Optimal Routing to Decrease Emergency Services Response Times: A Proposal

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The response time of Emergency Medical Services (EMS) to a life-threatening injury has a high correlation to the success rate of saving the patient. The main mode of transport of EMS is vehicular travel. Small hindrances in the road, such as speed bumps, road blockages, and other vehicles, can compound into a significant decrease in travel speed and consequently a significant increase in travel time. A system that provides a standardized communication link between EMS and other vehicles, interfaces with traffic signals, and plans routes to the nearest available hospital has been proposed to combat these issues. Furthermore, such a system can be simulated using microscopic models of traffic flow, which has been shown to yield realistic behavior.

I. INTRODUCTION

Contemporary emergency medical services (EMS) response times in reaction to life-threatening events play a critical role in determining the mortality rate of a patient. Prior empirical research has provided evidence that largely supports the importance of reducing response time [1–4]. Additionally, the idea that quicker response times lead to improved outcomes for patients is a widely accepted and established principle within the EMS field [2]. Introducing systems to EMS that decrease the response time of its vehicles is has a significant correlation with the likelihood of saving a patient.

EMS systems inevitably interact with stop-lights, road blockages, and vehicles. Previous research has shown that seemingly arbitrary variables such as the arrival frequency of buses and taxis to their stops slow down travel time [5]. Additionally, the effects of ambulance diversion (i.e. "a patient not being transported to their initially intended hospital because the hospital is unable to accept patients because of temporary emergency department overcrowding or closure") and clinical handover communication (i.e. "communication between staff in healthcare"), can effect the success rate of EMS systems [4].

To solve the aforementioned problems, we propose a system that can:

1. Provide a standardized way for emergency medical services to communicate with other vehicles, and vice versa.
2. Interface with traffic signals to improve route efficiency.
3. Plan routes to the nearest available hospital utilizing the systems mentioned above and taking into consideration any potential problems that may occur.

This proposed system is expected to improve the communications handling between EMS vehicles, traffic lights, other vehicles, and hospitals and improve the success rate of EMS systems.

II. SIMULATION/DEMONSTRATION

There are several models for traffic simulation. In this research project, we will focus mainly on microscopic models (i.e. models that model the behavior of individual vehicles) of traffic since research has shown that such models yield realistic behavior [6, 7].

The usage of a system of communicating Rasberry Pis in real-world cars has been considered as a way to demonstrate the concept. This is not as accurate as computer simulations and will be used as for demonstration purposes only so as to keep the scientific integrity of the project.

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