Reducing Vehicle Idle Time Emissions at Intersections

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Throughout the world, millions of people allow their vehicles to sit idle for minutes at a time for many different reasons. According to Sustainable America, the average American spends more than 16 minutes a day idling his or her vehicle [3]. Some of the main reasons vehicles sit idle is waiting in line at the drive-thru of a fast food restaurant or waiting at an intersection for the light to change. An EDF report shows that in New York City alone, idling vehicles produce 130,000 tons of carbon dioxide each year [1]. One way to reduce the amount of emissions at an intersection would be to integrate the engineering of a smart intersection.

The main objective of the smart intersection discussed in this report is to optimize the flow of traffic and allow traffic to proceed through the intersection with little to no idling. A main culprit of long wait times is the need for pedestrian crossing. If we incorporate pedestrian bridges or tunnels rather than normal crosswalks it will allow pedestrians to cross above traffic rather than through the intersection. Pedestrian bridges would be especially beneficial in big cities or places of the world that have a highly dense population of people that use walking as a main form of transportation. By alleviating the presence of pedestrians at an intersection it will allow traffic to flow more easily and shorten the length of the traffic signal.

To optimize the flow of traffic at an intersection, the timing system of the lights need to change in correlation to the amount of traffic proceeding through a green light, compared to the amount of traffic halted at the adjacent red light. The timing system would require the use of sensors to detect the amount of traffic and adjust accordingly. I will be creating a miniature scale version of a smart intersection to simulate how the timing system would be beneficial for the flow of traffic and minimize idle time.

The timing system of the smart intersection will be controlled through the use of an Arduino Mega and using IR sensors to detect the number of vehicles approaching the intersection at a given time. The length of red and green lights will be automatically adjusted depending on the amount of traffic the sensors detect. In addition to the timing system, a camera will be implanted on the intersection to identify if a vehicle runs a red light. If a vehicle is detected running a red light, a Raspberry Pi and Image Processing will be used to take a picture of the vehicle and extract the license plate number. An Android app will be developed where the picture and license plate number will be displayed along with the app having the capability to control the timing system of the intersection.

In addition to the timing system, a smart intersection would need the capability to communicate with oncoming traffic. One way to achieve this capability is an approaching vehicle would ping the intersection to determine the length of the light. The driver could then adjust their speed according to the results of the ping to make sure they make the light while it's green, forgoing the vehicle idling. This capability could also be introduced in intersections with train routes. The intersection would communicate with the train to determine the speed and the amount of carts being pulled and relay the information to approaching vehicles. If it is an extended amount of time the driver of the vehicle can use an alternate route; or adjust their speed to minimize the idle time.

The Transportation Energy Data Book shows that in 1960 nearly 79% of households in America owned less than two cars. In 2013 it had increased to more than 57% of households having a minimum of two vehicles

and less than 10% having no vehicles [2]. With the monumental increase of vehicles on the road and the innovation of autonomous cars, the need for improved intersections is becoming a necessity. Through the use of this type of intersection, automobiles would be able to minimize the time at an intersection, avoid unnecessary accidents, and lower the amount of emissions created by idling vehicles.

References

[1]"Attention drivers! Turn off your idling engines", *Environmental Defense Fund*, 2016. [Online]. Available: https://www.edf.org/climate/reports/idling. [Accessed: 15- Sep- 2016].

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[3]"Sustainable America", *Sustainable America*, 2016. [Online]. Available: http://www.sustainableamerica.org/. [Accessed: 15- Sep- 2016].