Obtaining road data

In the recent years, there's been an exponential growth in AI and object detection from images using a combination of hardware and software. There's even a google's open source API for image visualization called TensorFlow which is trained on the Microsoft's COCO (Common objects in context) dataset, which is capable of detecting vehicles. Using such API's and a live video input from the camera in the junction, this system will be capable of obtaining the number of vehicles on each road. To make things *scalable to a large extent, minimizing cost, and improving accuracy*, it's enough if the system wiretaps into a PNR (plate number recognition) camera, which already exists in almost every junction, so that this way the PNR camera becomes the embedded entity of the smart junction system and will have more information than using API's like TensorFlow. But, this method of obtaining data, is just for backwards compatibility and for recognizing vehicles which do not have RFID tags.

Knowing emergency vehicles

Emergency vehicles *(ambulance, fire and rescue vehicles, etc)* should be having a module which can communicate with the Smart Junction services server. Once the emergency mode of the vehicle is activated by the driver, the module will beam the positional data and the destination of the emergency vehicle to the server. And then the server traces its path to the destination and analyzes which all Smart Junctions the vehicle will pass through, and relays an Emergency Priority signal to all those junctions. Now the junction will be able to give high preference to the road in which the vehicle would be approaching and optimizes its traffic flow before the emergency vehicle approaches, eliminating traffic congestions for the emergency vehicles.

Purpose & Advantages of this system

The main purpose for bringing up this Smart Junction concept are:

- To reduce waiting time experienced by vehicles in a junction.
- Reduce fuel consumption and carbon emissions.
- Eliminate traffic clogging in junctions by optimizing traffic flow efficiently.
- To provide faster and safer clearance for emergency vehicle's such as ambulance, fire engines, etc.
- Instantly adapt to variety of traffic conditions.

Other advantages include:

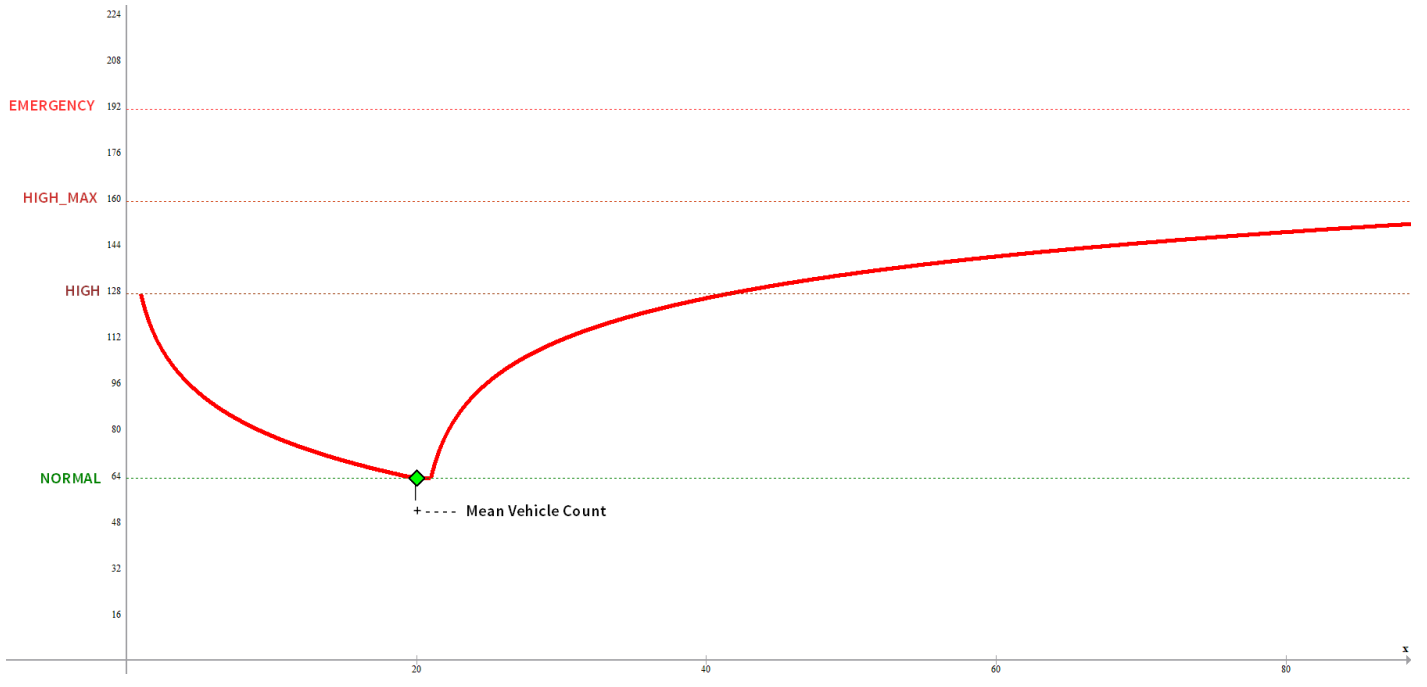
- Obtaining live traffic information for real time data sharing and for public viewing.
- Large-scale deployment can lead to much better optimization of traffic-flow as junctions would be able to communicate traffic information to their neighboring junctions.

Hypothesis

As per our research, we've analyzed that growing traffic is one the issues for causing traffic congestions, and the present traffic management system is an inefficient method to manage modern world traffic as the system is unaware of the traffic conditions of that junction. So we needed a system that's aware of the traffic conditions and accordingly manage traffic flow. For making this into effect we've designed the system which is more efficient in optimistically managing traffic, and can handle variety of situations.

Background / Research

We've attempted few types of algorithm and found out that some algorithms performed significantly better than others, although all had lower waiting time when compared to normal junction.



In this Traffic Congestion Rate vs Priority mapping graph, we've found that, this performs tremendously better in junctions where traffic is extremely minimal, but doesn't do a great job when traffic increases.

In the original finalized mapping graph, even though the graph looks very simple, it performs very optimistically in almost every conditions.

Results and discussion

After thorough testing and simulating we've found that this system performs better than existing junctions in managing traffic flow.
In light traffic conditions, waiting time is drastically reduced, and in extremely light traffic, waiting time is zero. But for practical purpose and in efficient deployment of junctions, in moderate traffic conditions, waiting time is reduced by almost half.

Conclusion

This concept of Smart Junction is the best way to manage and optimize traffic flow for this growing world in the most effective and efficient way, as it incorporates solutions for almost all problems faced in normal junctions.

Since waiting time is lowered, engine idle time is also lowered and hence carbon emissions also is reduced, although this change would be significantly observed on large scale deployment of the system.

This system is flexible so that it can be modified in future without much maintenance or work and can also be integrated with many other services.