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Cloud Based Services for Emergency Response Vehicles with Optimal Path Calculation

Ujwal Ashok Nayak[1], Sneha .K[2], Vibha .V. Baliga[3], Rakshitha Kamath .K[4], Alok Ranjan[5]
Member CSI[1, 2, 3, 4], Assistant Professor[5]
Department of Computer Science and Engineering
Canara Engineering College, Benjanapadavu, Bantwal, Karnataka, India

Abstract:
Based on the insights of the qualitative research on social needs within the realm mobility, our application is being put forth as an effective way of dealing with emergencies. Quick response time is generally considered to have a positive effect on life expectancy of patients during emergency. The aim is to assist emergency vehicles in quick and effective response to an emergency which avoids congested areas by sharing the real time traffic information and road conditions. Our system records the reported user emergencies and relays the information to the traffic departments and notifies them using cloud messaging. This system is intended to partially automate the emergency response procedure by providing an efficient route plan with the application of dynamic variables like historical traffic dataset that helps emergency response vehicles avoid traffic congestion and improve response time. Cost attributes or impedances, namely distance, free-flow travel time and time-varying travel time originating from historical traffic data, are applied to each routing scenario to determine the shortest, fastest, and optimal route from an origin to a destination. The best route is defined as the route with the least travel cost determined by the impedance applied. The shortest path once calculated is altered based on the traffic data. The proposed system automates the existing manual emergency service routine.

Keywords: Cloud Messaging, Global Positioning System, Mobile Computing, Route planning.

I. INTRODUCTION

Even though there are various modes of transport even to this day road transportation mode plays a major role in people's lives. In this busy world, everyone is in a hurry to reach their destination as quickly as possible which leads them to drive fast, recklessly, without obeying the traffic rules which further lead them to accidents sometimes also to their loss of lives. Indian traffic is non-lane based. It needs a traffic control solutions, which are different from the other Countries. Emergency never comes with prior intimation. In real world scenarios detecting such emergencies and reporting them is a real challenge [1]. The average speed over the route and total travel time varies from vehicle to vehicle. Two-wheelers reach the destination faster than car, followed by three-wheeler, followed by public transport [2].

The chances of a four wheeler getting stuck in traffic are huge. Keeping all these problems in mind, we have proposed this system which will try to minimize the possibility of emergency vehicle being stranded in traffic. With the accessibility of data in regards to the street conditions, , road users can be careful about or avoid the bad roads. Road monitoring can also help to foresee the estimated arrival time from one place to another. Previously a lot of work is done in this field but researchers mainly focused on monitoring either driver behaviour or road conditions using specialized hardware deployed inside the car or roadside which is expensive and also requires maintenance. We are advancing another thought to automate the process of emergency reporting which will record and report emergency in real time. It works in three steps i.e., feeding the location of emergency as received by 108 to the Emergency Response Vehicle (ERV), Detection of shortest path, informing the concerned traffic personnel. In emerging economies like India, the traffic flow is more chaotic as compared to developed countries. The condition is contrasted and impacted due to many factors like heterogeneous vehicles types, socioeconomic reasons, irregular driving patterns, poor quality of roads and liberal honking. Large population, poor road infrastructure, and rapidly growing economies lead to severe traffic congestion in many parts of the world [3]. The problem is aggravated by increased diversity in vehicle types and poor adherence to lane discipline. Existing methodologies for detecting traffic congestion do not deal with the diversity of vehicle types and the absence of lane discipline. Smart phones based method disposes the need to deploying special sensors in vehicle. This method also has the upside of high scalability as the number of cell phone users is increasing rapidly. SERVA, Service Efficient Emergency Response Vehicle Application, is a system that helps in easy communication between the ERV and the traffic police thereby reducing the chances of getting stuck in a traffic jam.

An administrator monitors the web application which registers the emergency and verifies the location of the emergency. The administrator can also generate reports pertaining to the accident prone zones. The ERV application shows route to be taken with real time dynamic road conditions. It consolidates maps and custom User Interface to permit easy navigation for the driver and provides him with real time road conditions. MapBox API is used for displaying satellite map. This system also communicates with the traffic department to obtain real time traffic and road conditions [4]. The route to be followed by the ERV will be dynamically calculated to ensure that the fastest path to the destination is obtained. This increases the overall systems effectiveness, as each component shares information, such as vehicle speed and status, route information and traffic conditions.

II. OBJECTIVE

Our society is more and more pervaded by computer controlled device. Today the usage of mobile phone has increased rapidly. We can control any activity through the mobile phone. The aim of our project is to establish a connection between the ERV and the traffic police department in a smart city so as to handle the emergency cases more efficiently using handheld device i.e. cell phone from anywhere, irrespective of distance. Our objective is to bring about an automated process to develop an advanced adaptive traffic control system while maintaining a minimal increase in congestion level for emergency service for smart cities. This application based project is an effort to make this a reality, and this is where the genesis of our project lies. The result is an application that knows the traffic conditions of the concerned roads in real-time and offers it to ERV to help them avoid traffic jams. The system should facilitate effective communication between the Emergency Response Vehicle (ERV) and the Traffic Department and improve efficiency of ERV services.

III. IMPLEMENTATION

The Application is divided into modules and the flow of each module is shown. The user is first prompted for his mobile number. The number is then verified through OTP (One Time Password) verification process. If it is a success, then additional user information is asked for setting up his account which includes a unique SERVA ID that restricts unauthorized users from registering. Once the registration is done, the user is logged in. No logout option is provided for Mobile users. The admin login is through the web application. Registration is allowed only if a valid SERVA ID is provided. If valid credentials are entered, then map is displayed indicating signed in user's current location. After user logs in the map is drawn asynchronously utilizing a call back. If the user changes his location, then database is updated with the new values. When the database values are changed, a call-back is triggered that updates the application data with most recent values. If an emergency routine is activated, then the control is transferred to navigation module. On emergency, the user logs into the user application to start an emergency. The users detail and location of emergency will be sent to the web application. A routine is activated to find the nearest emergency vehicle and forward the information to it. Java and XML will be utilized to develop the applications, i.e. ERV Application and Traffic Application. The Web Application layout will be produced with HTML/CSS. The communication between the Web Application and the Android Applications will be developed using the application server. Ajax will be used in the automatic updating of the content. Admin must have access to comprehensive documentation.

Algorithm 1 Path Calculation

```
1: procedure SHORTESTPATH
2:     source ← sourceLatLng
3:     destination ← DestLatLng
4:     if destination = null then return false
5:     waypoints [] ←SPA (source, destination)
6: loop:
7:     i ←i+1
8:     if waypoints[i] = trafficData[j] then
9:     waypoints[i] ← min(dist(i), dist(j))
10:    goto loop.
```

When the Android interface receives an emergency intent, it starts the navigation routine. Traffic data is obtained from the database which is updated frequently by the traffic police. Alternative routes are displayed (if available) with estimated time of arrival. The shortest path is calculated using the Dijkstra's Algorithm and modified using Path Calculation Algorithm [5][6]. For a given source vertex (node) in the map, the algorithm can be used to find shortest path from a single starting vertex to a single destination vertex. The algorithm for the shortest path is shown above. The shortest path once calculated is altered based on the traffic data. If the waypoint experiences a path that is congested, then the calculation will delete that waypoint and select another as option that is nearest to the one that is removed.

IV. RESULT

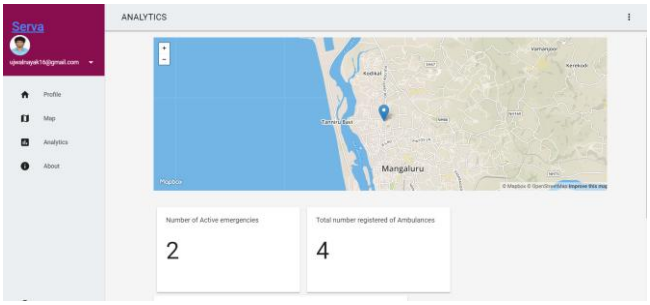

Figure.1. Emergency history and analytics

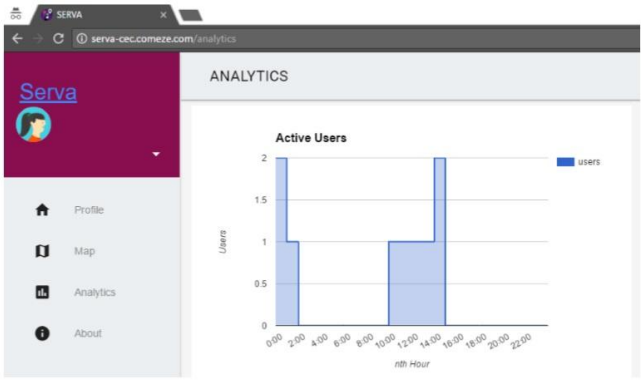

Figure.2. Active users in the system

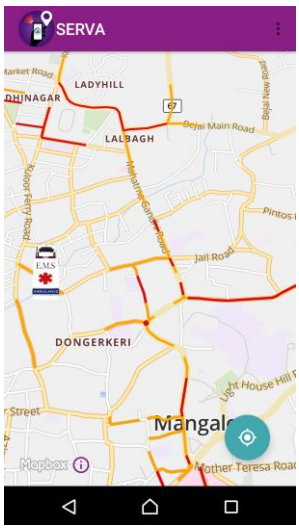

Figure.3. Traffic data

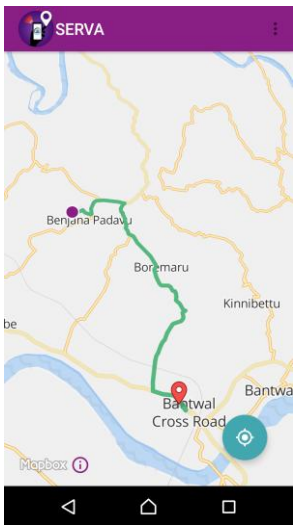

Figure.4. Emergency route display

V. CONCLUSION

SERVA can quickly process vehicle location and traffic event data keeping in mind the end goal to manage crises in real-time

with drivers who utilize this application. In our application, the vehicle location and traffic event streams transferred in real time are relayed to all the modules, accordingly providing the shortest path to the emergency site and back. Furthermore, traffic events are grouped based on occurrence time, location, content, and road segment of the traffic event transferred in real time in order to share only a representative traffic event. This application can conquer the issues confronted by emergency vehicles in real time traffic situations. The application can help the users in requesting emergency aid and tracking the emergency vehicle. The Web application keeps track of the emergency and also the caller. The application can send messages along with the location details if there should be an occurrence of any emergency. The application server can interact with the mobile device and send the message accordingly.

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