



Smart traffic monitoring system using Unmanned Aerial Vehicles (UAVs)

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ABSTRACT

Road traffic accidents are one of the leading causes of deaths and injuries in the world resulting in the not only loss of precious human lives but also affect the economic resources. According to the World Health Organization (WHO), over 1.35 million people are killed, and over 50 million are injured due to road accidents throughout the world. Unfortunately, as compared to other developing countries with the same ratio of vehicle possession, in Saudi Arabia, the fatalities and injuries are much higher. Every year around 7000–9000 people die, and over 39000 serious injuries occur in road accidents. There is at least one accident happens every minute in Saudi Arabia. To decrease the road traffic accidents, fatalities, and injuries caused by them, the Saudi Ministry of Interior came up with new rules, regulations, and hefty fines. Also, they introduced a new traffic system called the SAHER system. Still, due to the static nature and other limitations of the system, the drivers found loopholes and ways to deceive the system to avoid the fines and not being caught by the system. The most common violation includes excess speed, abrupt deceleration, and distracted driving. In this paper, we propose a smart traffic surveillance system based on Unmanned Aerial Vehicle (UAV) using 5G technology. This traffic monitoring system covers the existing limitations of the SAHER system deployed in KSA. By overcoming the existing limitations and loopholes of the SAHER system, it is observed that the number of accidents and fatalities can be decreased. The projected results show that those violations when to overcome, the number of accidents per year falls to 299,317 leading to 4,868 deaths and 33,199 injuries for 1st year, and in the next five years the number of deaths and will be decreased to 3,745 and injuries to 16,600 based on the current data available. We aim the system will further reduce the number of accidents and fatalities and injuries caused by it.

1. Introduction

Road traffic accidents (RTAs) are a global issue, and they are considered as one of the most significant threats to public health. RTAs cause thousands of severe injuries and fatalities every day due to distracted drivers, aggressive driving, and other traffic violations, with severe injuries leading to permanent disabilities. The World Health Organization (WHO) estimated that 1.35 million people sustain fatal injuries, and over 50 million people are non-fatally injured [1] due to road crashes globally each year [2]. According to the World Health Report (WHR) released in 2010, road traffic injuries (RTI) are the ninth most common cause of disability-adjusted life years (DALYs) lost for all age and gender categories [3]. Studies predict RTAs to become the third major cause of death by the year 2020. Rapid expansion and vast road networks lead to a rapid increase in vehicular use in Saudi Arabia. With this, the number of road accidents has increased drastically. Ministry of Interior, Saudi Arabia, has recorded over 4 million road accidents, and

7% of these accidents lead to permanent disabilities to the passengers and pedestrians [4,5].

Modern surveillance technology has come leaps and bounds in the last few years, and it can assist in solving robust and complicated problems like RTAs. Unmanned Aerial Vehicles (UAVs) or drones have become a renowned technology in recent years [6,7]. The UAVs are utilized in a wide range of applications, including civilian and military domains [8,9]. UAVs are used for Security [10], Survey [11], Monitoring [12], Surveillance [13], Disaster Management [14] and environmental mapping [15] [16]. It is due to its ease of deployment, dynamic design, low maintenance costs, high mobility and rapid response. The convenient and diverse deployment of UAVs at a comparatively low cost is one of the primary reasons for its success [17].

These are especially useful in conditions that are too monotonous, but also because of their energy and visual range limitations, UAVs are limited in geographical areas. A multi UAV network (more than one

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