TGD 1713
SMART TRAFFIC SYSTEM USING DEEP LEARNING

THE GREAT LAB (TGL) GRAND DESIGN CHALLENGE

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ABSTRACT

Traffic light control systems are widely used to monitor and control the flow of automobiles through the junction of many roads. We propose a new end to end solution that depend on detecting and counting the vehicles in each lane using a supervised deep learning network, then this will be input for a reinforcement q-learning agent that is able to obtain the optimal timing needed for each traffic signal. Finally this output will be transferred wirelessly using MQTT protocol for the real traffic light signal.

PROBLEM STATEMENT

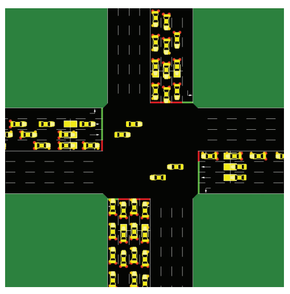
The World Bank have shown that in 2014, economic losses due to traffic congestion in Greater Kuala Lumpur was estimated at around RM20 billion per year or RM54 million every day! . Thus caused by the fixed timing system with the help of induction loop detector in each lane that has been implemented in most of Malaysia roads.

Our traffic signal has huge cases of violations and accidents due to less recorded evidence of violations.

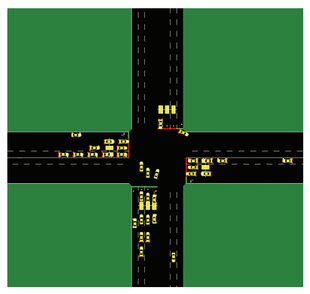
OBJECTIVES

- To develop an artificial intelligent end-to-end deep learning traffic light solution that help in reducing traffic congestions and accident rate.
- To assist in having a recorded or streaming video from the traffic light signal location that help in analysing and providing violation evidences.
- To design a reinforcement Q-learning agent that learns to reach the optimal traffic conjunction.
- To develop a deep supervised learning network to use as a vehicle detection and recognition by the use of the convolutional neural network “CNN” and camera monitoring system.
- To design an easy IOT controlling and transferring traffic light signal by the use of Message Queue Telemetry Transport “MQTT” protocol

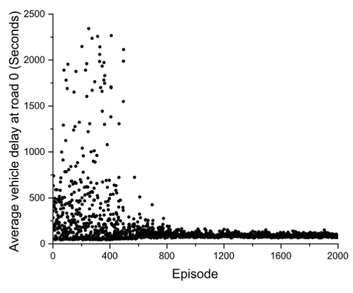
TRAINING RESULTS



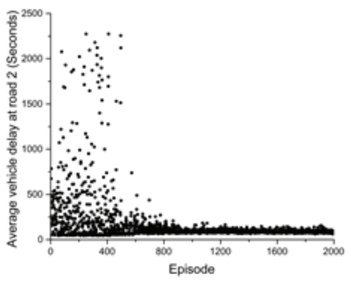
(i) Start of Training



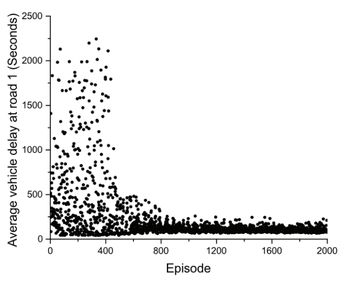
(ii) End of Training



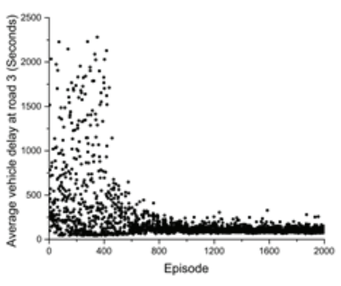
(iv) Roud 0



(iv) Roud 1

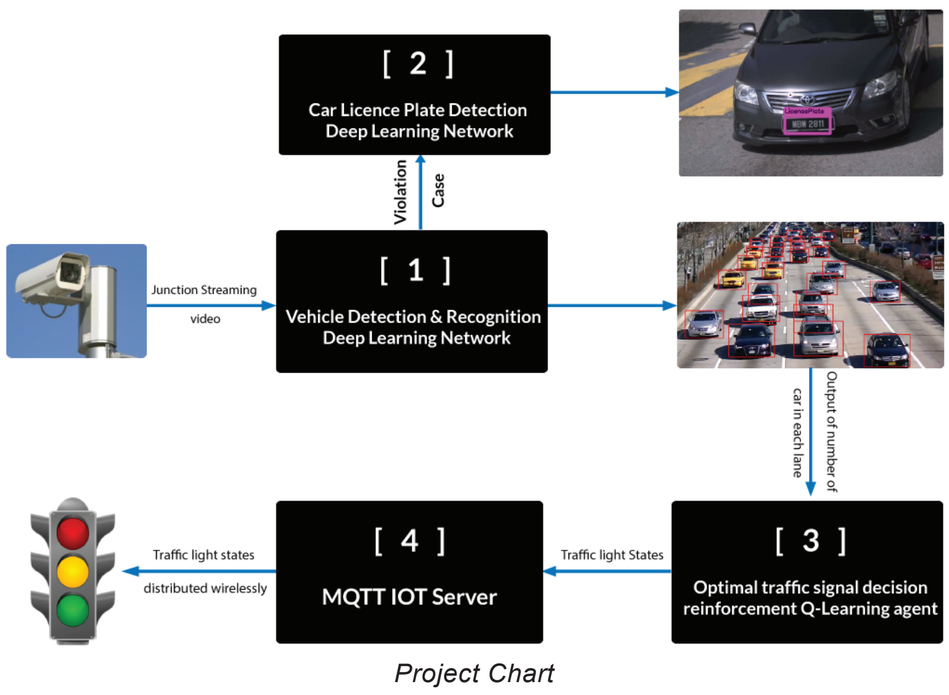


(iv) Roud 2



(iv) Roud 3

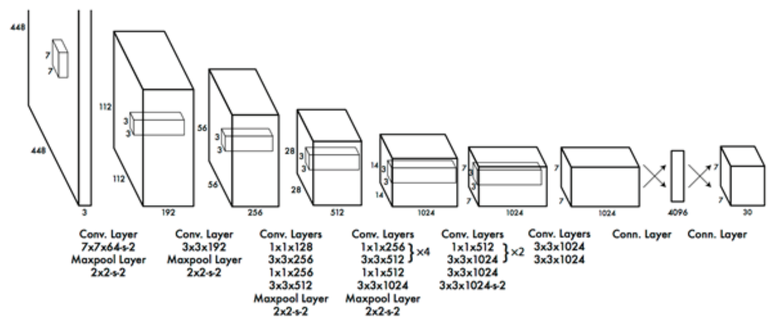
METHODOLOGY



Project Chart

[1] Vehicle Detection & Recognition [1]:

This network is based on supervised machine learning real-time object detection called YOLO “You Only Look Once”. This model has training with many thousands of vehicles image with its category .



Tiny YOLO Architecture

[2] Car License Plate Detection:

This network is sharing the same architecture with vehicle detection network; the only difference is the training dataset for each model.

[3] Reinforcement Q-Learning traffic light agent [2][3]:

A four Layers neural networks has designed to make our agents interacting with an environment “SUMO Traffic Junction” so as to maximize some notion of cumulative reward “Decrease number of car and its halting-time” by referring to trial and error concept “10,000,000 trial”.

[4] MQTT IOT Broker:

Message Queuing Telemetry Transport “MQTT” is light weight massaging protocol that : Provides resource-constrained network clients with a simple way to distribute telemetry information, uses a publish/subscribe communication pattern and Machine-to-machine (M2M) communication and plays an important role in the Internet of Things (IoT).

REFERENCES

[1] J. Redmon, S. Divvala, R. Girshick, and A. Farhadi, You Only Look Once: Unified, Real-Time Object Detection, arXiv:1506.02640 (2015).

[2] W. Genders, and S. Razavi, Using a Deep Reinforcement Learning Agent forTraffic Signal Control, arXiv:1611.01142v1 (2016).

[3] J. Gao, Y. Shen, J. Lia, and M. Ito, Adaptive Traffic Signal Control: Deep Reinforcement Learning Algorithm with Experience Replay and Target Network, arXiv:1705.02755v1 (2017).