Automated Speed Enforcement Devices for Residential Neighborhoods

Introduction

Speed detection is used by police forces to encourage people to follow speed laws. However, with a large number of travelers using the major roadways, many of the smaller streets go unpatrolled. As of 2007, 11 states were using automated speed enforcement machines in order to aid road system patrol [1], with more and more transportation officials relying on these unmanned speed detection devices in order to help monitor less traveled roads. This technical review summarizes current automated speed enforcement designs, provides a brief description of the technology behind them, and gives various techniques for their implementation.

Commercial Applications

Speeding contributes to approximately 30% of all vehicle crashes [2]. As a result, the National Highway Traffic Safety Administration (NHTSA) has begun using stand-alone machines, which are structures placed on the side or above a road system that detect and cite speeding vehicles. Brekford Corporation offers devices called Portable Speed Solutions, which are placed on the side of the road and use one or more sensors that produce recorded images of vehicles traveling at speeds above a defined threshold [3]. This piece of equipment is re-deployable, and can identify vehicles in all lighting conditions [4].

A Maryland based company, called Optotraffic, has also developed a red light and speed detection system, which is housed on a trailer and can be erected on the side of the road. It uses Light Detection and Ranging (LiDAR) technology so that it can work in both light and dense traffic and on multiple lanes as well [5]. Optotraffic operates and maintains all of their equipment, but is contracted by traffic agencies to monitor certain roads. Systems similar to those produced by Optotraffic and Brekford Corporation available on the market are valued anywhere from $50,000 to $75,000.

Technology

The process of automated speed enforcement relies on many components. Different suppliers provide slightly varying elements, but all systems include a speed detector, a video/camera sensor, an image processor, and a transmitter. Of these parts, the speed detector encompasses several vital processes in order to create an end result.
Speed Detection

Traditional police radar sensors are becoming insufficient due to the wide beam widths they use, anywhere from 12° to 18°, which leads to erroneous data [6]. Newer technology has provided more accurate ways for performing speed detection. One technique involves video sensing, which incorporates a time-over-distance technique where simultaneous frames are compared to determine the speed that the vehicle is traveling. In this process, a car drives past a sensor, which activates the camera to take multiple pictures that are a specified time apart. Then, a processor calculates the number of pixels that the vehicle has moved from one picture to the next. Finally, knowing the distance that the automobile is away from the camera, a calculation can be made to determine the rate at which the motor vehicle is moving [7]. Another uses pressure-activated sensors in the road, which are a certain distance apart, in order to calculate an average velocity. A vehicle passes over one sensor, which activates a timer. Then, it passes over the second sensor, which stops the timer. Now, the machine divides the distance that the sensors are apart by the time it took the vehicle to travel that distance. Thus, calculating the average velocity of that automobile. Perhaps the most modern way to record speed accurately is through LiDAR systems. They also use a time-over-distance principle in which laser light is bounced off of objects and the return time of the light is detected and recorded. The recorded data can then be compared in order to calculate the speed that an object is traveling. LiDARs have a beam width of approximately 0.15° and are not affected by the Doppler principle, so they are much more accurate that police radar guns [6].

Implementation

Automated speed enforcement devices can be implemented on any roadway. The hardware required for a system includes a structure, power source, speed sensor, camera, transmitter, and an external storage device. They also require software which can record and calculate average velocities from data, as well as process images to obtain license plate characters. In addition, it is important to study the traffic behavior of road systems before making a decision on where to place these machines. Proper placement can result in an increase in the safety of the roadway and the surrounding areas because the threat of getting a ticket strongly influences motorists’ speed choices [8].
References


