A Review on: Automated Highway System

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Abstract: -
Automated highway system (AHS) is an intelligent transportation system, which removes human drivers from the operation of vehicles during driving. AHS includes control problems from the vehicle level to the highway network and its challenging opportunities for intelligent mechatronics. This technology requires extreme accuracy in vehicle location within the least times. AHS refers to a set of designed lanes on a limited-access roadway where specially equipped vehicles are operated under completely automatic control. It can help reduce fuel consumption and individual vehicle discharge. The AHS designed requires advanced sensors, actuators, and communication technologies. It managed transportation systems for traffic problems in big cities, congestions, accidents, delays. This technique can change the driving & safety scenario of India**.**

Keywords: - Mechatronics, Actuator, Congestions, Scenario.

I. INTRODUCTION

Automated highway system (AHS) concepts define a new relationship between vehicles and the highway infrastructure in which vehicles moving on lanes limited access roadway on which specially equipped vehicles are operated under completely automatic control.

Automated highway system uses technologies during which driver lose the full control on the vehicle for gaining the additional benefit of safety and efficiency. Routes are set manually by the driver and all trip decisions are made by the vehicles automatically and Operations like steering and braking control are done automatically to supply safer and more convenient travel to the driver. Automated highway system uses obstacle-detection and head-on collision technologies for the safe-flow of the vehicles on the highway. Other technologies are used to recognize the external infrastructure conditions and provide highway cooperation to coordinate with the vehicle movement.

An automated highway system reduces the clear distance between the cars and allows more cars to occupy a given stretch of road. An automated highway system aims to provide safe, orderly, and efficient movement of persons, goods, and to protect collisions where possible which enhances the quality of the local environment and to the adjacent roads. With the increase in traffic problems in big cities such as congestions, accidents, delays, fuel consumption, etc., there arouses a need for a properly managed transportation system. Because traditional transport system is unable to face the increased demand of vehicles due to urbanization with a growth rate of 15-17% annually with thousands of new vehicles are running on the road every day.

An automated highway system provides us a correct well-mannered managed transpo-rtation system that enables us to cope with the above-defined problems. This is done using a sensor that serves as the vehicle eyes lane position and the speed and location of their vehicles. Automated highway system vehicles often also have the equipment to communicate with other vehicles.

II. LITERATURE REVIEW

Praveen Kumar (2005): - Has found an implementation of GIS in combination with other advanced communication computer techno- Logies to traveler information systems enables the conspicuous dissemination of information about fixed-route facilities, such as offices, educational institutions, health facilities, places of tourist interest, etc.

Baublys (2002) Has found transport management and substantiated national transport system development may reveal numerous qualitatively new ideas, which would essentially enable the enhancement of transport efficiency and realization of big, still unused, its economic and technological progress reserves.

Chien, Y. Zhang, and A. Stotsky (1993) have defined a model based on the behavior of human drivers. While it is possible to design control laws for automated vehicles so that they behave like those driven by people, this is not the only approach. No multiple lanes or lane change commands are considered in this work.

Jose E. Florez (1990) combines Linear Programming (LP) with automated planning techniques to obtain good quality solutions and introduced TIMIPLAN that successfully solves big multi-modal transportation tasks. Multimodal transportation usually involves the combination of many resources, together with temporal constraints, resource consumption, cost functions, etc.

Agostino Nuzzoloa (2014) Describe some theoretical and operative aspects of the Advanced Traveller Advisory Tool (ATAT). It can give personalized information to the user by real-time data. It is based on a path choice modeling framework able to provide path alternatives based on personal travel preferences defined according to a learning process.

J.K. Hedrick (1994) has focused on interactions between the various layers of the system architecture, as well as control problems associated with entry/exit, merging, and lane change maneuvers. In addition, continued investigations of alternative sensors and vehicle actuators are being conducted.

Khattak, H. Al-Deek, & P. Thananjeyan (1998) Develop a simulation comparing user choices when different market segments are given different sources of information (ATIS with full compliance, radio reports, and observation).

Maurizio Bruglier (2015) has designed a real-time mobility information system for the management of unexpected events, delays, and service disruptions concerning public transportation in the city. Representation of the city transit based on a time-expanded graph that considers the interconnections among all the stops of the rides offered during the day.

Qu and Chen (2008) Describe the multi-modal transport problem as a Multicriteria Decision Making Process (MCDM). They propose a hybrid MCDM by combining a Feed-forward Artificial Neuronal Network (ANN) with a Fuzzy Analytic Hierarchy Process (FAHP).

III. METHODOLOGY

The AHS will consist of at least two major subsystems: vehicles and infrastructure. The vehicle subsystem will contain the portion of the system that moves along an AHS. The vehicle subsystem includes sensors, data processing, actuator, linkage, and communications equipment. The AHS will automate the following driver functions to control vehicle movement.

AHS Entry: The system will enter vehicles onto the automated highway with simultaneous speed adjustment between several vehicles to successfully merge vehicles.

AHS Exit: The system will move vehicles from the AHS lane and will return control of the vehicle to the driver after ensuring that the driver is prepared to safely operate the vehicle.

Object Detection and Collision Avoidance: The system will detect moving and stationary objects on the automated lanes and will avoid collisions with these objects.

Longitudinal Vehicle Control: The system will adjust the vehicle speed, both to maintain a safe overall speed (as influenced by environmental conditions), and the appropriate longitudinal distance between vehicles.

Lateral Vehicle Control: The system will steer the vehicle by sensing the lane boundaries or lane centers of the automated lane and control vehicle steering to keep the vehicle in the lane, coordinating lane changes and entry/exit maneuvers.

Navigation: The system will track the vehicle's position on the highway network to ensure that the vehicle leaves the system at the driver's desired exit or guide the vehicle to another exit if the desired exit becomes unavailable.

The Five Layer Theory

The Physical Layer

It comprises all the onboard vehicle controllers of the physical components of a vehicle. These include the engine and transmission, brake and steering control systems, as well as the different lateral and longitudinal vehicle guidance and range sensors. The main function of the physical layer is to decouple the longitudinal and lateral vehicle guidance control and to approximately linearize the physical layer dynamics.

The Regulation Layer

It is responsible for the longitudinal and lateral guidance of the vehicle, and the execution of the maneuvers ordered by the coordination layer. The regulation layer must carry out two longitudinal control tasks. The first task is that of a vehicle follower in a platoon and consists of maintaining a prescribed constant spacing from the preceding vehicle. The second task is that of a platoon leader or free agent and consists of safely and efficiently executing a maneuver commanded by the coordination layer.

The Coordination Layer

It is responsible for selecting the activity that the vehicle should attempt or continue to execute, to realize its currently assigned activity plan. It communicates and coordinates its actions with its peers the coordination layers of neighboring vehicles and supervises and commands the regulation layer to execute or abort maneuvers.

Link-layer

There is one link layer controller for each 0.5 to 5 km-long segment of the highway, called a link. Its task is to control the traffic flow within the link to attain its full capacity and minimize vehicle travel time and undesirable transient phenomena, such as congestion.

Network layer

The task of the network layer is to control entering traffic and route traffic flow within the network of highway links that constitute the AHS, to optimize the capacity and average vehicle travel time of the AHS and minimize transient congestion in any of its highway links

FUTURE SCOPE

The reliable intelligent driver assistance systems and safety warning systems are still a long way to go. However, as computing power, sensing capabilities, and wireless connectivity for vehicles rapidly increase, the concept of assisted driving and proactive safety warning is speeding towards reality. As technology improves, a vehicle will become just a computer with tires. Driving on roads will be just like surfing the Web there will be traffic congestion but no injuries or fatalities. Advanced driver assistant systems and new sensing technologies can be highly beneficial, along with a large body of work on automated vehicles. These findings suggest that the research into autonomous vehicles within the ITS field is a short-term reality and a promising research area and these results constitute the starting point for future development

IV. CONCLUSION

Transportation systems are an indispensable part of human activities. Estimation shows that an average of 40% of the population spends at least one hour on the road each day. People have become much more dependent on transportation systems in recent years; transportation systems themselves face not only several opportunities but several challenges as well. The competitiveness of a country, its economic strength, and productivity heavily depend on the performance of its transportation system.

The automated highway is one of the most promising technologies to reduce traffic accidents and urban traffic congestion. New technology engineers and policymakers have some important decisions to make that will affect the future of transportation. The potential to save lives is what makes this technology so exciting, automated highways can also reduce accidents and reduce delays, congestion, high density in urban areas. Automated highway system allows more benefits in terms of safety, efficiency, affordability, and usability as compared to traditional transportation

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