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Advanced Dynamic Traffic Management System

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Abstract

The population of the Kingdom of Saudi Arabia is growing and is expected to reach 50 million by the year 2030. As a result, congestion and heavy traffic will get worse over time. Moreover, worldwide traffic congestion becomes more problematic and complicated to solve. These add to the existing factors that necessitate an overall solution that considers all pre-existing challenges. This research proposes a system model approach to retrieve data from various sources and model a wide range of constant solutions. The proposed system consists mainly of two sections: the first part is the reporting section, and the second part is the execution section. The implemented modeling consisted of multilayers which are 1- data input layer 2- data modeling layer 3- data output layer 4- data reporting layer.

Introduction

Traffic safety is a growing concern to officials around the world. In fact, there are about 1.3 million deaths each year as a result of traffic accidents [1]. Additionally, the number of deaths from traffic accidents in Saudi Arabia from 2018-2020 was "16,159" [2] which is more than the civilian deaths in the Russian-Ukrainian war [3]. Furthermore, the congestion level in Riyadh is 23% [4]. In comparison to the baseline non-congested conditions, travel times were, on average, 23% higher. This indicates that a 30-minute trip taken in free-flow conditions will require an additional 7 minutes of travel time when the congestion level is at 23%.

Methodology

To utilize the overall objective of this research, modeling, and simulation was used. The conceptual layer was modeled ontologically, and the logical layer was modeled through the use of system engineering language.

Result and Discussion

The model comprises three model approaches, as demonstrated by the preliminary data. The overview system model is illustrated in Fig. 1. In the example shown in Fig. 3 the system used an equation to determine the density of cars (Q) on the road to predict congestion, and then it compared that to the capacity of the road (C). There were two cases: if (Q) was less than (C), the system predicted that there would not be any congestion, but if (Q) was more than (C), it predicted that there would be congestion. By simulating the situation, the system was able to find the best way to avoid congestion before it happened via a machine learning as we see in Fig. 2.

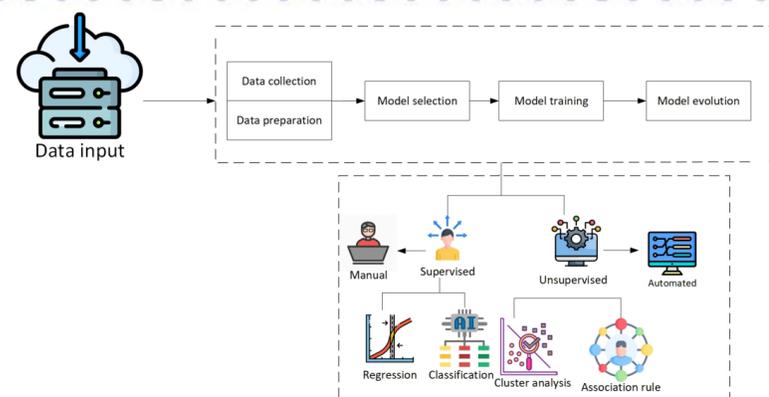


Fig.2 Machine Learning Model

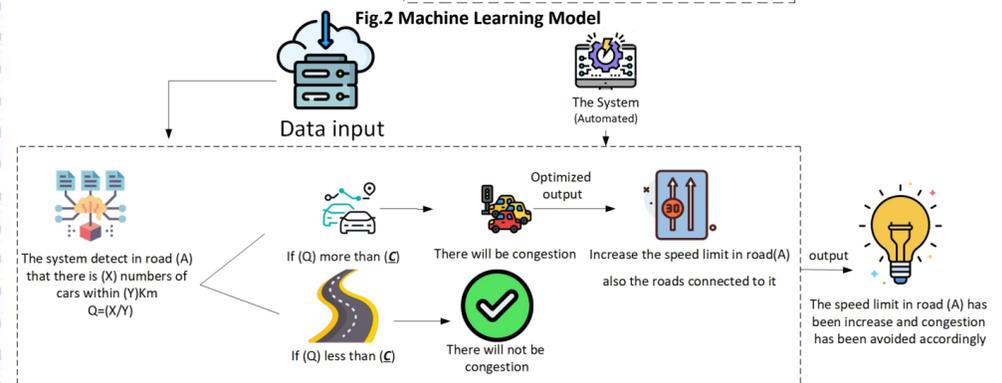


Fig.3 Example Of The Executions

Conclusion

The number of traffic accidents worldwide is increasing. Therefore, the need for a system to reduce traffic accidents and traffic congestion is vital. This system will be a huge shift for management systems traffic and the function of this system are many, including:

- Helps to make the cities smart.
- Predict the traffic congestion and avoid it before it happens.
- Reducing traffic accidents.
- Allow the research centers to reach a big amount of data.
- Send periodic reports to the executive authorities.

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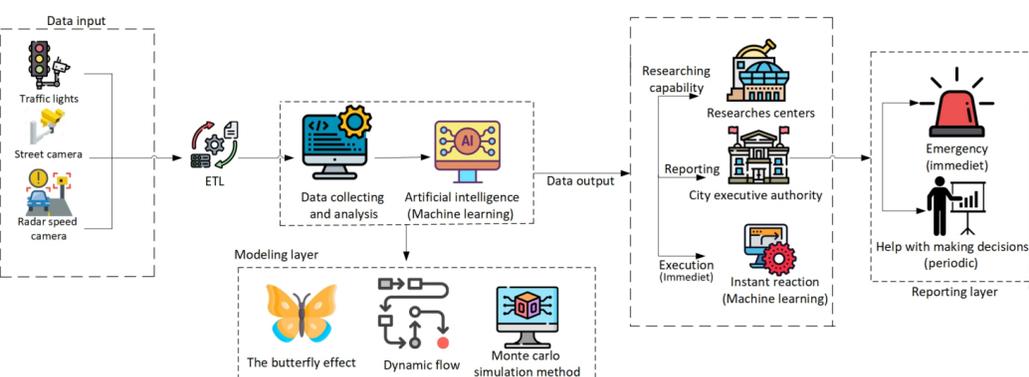


Fig.1 System Overview