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Study and Analysis of Automated Highway System

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ABSTRACT: A combination of market forces, cost constraints, and other factors necessitate incremental evolution of a fully automated highway system (AHS) rather than instantaneous deployment. Thus, an understanding of the interdependencies among required AHS functional capabilities is essential for planning. This paper proposes a set of three AHS functional evolution reference models that include essential as well as supplemental functions. The reference models include lateral motion handling, longitudinal motion handling, obstacle handling, and selected infrastructure support functions. This family of three models is used to present the needs of baseline autonomous tactical vehicle operation, the benefits of adding inter-vehicle communications, and the benefits of adding infrastructure support. The reference models reveal a critical need for vehicle motion prediction capability, and suggest that both communications and infrastructure support are beneficial but not mandatory for achieving an AHS. Furthermore, there appear to be a number of safety and efficiency benefits that can be realized with only partial automation and in some cases no automation. These results could help set priorities and guide strategies for incremental introduction of AHS technology into vehicles and roadways.

KEYWORDS: AHS functional evolution; incremental deployment.

I. INTRODUCTION

Automating the vehicle also presents difficulties: shifts in legal liability, issues of technical feasibility, and questions of political and social acceptance make the design of an AHS highly constrained, and often subject to heated debate. There is not yet consensus on exactly what policies and configurations will be used in the operation of a fully deployed AHS. However, it is clear that an automated system will require a number of common functions such as the ability to stay in a traffic lane and to avoid collisions. Furthermore, a number of cost, technical, social, and customer constraints make it seem likely that any deployment of AHS will need to be an incremental one, as opposed to a fielding of a completely automated system from the beginning (National Automated Highway System Consortium Stakeholder Workshop #3, Minneapolis Minnesota, September 18-20, 1996, unpublished). This paper addresses the technical evolution of the AHS by asking the following questions: what common functions are all automated vehicles required to have? and what are the evolutionary dependencies among these functions? The answers to these questions form a proposed family of three reference models for AHS evolutionary development.

In this context, the reference models illustrate a reasonably straightforward way to implement the incremental introduction of technology into the vehicle-highway system. It is not necessarily the only possible way, but rather a general representation that encompasses essential issues. These reference models may be useful for both planning and for providing common ground for detailed discussions about technological dependencies and Bayouth & Koopman 3 tradeoffs.

These models do not include control policies (e.g., whether vehicles follow each other at short distances in “platoons”), but rather focus on the common underlying technical functions (such as maintaining safe headway spacing among a group of vehicles).

II. PROBLEM STATEMENT

There are many different causes of road defects. Some of the causes on the Indian roads are.

1. POOR DESIGN AND CONSTRUCTION.

Failures like cracking in rigid pavement are caused by inadequate curing of concrete, settlement, movement or restraint



at joints may also lead to the development of cracks and subsequent failure. Most of the roads in the country are designed in the ministries or by consultants some of who are not within the environment of the road work. This leads to a situation where preliminary studies of the environment that will help the design and construction decisions are not done. This leads to poor understanding of the road environment which subsequently leads to poor road design and construction. Oguara (2010), then said that to save the road network from total collapse, requires good and efficient management which had to be done in a pragmatic and organized frame work.

2. HEAVY TRAFFIC

All road surfaces wear under the action of traffic, particularly during the very early life of the road. But within a short time the micro texture reaches an equilibrium level and thereafter the low speed skidding resistance remains reasonably constant. However, the action of traffic continues to wear the macro surface texture and thus gradually reduces the high speed skidding resistance. Oguara(2010) stated that with the increase of traffic loads both in terms of numbers and axle loads due to increased economic and developmental activities in the country, the road network was experiencing a systematic deterioration equivalent to an asset loss of about N80 billion due to road deterioration and vehicle operating cost of N53.8billion per annum. One of the defects caused by heavy traffic on the road is the deformation of the road way which is the change in a road surface from the intended profile. This results due to the application of overload that is beyond what the roadway is designed and constructed for.

3. POOR MAINTENANCE CULTURE.

Even if the roads are well built they need adequate maintenance for sustainability. One of the main problems of highway development in India is maintenance. The roads are rarely maintained and whenever maintenance is attempted it is done haphazardly.

4. POOR HIGHWAY FACILITIES.

Highway facilities like drainages when not in use or lacking in performance result in some of the environmental related defects like roadway deformations and pot holes. As at 2011, virtually all roads in the country have become hubs of intractable snarl-ups and ghastly motor accidents, as unsuspecting motorists speed into deadly craters and monstrous potholes (Igomu 2011).

Every part of India's main roads is not spared the onslaught of deadly potholes that have inflicted both physical and emotional torture on motorists. The situation degenerates by the day aided by the rains and failed drainages filled with silts.

5. POOR LABORATORY AND INSITU TESTS ON SOIL

There is the need for the adequate test of the soil and the materials used for road construction. Unfortunately this is not always done. This is due to lack adequate laboratory facilities and trained laboratory manpower for the job. Since most of the construction companies in the country could not afford adequate laboratory facilities they should make use of the laboratories in the universities and polytechnics that have better facilities in the country for the test of their construction materials. Even the road research institute in Ogun state can help if the facilities are adequate.

III. OBJECTIVES

Automated highway system's ambitious goals can be achieved by: Developing advanced concepts for advanced road vehicles for passengers and goods.

Most of the earlier projects addressed isolated aspects of the mobility problems of cities, whereas automated highway system focuses on the overall urban transportation problem.

Introducing new tools for managing urban transport. automated highway system will develop tools that can help cities to cross the thresholds that are preventing them from introducing innovative systems. For instance, the absence of certification procedures and the lack of suitable business models will be addressed. Taking away barriers that are in the way of large-scale introduction of automated systems. Some of these barriers are of a technological nature, some are of a legal or administrative nature: for example, the legal requirement for vehicles using public roads where the driver is responsible for the vehicle at all times, which effectively prohibits driverless vehicles from using public roads. Validating and demonstrating the concepts, methods and tools developed in automated highway system in European cities. In a number of other cities, studies will be carried out to show that an automated transport system is not only feasible, but will also contribute to a sustainable solution for the city's mobility problems, now and in the future.



To survey and document automated highway system with pedestrian safety systems on roads. These systems include crossing control arms, video cameras, radar and acoustic detection systems, skirts, and collision avoidance systems.

1.3 SCOPE :-

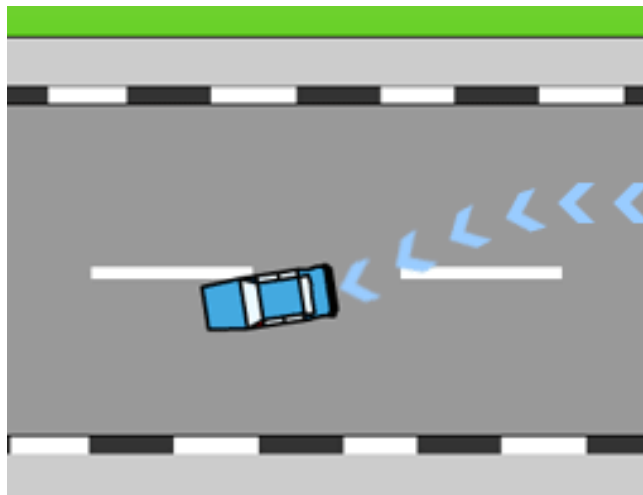
The reliable intelligent driver assistance systems and safety warning systems is still a long way to go. However, as computing power, sensing capacity, and wireless connectivity for vehicles rapidly increase, the concept of assisted driving and proactive safety warning is speeding towards reality. As 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 largebody 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 developments. Some of the 169 suggestions towards extension and/or future related works are identified and are summarized below: New sensory systems and sensory fusion is to be explored to plug additional information to the control system. This work can be extended to include different maneuvers to make the driving system capable of dealing with all driving environments. Future issues may also include an algorithm for autonomous formation of the cooperative driving. Thus, with the current and growing awareness of the importance of security, trustworthy vehicle autonomous systems can be deployed in few years.

V.METHODOLOGY

1.LANE CHANGING MECHANISM

You might need to change lanes on roads with more than one lane in the same direction. You may want to change lanes to overtake another vehicle, to avoid a parked vehicle or when the vehicle ahead slows to turn at an intersection.

Always give proper signal before changing lanes and ensure the move can be made safely.



Steps for changing lanes-

1. Check for a space in traffic where you can enter safely.
2. Check your blind spot by looking over your shoulder in the direction of the lane change. Give an indicator in the direction you want to move.
3. Recheck to ensure the way is clear and that no one is coming at a fast speed from behind.

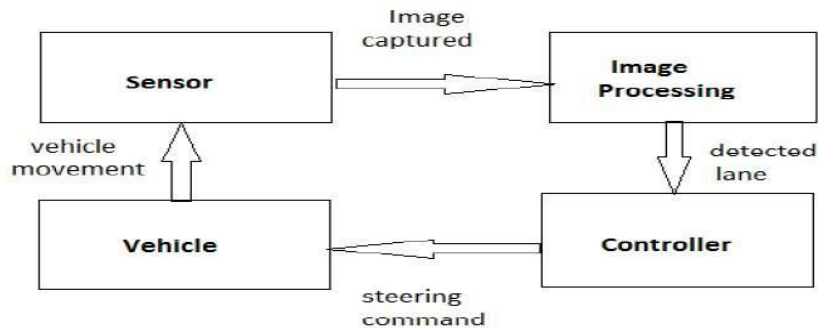


Fig.1. The four subsystems of a vision-based autonomous vehicle driving control system

1. Sensor

The sensor is the key element of an autonomous vehicle system, because it provides the information about a driving scenario. The system discussed here uses a single video camera as a sensor. To get the input data from the image, the video image sequences must be captured.

The input data of this system is provided by colour image sequences taken from a moving vehicle. A single colour video camera is mounted inside the vehicle behind the wind shield along the central line.

This records the images of the environment in front of the vehicle, including the road, the vehicles on the road, traffic signs on the roadside and, sometimes, incidents on the road. The video camera saves the video images in AVI file format, then the video file is transferred to the computer.

1. Image Processing and Analysis for Predicting and Detecting the vehicle lane

The goal of the image processing is to extract information about the position of the vehicle with respect to the road from the video image. Two major processes are implemented: the preprocessing process and then the lane detection process. The goal of pre-processing is to remove image noise and make the images sharper. The goal of lane detection is to detect the desired lane of the vehicle in order to obtain the look-ahead distance and the lane angle. This process is based on the real-time data of video sequences taken from a vehicle driving on the road. The four processing steps of the lane detection algorithm are image segmentation, edge detection, Hough Transform, and lane tracking.

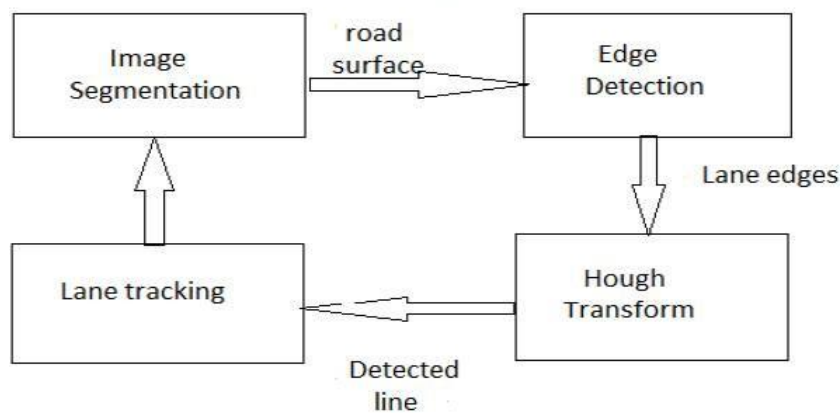


Fig. 2. Image processing steps of the lane detection algorithm.

1. Regions of interest measurement and features extraction using Color Cue Segmentation

Segmentation of the images is crucial for the analysis of the driving environment. Parts of the traffic scenes can be recovered by extracting geometric features in order to infer and verify the existence of certain categories of objects.



Another relevant method of segmentation is based on region growing and clustering. The effectiveness of such a method crucially depends upon the capability of measuring similarity, such as in texture and pixel color information.

Cost Sheet-

1. Sensor (video-camera)- Rs 15000
2. Image processing Module- Rs 18000
3. Controller(Raspberry Pi 3) – Rs 3500 Total- 36500

Benefit-

1. Safe Driving
2. Avoid Accident

OVERTAKING

- 1) Overtaking is changing lanes to move past a slower vehicle.
- 2) Never overtake other vehicle unless you are absolutely sure you can do so without danger to yourself or others.
- 3) Points to consider while overtaking a vehicle

V.CONCLUSION

Automated highway are one of the most promising technologies to reduce traffic accident and urban traffic congestion. New technology engineer and policy maker have some important decision to make that will effect the future of transportation. The potential to save lives is what makes this technology so exciting automated highway can also eliminate all accidents and also reduce delays, congestion, high density in urban areas. Automated highway system allows more benefits in terms of saafety, efficiency, affordability, and usability as compared to traditional transportation system in any city. Automated Highway Systems brings major transportation benefits in terms of safety, efficiency, affordability and usability, and environment in order to achieve its development goals. A key feature of the control design architecture is the separation of the various control functions into distinct layers with well-defined interfaces. Each layer is then designed with its own model that is suited to the functions for which it is responsible. The models at the various layers are different not only in terms of their formal structure (ranging from differential equations to state machines to static graphs), but also in the entities that have a role in them. The AHS is a complex large-scale control system, whose design required advances in sensor, actuator, and communication technologies (not discussed here) and in techniques of control system synthesis and analysis. It is a measure of the advanced state of the art that these techniques have reached a stage that they could be successfully used in the AHS project.

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