

## INTISARI

### **Sistem Lampu Lalu Lintas Adaptif Berdasarkan Panjang Antrean Menggunakan Algoritme Q-Learning dan Algoritme Genetika**

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Kemacetan merupakan permasalahan terkait dengan manajemen lalu lintas. Salah penyebab kemacetan adalah pengendalian lampu lalu lintas yang tidak efektif. Secara umum, pengendalian lampu lalu lintas di Indonesia menggunakan metode konvensional dimana penentuan durasi sinyal tidak mempertimbangkan keadaan lalu lintas dari waktu ke waktu. Oleh sebab itu, maka diperlukan sistem pengendalian sinyal lampu lalu lintas yang memiliki kemampuan beradaptasi terhadap perubahan keadaan lalu lintas dari waktu ke waktu.

Penelitian ini mengembangkan sistem penentuan durasi sinyal lampu lalu lintas berdasarkan panjang antrean kendaraan di persimpangan menggunakan algoritme Q-learning dan algoritme genetika. Pemrosesan dilakukan dengan cara memberi input nilai panjang antrean ke sistem. Kemudian Q-learning mengklasifikasi antrean menjadi 3 golongan, yaitu “low”, “medium”, dan “high”. Selanjutnya tindakan terbaik dipilih sesuai dengan keadaan antrean ditentukan berdasarkan nilai reward tertinggi yang tersimpan di Q-tabel. Tindakan terbaik tersebut dijadikan input algoritme genetika. Kemudian dilakukan proses fitness function, operasi mutasi, dan operasi seleksi. Output sistem ini berupa nilai durasi sinyal lampu hijau berdasarkan panjang antrean.

Hasil penelitian menunjukkan bahwa sistem pengaturan durasi lalu lintas adaptif menggunakan algoritme Q-learning dan algoritme genetika (QLGA) meningkatkan efektivitas cycle-time sebesar 17%, serta menurunkan waktu tunggu rata-rata kendaraan untuk jalur utara, timur, selatan, dan barat masing-masing sebesar 24,76%, 12,86%, 7,96%, dan 24,15% dibandingkan dengan metode lokal.

**Kata kunci** — kemacetan, lampu lalu lintas, algoritme q-learning, algoritme genetika

## ABSTRACT

### Adaptive Traffic Light System Based on Queue Length Using Q-Learning Algorithms and Genetic Algorithms

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Congestion is a problem related about traffic management. One of the causes of congestion is the ineffective control of traffic lights. Generally, traffic light control in Indonesia uses conventional methods that the determination of signal duration does not take into account traffic conditions. Therefore, we need a traffic light signal control system that has the ability to adapt to changes in real time traffic conditions.

This research develops a system for determining the duration of traffic light signals based on the length of the vehicle queue at the intersection using the Q-learning algorithm and genetic algorithm. The system accepted value of queue length. Then Q-learning classified the queue into 3 groups, namely "low", "medium", and "high". Furthermore, the most appropriate action according to the queue is determined based on the highest reward value stored in the Q-table. The best action is used as input to the genetic algorithm. Then compute the fitness function process, mutation operations, and selection operations. The output of this system is the value of the duration of the green light signal based on the length of the queue.

The results showed that the adaptive traffic duration control system using Q-learning algorithm and genetic algorithm (QLGA) increased the effectiveness of cycle-time by 17%, and decreased the average waiting time of vehicles for the north, east, south, and west lanes respectively 24.76%, 12.86%, 7.96%, and 24.15% compared to conventional methods.

**Keywords** — congestion, traffic light, q-learning algorithm, genetic algorithm