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Traffic Flow Control and Optimization System

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Abstract: **Congestions of the traffic flow within the urban traffic network have been a challenging task for all the urban developers.Many approaches have been introduced into the current system to solve the traffic congestion problems. Reconfiguration of the traffic signal timing plan has been carried out through implementation of different techniques. Occurrences of traffic congestions within the urban traffic network are increasing in a rapid rate due to the rising traffic demands of the outnumbered vehicles on road. The effectiveness of management from traffic signal timing planner is the key solution to solve the traffic congestions, but unfortunately the current traffic light signal system is not fully optimized based on the dynamic traffic conditions on the road. Adaptable traffic signal timing plan system with ability to learn from their past experiences is needed to overcome the dynamic changes of the urban traffic network. The ability of Q-learning to prospect gains from future actions and obtain rewards from its past experiences allows Q-learning to improve its decisions for the best possible actions. A good valuable performance has been shown by the proposed learning algorithm that able to improve the traffic signal timing plan for the dynamic traffic flows within a traffic network. The simulated results show that the Q-Learning algorithm is able to learn from the dynamic traffic flow and optimize the traffic flow accordingly.**

Keywords: **learning algorithm, Q-learning, signal timing plan, traffic control.**

1. INTRODUCTION

The demands of the traffic flows in the urban area are usually supported by a complicated traffic network which covers the whole urban cities. Unfortunately, in the urban area, there are always high traffic demands with dynamic traffic conditions. In addition, reconstructions of the traffic road to cope with the high traffic demands are not an option for a fully developed city with limited availability of landscapes. When the existing traffic network is unable to meet the saturated traffic demands by the on-road vehicles, traffic congestions occurred around the urban traffic network. The most common solution for the traffic congestions problem is the implementation of traffic lights system to control the traffic flow within the traffic network. The conventional method of predetermine the traffic lights signals timing plan based on the historical traffic statistics data is insufficient to handle the actual traffic flow demands.

Q-Learning algorithm gathers information from its learning process as its experience and learns from the environments. This learning ability is emphasized in this study of traffic flow optimization system to act as multi-agent systems. The Q-learning algorithm implemented at traffic light intersections will be able to learn from the traffic environment for increasing its adaptability and making a better decision in the future.

2. LITERATURE SURVEY

In this paper "Q-LEARNING BASED TRAFFIC OPTIMIZATION IN SIGNAL OF MANAGEMENT TIMING PLAN"-[2013].[1]-Y.K.Chin. has propose basics functions of systems. The demands of the traffic flows in the urban area are usually supported by a complicated traffic network which covers the whole urban cities. Unfortunately, in the urban area, there are always high traffic demands with dynamic traffic conditions.

In this paper "OPTIMIZATION OF URBAN MULTI-INTERSECTION TRAFFIC FLOW VIA Q-LEARNING" -[2013].[4]-N.Bolong ,A.Kiring has propose the Q-learning algorithm from this paper which is the overcome of above paper congestions of the traffic flow within the urban traffic network have been a challenging task for all the urban

developers. Many approaches have been introduced into the current system to solve the traffic congestion problems. Reconfiguration of the traffic signal timing plan has been carried out through implementation of different techniques.

From above literature survey we have conclude that existing system having some disadvantages and existing system is not a perfect solution for traffic signal management in urban area. so we implement propose system and we study the overall flow of propose system.

3. PROPOSED SYSTEM

To satisfy the requirements for real-time data collection, the complexity of the approach has to be balanced against its effectiveness. Some of the pattern recognition and model-matching algorithms cannot be executed for real-time detection due to their over-expensive computational cost. In this project fixed control system i.e. existing system is compared with proposed system. To calculate the optimal time of the traffic signal on each phase of the cycle, firstly we need to estimate traffic intensity that arrives and departs at the intersections.

Why Q-learning algorithm:

Q-Learning is temporal-difference learning algorithm which learns state-action values. The Q-Learning algorithm learns the optimal action-value function Q* directly. The Q-Learning follows policy during learning has no effect on the learned value estimates; therefore Q-Learning is also called off policy method.

Signal Time:

In proposed system signal time is based on traffic volume, according to traffic density signal time will get change so that waiting time of vehicles is less than the waiting time of latest traffic control system's vehicles. If waiting time of proposed system's vehicles is less than latest traffic control system's vehicles then reward is obtained otherwise system may get penalty. The main aim of proposed system is to obtain as many rewards as possible. If the system get more rewards than penalties then policy is set that system is safe otherwise system is unsafe.

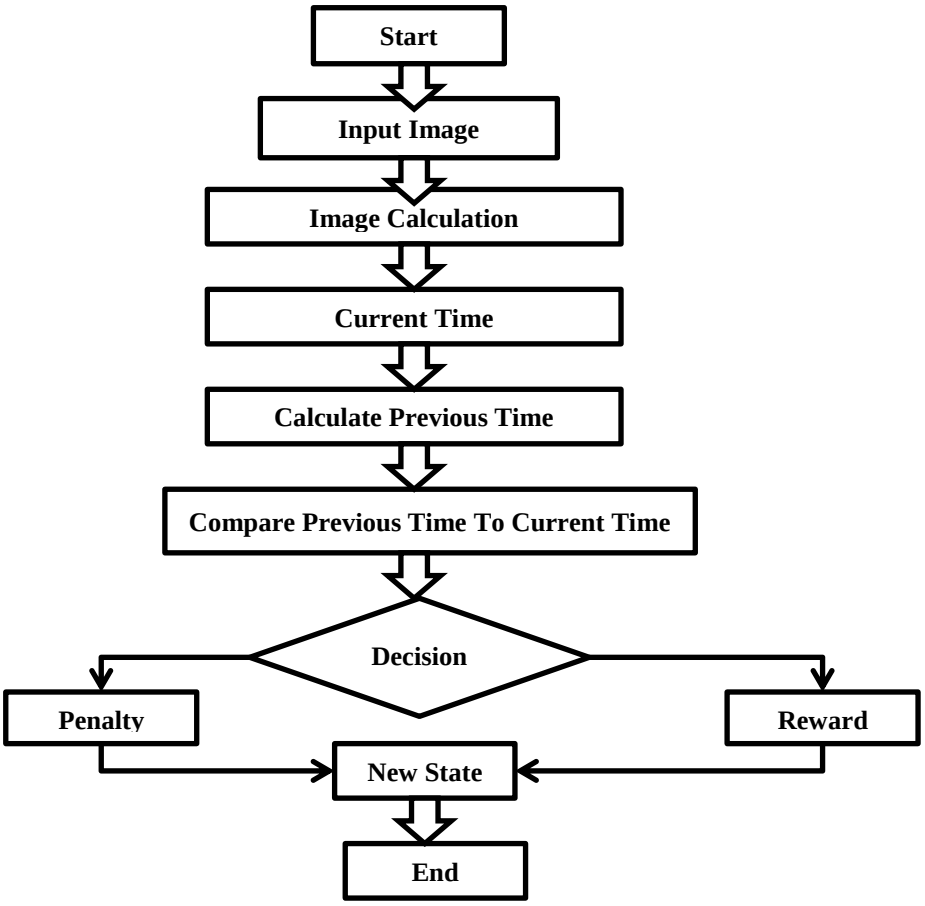

Fig 1: Traffic Control Flow System

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4. EXPERIMENTAL RESULTS

Our goals in this work are, initially we want to improve the today's traffic more effectively and achieve good performance. Secondly, we want to target known weaknesses of the system that motivated this research, thirdly, we aim to compare the performance of the proposed system with fixed control system and shows the better results than fixed control system using Q learning algorithm.

4.1RESULTS AND ANALYSIS:

Our goals in this work are, initially we want to improve the today's traffic more effectively and achieve good performance. Secondly, we want to find out weaknesses of the latest system that motivated this research, Thirdly, we aim to compare the performance of the proposed system with latest system and shows the better results than today's traffic control system using Q learning algorithm.

Our results estimate the waiting time (WT) of vehicles in the system. Following graphs shows the results of proposed system. The results are compared with latest traffic control system and proposed system which is obtained by estimating waiting time of proposed system and compared it with waiting time of latest traffic system.

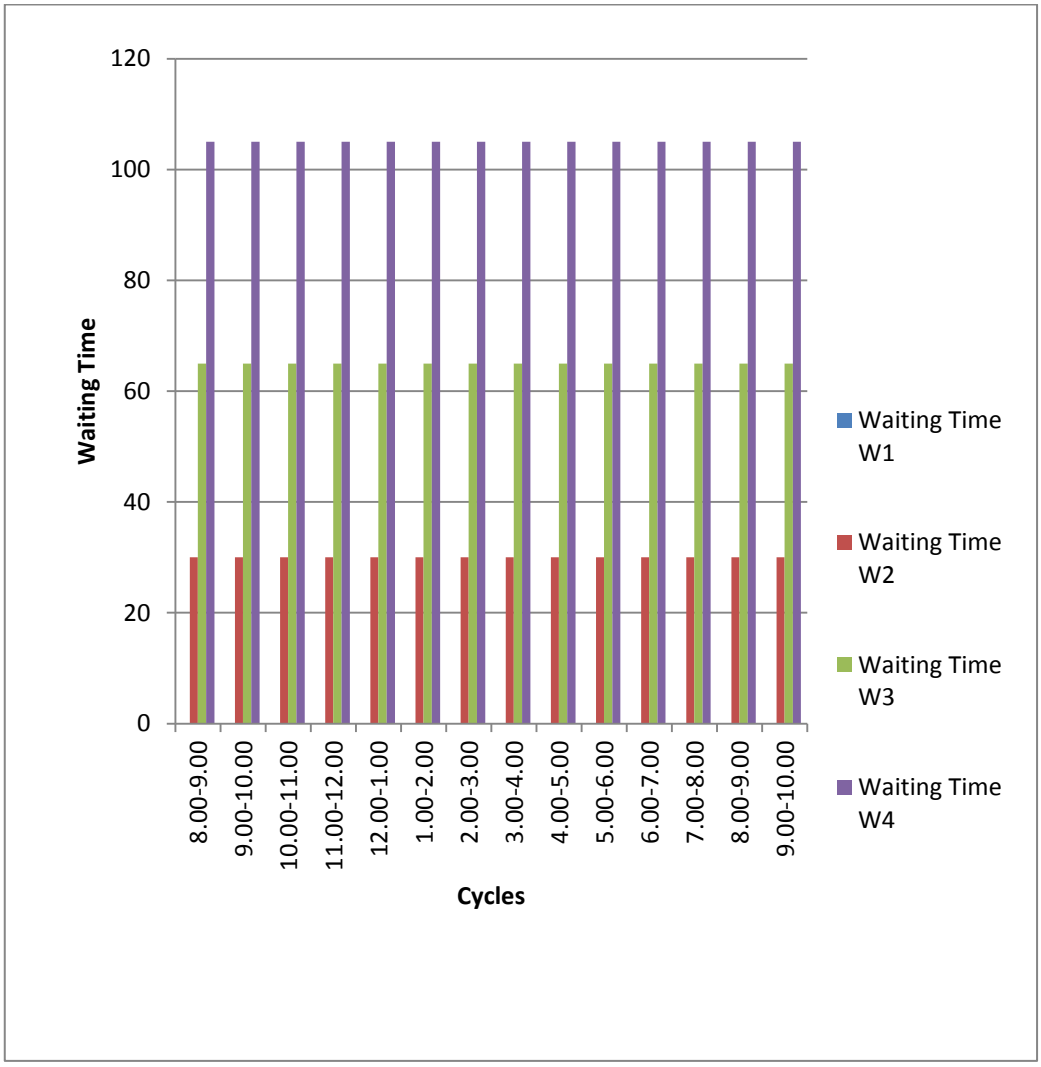

Fig 2: waiting time and cycles of latest traffic control system

Figure 2 shows the graph of latest traffic control system, in which waiting time with daily cycles i.e. time from morning 8am to night 10pm is shown. This graph shows the constant waiting time because signal time is doesn't change according to traffic volume. This is the disadvantage of latest traffic control system. On the other hand figure 5 shows the graph of proposed system in which estimated waiting time is less than waiting time of latest traffic system.

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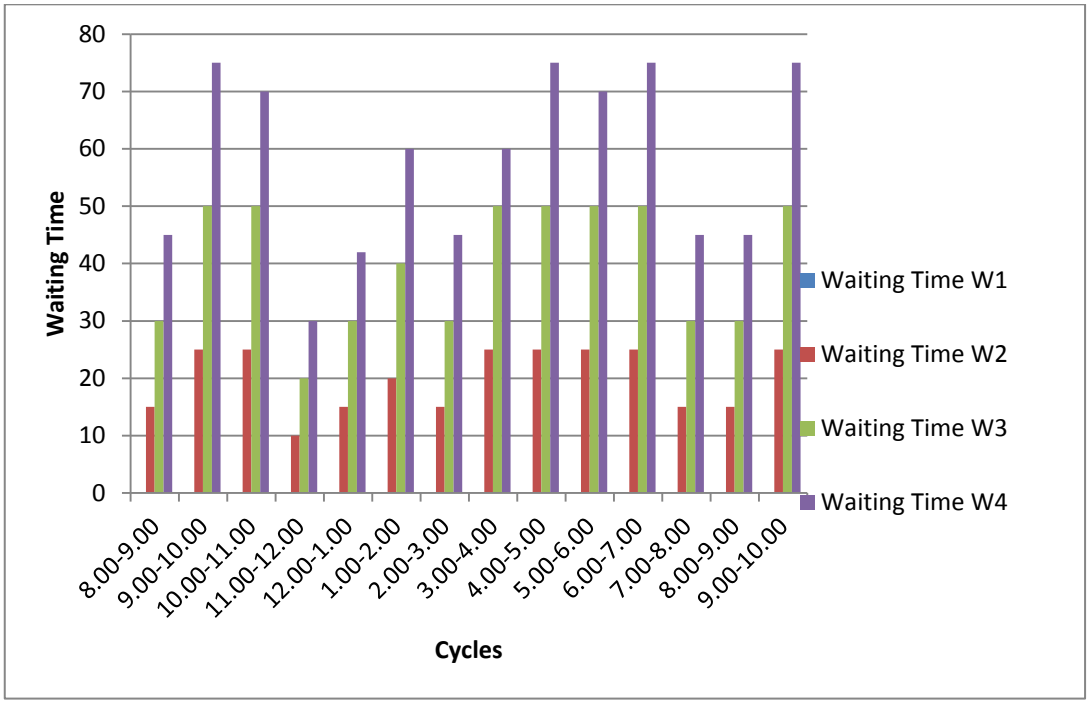

Fig 3: waiting time and cycles of proposed system

5. CONCLUSION

In this project, studies have been carried out on the traffic flow control systems. The developed Q-learning based traffic signal timing plan management system has shown its performance through the simulations and the ability to perform well in various traffic environments are proven. Q-learning algorithms' exploration in the dynamic traffic flows and exploit its best actions based on its experience has shown a good performance in the traffic signal timing plan management system.

The traffic signal timing plan system is encouraged by the ability of Q-learning to learn and adapt with the dynamic changes of the traffic flow. Q-learning is accessed via the simulation to be a suitable method or technique to be implemented into the traffic flow control and optimization of urban traffic network system.

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