifiable embedded computing devices within the existing Internet infrastructure. Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications (M2M) and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects, is expected to usher in automation in nearly all fields, while also enabling advanced applications like a Smart Grid. This project is mainly 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.

2. Literature Survey

The related work can be generally divided into the following categories.

2.1 Devyani Bajaj, Neelesh Gupta, "GPS Based Automatic Vehicle Tracking Using RFID"[1]

This paper illustrates about a vehicle tracking system is an electronic device installed in a vehicle to enable the owner or a third party to track the vehicle's location. The objects of the paper are: designing of a remote control vehicle having the facility of tracking location through GPS tracking & detection of object to avoid collision.

2.2 Dr. Khalifa A. Salim, Ibrahim Mohammed Idrees, "Design and Implementation of Web-Based GPS-GPRS Vehicle Tracking System"[2]

This paper states that an integrated cost effective web based GPS-GPRS vehicle tracking system was designed and implemented. The system enables enterprises owners to view the present and past positions recorded of the target vehicle on Google Map through purpose designed web site. The current position of the vehicle was acquired by GPS device which is integrated in the target vehicle and the location coordinates are sent through GPRS service provided by the GSM network. The GPS data are sent using Get method of HTTP protocol, the data at server side are stored in a database tables and can be retrieved as request for position browsing on map. A web application is developed using JavaScript, Ajax, XML, and MySQL with embedded Google Map to retrieve and display on track details.

2.3 Obuhuma, J. I., Moturi, C. A, "Use of GPS With Road Mapping For Traffic Analysis"[3]

This paper explored the development of a GPS TCP Server that listens to GPS trackers' data and routes it to a centralized database. In addition, a client-side application that retrieves and displays the raw GPS data in a user-friendly and human readable format was also explored. Furthermore, a road mapping concept for different analytical purposes relating to traffic analysis on the Kenyan roads is incorporated. The study aims at streamlining the transport industry by analyzing the operation patterns on the roads and the general road usage patterns including speed of traffic with email alerts on speeding.

2.4 Joseph Owusu, Francis Afukaar and B.E.K. Prah, "Urban Traffic Speed Management: The Use of GPS/GIS"[4]

This GPS-GIS integrated system provides real-time meaningful location and status of the vehicles in the network. The system has been used to show the second-to-second positional changes in speed and directions of vehicles travelling in Kumasi. Using the geographic components in a dataset and visualizing the results in a map provided a clearer picture of the traffic state of every route in the network. The GPS has clearly indicated the road sections where speeds are unacceptable and driver behavior is affected giving transport planners the option to choose the desired speed management technique to improve the traffic system.

Motivation

Tracking the location of the ambulance and controlling the traffic signal as related to the speed and distance of the ambulance. By using latitude and longitude, GPS location is registered in the cloud and the traffic signal location is also registered simultaneously. The location of the device gets updated automatically. The device at 1km distance from the ambulance, the process gets started. The particular way that the ambulance travels, turns back to the green color and the other signals transferred to red color automatically.

Section 3 describes the modules in the proposed traffic signal controlling system. Section 4 details about Performance Evaluation in terms of Execution time. The last section concludes the paper with the scope of future Enhancement.

3. Proposed System

Now a days there is a high traffic at a particular time due to that the traffic signals should maintained correctly to reduce accidents but at the same time during some emergency situations ambulance may blocked in the signal it leads to major cause. To avoid this, based on all statistics, traffic signal should be controlled. For that strategy, the proposed system is built in real time. This application is very useful for the world's day to day life to save someone's life.

IoT plays the role between ambulance and the traffic signals. Cloud computing provides the way for handling and managing the enormous amount of data that are generated by these devices and it can also be even used to send command to those devices to perform a particular task. This project is based on the IoT and cloud to save the human life at critical situation. This project is to establish the communication between the traffic signals and the ambulance so that the traffic signal can respond to the arrival of the ambulance and respond according to that. When the traffic signals are changes its states according to the position of the ambulance it can able to make a free way for the ambulance. Thus this project will act as a life saver. Components of the system is mentioned in Figure 1

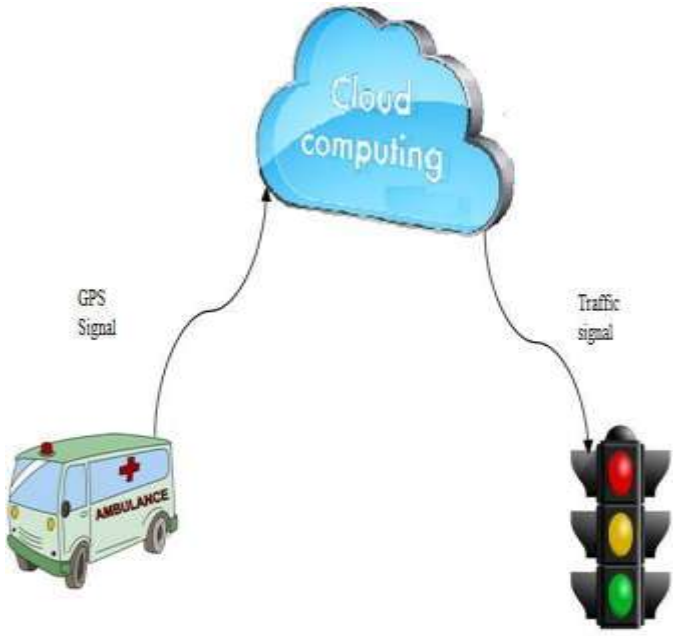

Figure 1: Components of the System.

The disadvantage of acoustic system has been overcome by the proposed method which uses GPS technology. In this project an automatic traffic signal control through Global Positioning System (GPS) is implemented to avoid congestion of traffic, to reach the particular place (hospital) and to save the life of the human as shown in the Figure 2.

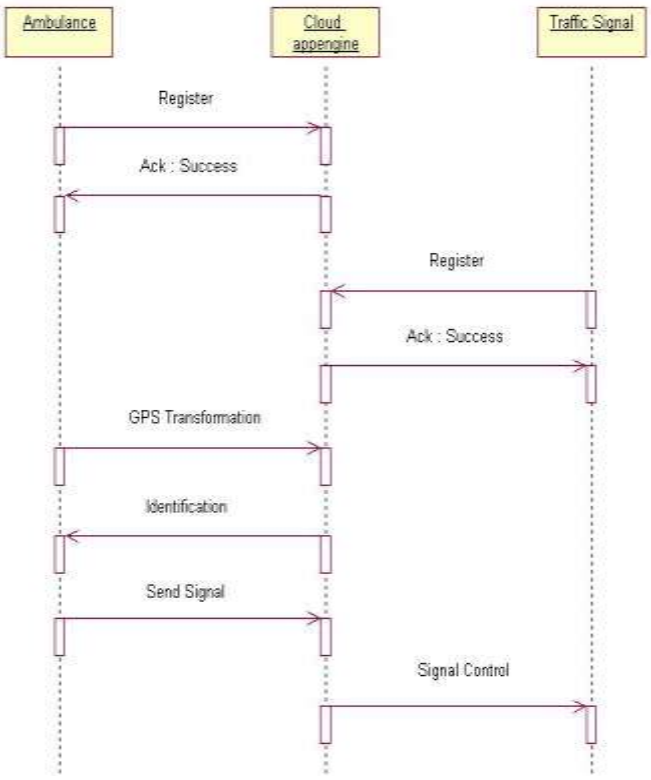

Figure 2: System Design.

The traffic signal is automatically controlled using a simple mobile phone app which uses GPS by capturing the latitude and longitude of the ambulance vehicle and sends signal to the local system, hence making uninterrupted traffic to the ambulance vehicle. And then, the traffic signals are controlled by cloud server.

This proposed method consists of three modules and the block diagram is shown in Figure 3.

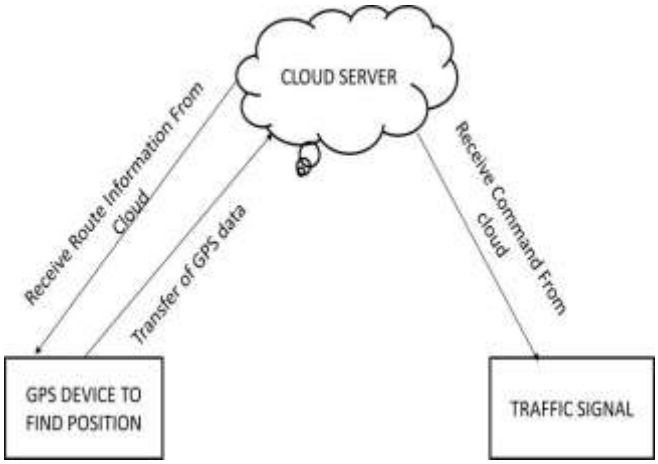

Figure 3: Block Diagram.

3.1 Finding the Current Location

Global Positioning System

The GPS is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to three or more GPS satellites. One of the easiest applications to consider is the simple GPS tracking device; which combines the possibility to locate itself with associated communications technologies such as radio transmission and telephony. Tracking is useful because it enables a central tracking center to monitor the position of several vehicles or people, in real time, without them needing to relay that information explicitly.

GPS System in Android

The Proposed System is implemented by using android application[5]. The apk file will be installed in the smart phones and the registration will be conformed to the cloud server and the latitude and longitude of the local signal system is stored in the cloud computing server. The ambulance vehicle lattitude and longitude is traced by the by GPS beyond 1Km and intimated to the server at any time and it's provide location off GPS, location of network and address of the curent location.

All packages which are used for the process in android and Google API is imported and then the location of the device should be tracked. The latitude and longitude of the current place is estimated. By the use of GPS, the accurate location is identified and it returns the current address, locality, postal code and country name.

There is an automatic update in location of the device when it is moving is shown in Figure 4. These all activities are processed while registering into cloud.

Figure 4: Get Current Location

3.2 Traffic Signal System

Traffic Signal System in Android

The Proposed System is implemented by using android application [5]. The apk file will be installed in the smart phones and the registration will be conformed to the cloud server and wait for the signals command from the cloud. Once the application receives the command from the server and it changes to the appropriate color that the cloud sends.

This chapter contains two different applications by buttons. One of the buttons is by creating the register button. By clicking the button, the unique id of the device is registered in the cloud. Here the device is to represent the ambulance. After receiving the signal, cloud acknowledge to the ambulance.

The location is called from the previous chapter and stored by clicking the other button which is named as GPS location. These two processes are used to register and control the system using cloud infrastructure. These two main applications is shown in Figure 5

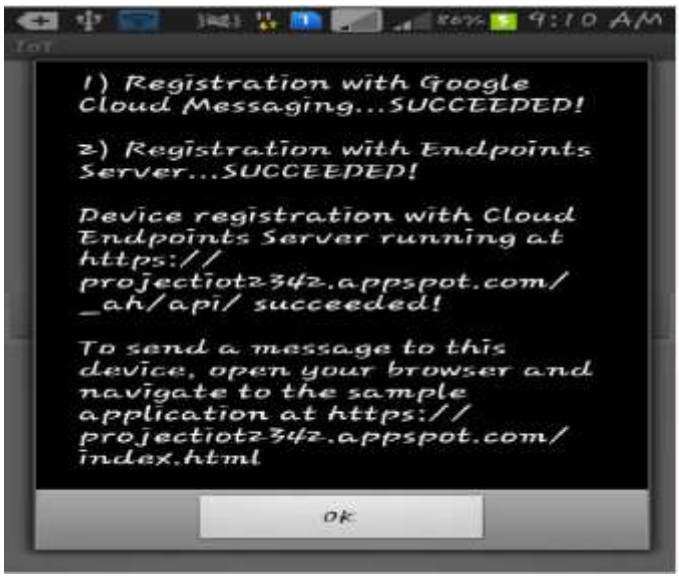

Figure 5: Registration screen.

Cloud Setup

The designed page deployed in the Google app engine that acts as a cloud server [6] and the smart phones unique id is registered for the authentication. In the Cloud Server the command will be selected and send it to the application tochange the traffic signals color. And also the time of the phones registered to the cloud will also be displayed in that deployed page.

IoT Command Sender controls the traffic signal in case of ambulance emergency situation. Normally signal contains three lights Red and Green. These are the commands that will be sent by a ICS.ICS will send one of the command to the signal receiver to control signal to remove the hurdles in the road to make the ambulance run safely and fast shown in Figure 6.

Figure 6: Command sender.

The mobile's unique ID(generated by the app) is linked to the cloud server. Individual id are store in cloud server. With the help of this ID, signals are being sent.That mobile will receive a GREEN signal while other mobiles will receive a RED signal to demonstrate the traffic signals show in Figure 7.

Figure 7: Command Receiver

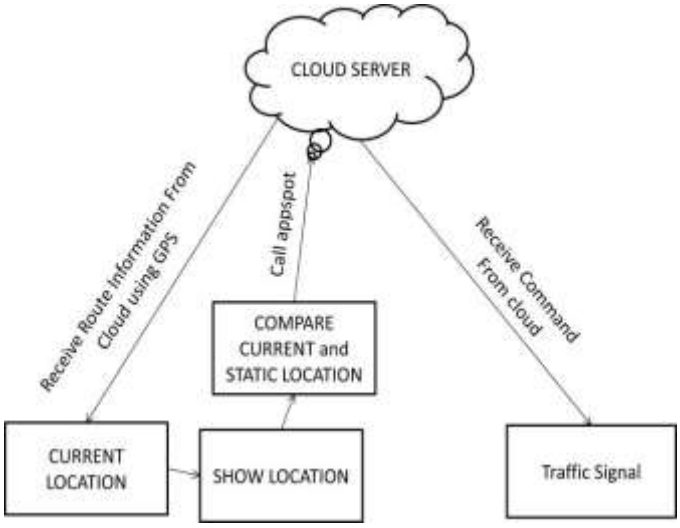

Figure 8: Flow Diagram

3.2 Automatic Signal Control

This Chapter IoT act as majore roll when the ambulance reach within 1Km from the local signal system, the traffic signal except the way which the ambulance comes towards the signal is opened and all other are closed. Hence making way to the ambulance without any interruption and make the crews to reach the hospital or specified location on time with safe.

The ambulance to share their current location by GPS to the cloud server [7] and then call the app engine to send the signal to the traffic signal automatically.

All the processes done in both previous chapters are processed automatically here.

Process Steps

1. Declare latitude and longitude as zero initially.
2. Then getting the current ambulance latitude and longitude values. The cloud process is done through the apphost.
3. Retrieve all the signals from the device and the traffic signal.
4. Track the automatic location updating of the signal.
5. Allocate the static value of the traffic signal which is the distance before 1km of the signal.
6. Compare both the updated value and the static value.
7. If both the values are equal, then the cloud automatically control the signal into green.

Figure 8 illustrates Automated Emergency System in Ambulance To Control Traffic Signals.

The GPS location identification is matched with static value which is already registered by the developer. If both values match, then the process of updating for controlling the traffic signal performs automatically and the traffic is changed to green when the ambulance is nearer to that particular signal. At the same time other signal are controlled properly. These all process are done automatically by the use of Uri url to call appspot automatically. Figure 9 is shown as a final implementation.

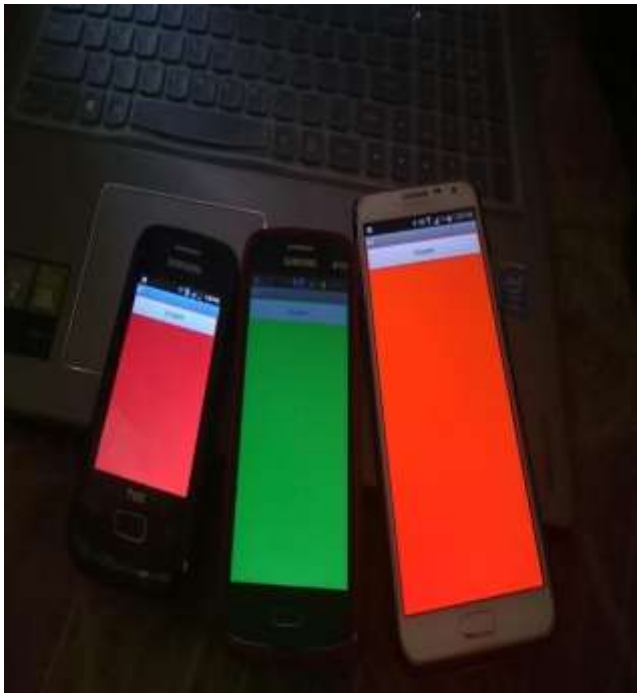

Figure 9: Automatic Signal Control.

The accurate results may guaranteed, when the process is working in 3G and hence the final results are obtained as given in Table 1 and represented the same as a graph in Figure 10.

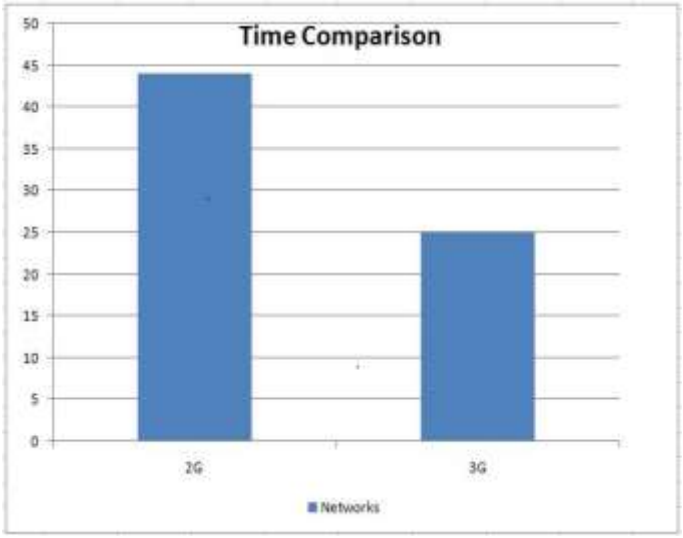

Figure 10: Time comparison

4. Experimentation and Results

The performance of this application is critical since it is a real time application. The application mainly depends on the availability of cloud since the infrastructure required for the functionality of the application is supported by Cloud. The practical cloud offerings cannot guarantee 100% availability to its users. All the functionalities based on cloud must take place over the network. So, the speed at which signals can be transmitted between the ambulances and traffic signals is heavily limited by the availability and the bandwidth of the supporting infrastructure.

A relevant comparison of the time delay caused by 2G and 3G network is illustrated in the graph. So, the availability and the bandwidth of the network and cloud directly impact the performance of the application. Given that the application has required bandwidth, the communication between the ambulances and the traffic signal is almost instantaneous. So, when the application goes live on real time traffic signaling system, it is advisable to install application using dedicated 100% available server infrastructure.

Table 1: Time comparison

S.No	Networks	Time(Seconds)
1	2G	44
2	3G	25

After all the implementation gets completed, the application process has been analyzed with respect to two different networks. The analysis is based on the speed and band width rate. The process take place over the device to the cloud infrastructure and vice versa. Both speed and bandwidth rate are higher in 3G than in 2G.

5. Conclusion

Human life is very precious and must follow safety measures very conscious in all aspects. In this application, an automatic traffic signal control through Global Positioning System (GPS) is implemented to avoid congestion of traffic, to reach the particular place, hospital and to save the life of the human. The traffic signal is automatically controlled using a simple mobile phone app which uses GPS by capturing the latitude and longitude of the ambulance vehicle and sends signal to the cloud system, hence making uninterrupted traffic to the ambulance vehicle. The traffic signals are controlled by cloud server. This gives a solution for the easy passage of emergency vehicles without any interruption. Hence reduce the emergency response time and increase the minimum inconvenience to regular traffic in saving the life of the people. In future the system is enhanced to checks the nearest hospital and also find the shortest route to reach that hospital. And checks the availability of the doctors in that particular hospital. The cloud server in turn returns the shortest distance between the current locations to the hospital automatically. Store all traffic signals details and hospital location to the cloud server. Build prioritized to the ambulance and give the free way.

References

[1] Devyani Bajaj, Neelesh Gupta, “GPS Based Automatic Vehicle Tracking Using RFID”.

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[7] 2-dot-projectiot23421@.appspot.com

Author Profile

Dr. A. Balamurugan, is working as Professor & Head of CSE department at Sri Krishna College of Technology. He is having more than 22 years of teaching experience. He has published more than 20 papers in National and International Journals. He is a member of various professional bodies. He has guided more than 12 PG projects in the field of computer communication Networks. His area of interest includes Wireless Sensor Networks, Internet of Things, etc.

Mr. G. Navin Siva Kumar is currently pursuing Bachelor's degree in Computer Science and Engineering at Sri Krishna College of Technology, Coimbatore. His area of interest includes Cloud Computing and Internet of Things.

Mr. S. Raj Thilak is currently pursuing Bachelor's degree in Computer Science and Engineering at Sri Krishna College of Technology, Coimbatore. His area of interest includes Cloud Computing and Internet of Things.

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