

Real-time Traffic Management in Emergency using Artificial Intelligence

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Abstract—Artificial intelligence (AI) is smart behavior performed by the machine. Computer uses its own brain and algorithms to predict the solution of the problem. AI performs tasks as good as human brain does. It mainly focuses on developing machines that performs and studies the task from the surrounding and performs action which requires human intelligence. This paper presents a study on how artificial intelligence can play an important role in traffic management in the future time. Urban traffic system is the key problem faced by first world countries these days. It affects day to day life of people by increasing the problem faced by world because of inefficient human management of traffic. This paper suggests the measures those should be taken for the perfect implementation of Artificial Intelligence in traffic system and reduce the problem faced. The paper proposes a design to implement lane management for effective traffic flow during medical emergency. The path of ambulance is tracked real time and diversion takes place based on intelligent traffic signal management. The paper also talks about the various ideas and designs explored in the past work done by researchers.

Keywords— Artificial intelligence, Neural network, Traffic Management

I. INTRODUCTION

Artificial Intelligence is defined as intelligent behavior in artifacts. This kind of intelligent behavior includes perception, reasoning, learning, communicating and acting in complex surrounding [1]. It mainly focuses on developing machines that performs and studies the task from the surrounding and performs action which requires human intelligence. AI basically means that the computer uses its own brain and algorithm to design the solution for the problems and suggests the measure required for the different region [8]. All we need to do is to program the machine or system in a way that it can perform different tasks simultaneously and predicts the accurate solution for the larger which is not possible for human brain to deal at a particular time.

Artificial intelligence is known for its enormous processes which includes a different pattern recognition technique. Pattern recognition helps in improving day to day scenario by restricting the application of human interaction. Recognition of patterns with learning can be used to avoid generalization based on previously gathered experiences which further reduces search. By analyzing the circumstances and using planning methods we can obtain a basic improvement by exchanging the given search with smaller and more suitable option [9]. Artificial Intelligence is stated playing an important role these days in the day to day task of human being. AI it not only precise or accurate, but it also reduces

the risk factor which was there during human interaction. AI has been used extensively in various fields. Few are like:

- Speech recognition – It works as a transcript between human and the device.
- Natural Language Generation- It is a tool that produces text from the speech input. E.g. google speech to text
- Virtual Agents- Virtual character which talks like human and solve our daily problem. E.g. Siri, Alexa
- Machine Learning- One of the important uses of AI that provides algorithm to develop the different applications and is deployed in many prediction and classification.

The constant increase in traffic and congestion on road has led to huge loss of money, cost productivity, property damage and personal injuries or human lives. These incidents are non-recurring events like accidents, disabled vehicles, spilled loads, maintenance work and many more which disturbs the normal traffic flow [16]. Also, with growing technology, AI has a significant impact on various sectors like marketing, finance, banking and many more.

Due to the increasing rate of road congestion and events on the road automation, a real time analysis is necessary to overtake the work of human management system [2]. The work includes study and optimization of traffic signal. For an instance during the peak time, the peak lane will have less stoppage time and for the same time less peak lane will have more stoppage.

Sometimes artificial intelligence management and analysis requires a lot of hardware support and maintenance. as AI is purely machine intelligence and sometimes problems occur in it leading to wrong decisions which can cause traffic blunder. Sometimes AI is not capable enough to detect traffic signs accurately. Recognition is usually done by color segmentation in neural network. Data of traffic sign gathering helps in building a database which is later use to manage the traffic among the city.

This paper conducts the study to review the work done by the researchers in the past which has played a key role in development of AI in traffic system. The paper has also tried to cover the gap that is found in literature and consequently proposes the solution for the problem came across. The proposed work suggests a design with respect to medical dedicated path throughout the city that can be used at the time of an emergency. The lights and the management system around the city will be capable enough to create a corridor in

just a few commands using the concepts of neural network in AI [5].

II. AI AND TRAFFIC MANAGEMENT

This section presents a discussion about the areas where AI can be applied in the domain of traffic management.

A. Uses Of AI

- AI at present provides instruments and allows solving problems in each kind of transport and their interaction (air, road, railway and water transport) used in areas such as: Real time transport managing, design and approach of management intersection.
- Transport planning and managing of environmental issue such as traffic, tolls, pollution etc.
- Pedestrian and drive behavior analysis
- City planning and sustainable mobility system.
- Service oriented infrastructure for vehicle to vehicle communication.

B. Study of related work

1) *Traffic algorithm using fuzzy logic*- The paper describes the use of fuzzy logic in understanding the density of traffic fic.

- Fuzzy logic is basically the resemblance of computer reasoning with human reasoning skills
- The logic proposed in the paper collects the data for density of traffic at a particular location and deals with it through fuzzy logic.

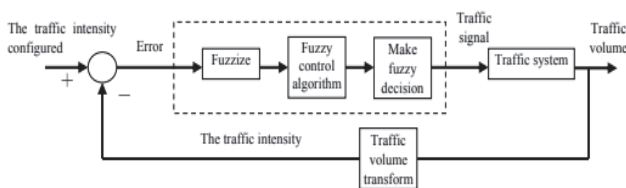


Fig. 1. Traffic system logic [8]

- After the collection of data at time if it is found that the density is increasing at the particular location then the fuzzy logic is invoked automatically to deal with the situation
- It also takes help of ANN (Artificial neural network) It is a logic which helps in understanding the relation between the data on its own to provide reasonable solution.

2) *Reservation based urban traffic system*- The paper proposed the idea of intersection managers and reservation system-

- The paper gives the idea of problem happening at the intersections. There should be an intersection manager at every location which communicates with other intersection as well.
- Every person approaching an intersection should request for a reservation. Person can be denied reservation if congestion is more than normal.

- If a person reaches to an intersection without a prior reservation, there is a possibility to get reservation instantly if there is no congestion but if there is congestion and the person is not having a reservation then can be liable to pay some amount to get the reservation done.

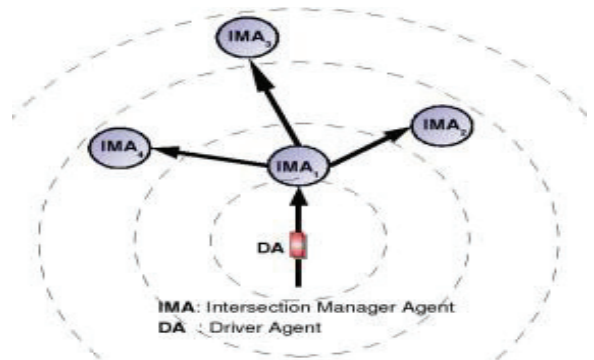


Fig. 2. Communication Range [12]

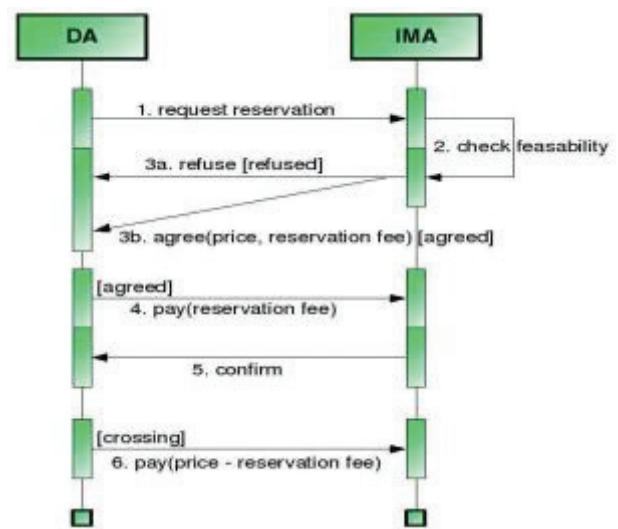


Fig. 3. Purchasing Protocol [12]

- If the person was denied reservation at a particular intersection so they can wait re-request it, after some time to get the reservation when the density reduces.

3) *Dynamic traffic analysis*- Dynamic traffic analysis idea is proposed in the paper, the scenario changes at every intersection and for every vehicle. Different model is proposed in the system for different scenario.

- The first model is derived for the driver's behavior model and react according to that
- The second model deals with the density of vehicle at a particular location and works according to that.
- Every model divides itself in two different core solutions
- The neural networks embedded in the system itself choose which path to choose according to the scenario.

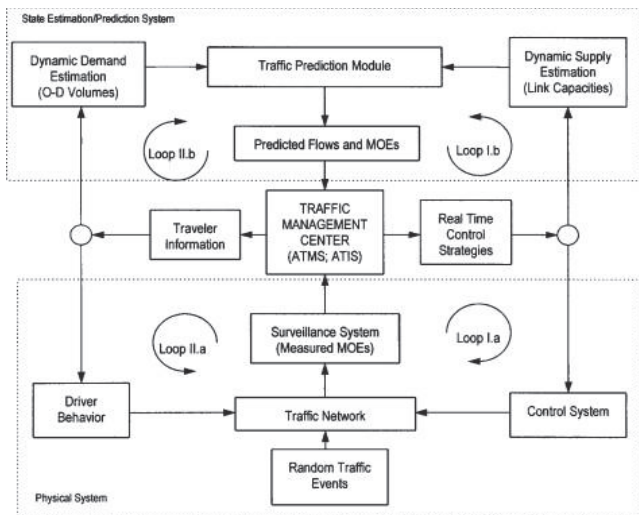


Fig. 4. Traffic system logic [3]

4) *Predictive control of traffic*- The paper [4] has proposed an MPC (Model predictive control) which will be used on the highway and focuses on the roadside control. The paper basically provides information on how MPC can be applied for speed control and lane allocation. It basically works with the lane requirements and speed allocation.

- The paper states that every car running on the highway can be allocated a certain speed for the particular time.
- The time span given and the lane given to vehicle is independent.

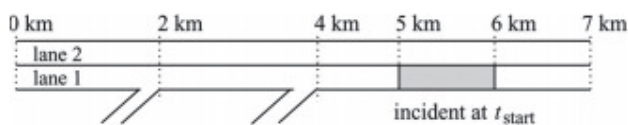


Fig. 5. Lane base time system [4]

5) Different lanes for different vehicles

There should be a special lane and a specific speed for every lane so if anyone tries to breach the limit should be punished by scanning their number plate and passing information to next check point.

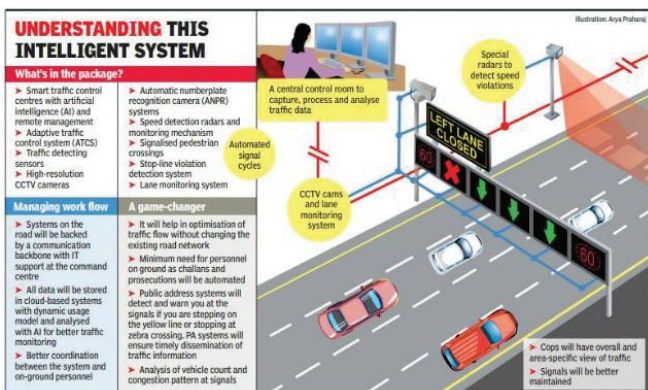


Fig. 6. Lane management system [13]

III. PROPOSED DESIGN

The full use of AI in traffic management can be revolutionary. It will increase the safety of the passengers,

and will prove better to ensure an efficient traffic management and its movement.

A. Variable signal timings

Signal timing should be variable and should vary according to the density and requirement of traffic at that particular time which is being analyzed. This can be done using real time analysis method using artificial intelligence

B. Driver behavior modelling

Sometimes using GPS and other navigation doesn't have to be the best solution. Driver must decide the best path while driving on the road. The proposed system helps in analyzing the behavior of driver while driving with the help of smart camera and sensor. If anything found suspicious the information is sent to the nearest patrolling vehicle.

C. Driving of unmanned vehicle or computer-controlled cars

The vehicle approached without having a proper driver which really happens because there is self-driving system in many of the cars. Many cars in India also comes with crude control in which sometimes it is found that the drivers are sleeping, so AI helps in recognition of these people and their number plates

F. Particular corridor for medical emergency

There should be a particular corridor specifically for medical emergency, so whenever any emergency occurs it can be activated from the control center by which the traffic can be slowly and steadily moved from that corridor and the corridor can be ready to function in few hours or in less time as per requirement. This will save lot of man power as well as life of many people who are in need.

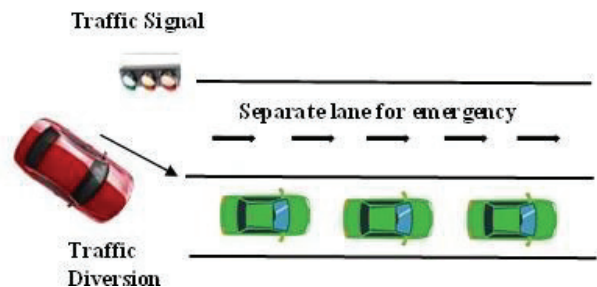


Fig. 7. Proposed architecture

D. System for maintenance

The system designed with the help of AI to recognize the AI is used here to process road surface snapshots and assigning them to different defect categories. Diagnostic sub-system also automatically detects by-pass roads or damaged roads.

IV. CONCLUSION

AI is paradigm that is being widely used to solve many human life problems. Traffic management is one such problem faced by developing countries that needs to be addressed with use of technology. This paper attempts to propose a proper solution for the problem of traffic management based on artificial intelligence. A systematic review based on the study of the previous research work related to the problem of traffic management and its solutions is presented. Further, a design is proposed with a solution driven by two parameters -

variable signal timings as per the requirements and special corridor for medical emergency. The design proposed is to implement effective lane management for ambulance free path with real time data using intelligent traffic signal switching. The path of ambulance is tracked real time and diversion takes place based on intelligent traffic signal management. The proposed design can be used to implement a system that can be of interest to the first world countries who are investing on the management of traffic in years to come. AI will take over the major work done by the human being. The goal of the project is to do this by solving complex problems of the real world in this way of having permanent and serious consequences in everyday life. The problem is basically a multiagency problem that is the large number of vehicles in a state or country is more than sufficient to overwhelm even the most hi-tech computer.

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