Real Time Traffic Management System Using Object Detection based Signal Logic

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According to PRB (Population Reference Bureau), road traffic accidents are the third-leading leading cause of death by injury and the tenth-leading cause of all deaths globally. Delay due to traffic congestion at the junctions is causing the people to exceed speed limits leading to increased road accidents that demands for effective traffic management. Traffic management is a critical issue in densely populated cities. Currently a fixed quantum of green time is allocated in all the directions irrespective of traffic density leading to unnecessary waiting. Automated object detection and counting technologies can provide benefits to develop the next-generation of AI-supported real-time traffic management systems. In this paper, we present a novel green time estimation algorithm that provides the green signal time in each direction (North, West, South and East) based on the traffic density and use AI and ML techniques for predicting the green time in a short interval. Directional loads were estimated using Linear, Quadratic, Exponential, Logarithmic Regression and time series ARIMA models. Among all, Linear Regression model proved to be best. Inputs include: number of directions, maximum green time for a direction, maximum green cycle time, and departure rates in various directions. Two dictionaries are maintained to store vehicle counts and green time is provided in all the directions. A signal logic scheme is detailed that uses directional threads to get vehicle counts every second by implementing Yolo algorithm for object detection. The cycle starts with North followed by West, South and East. We conclude by providing a case study of our object-detection based signal logic scheme using real world data sets in the Kakinada Smart City test bed.