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AUTOMATED HIGHWAY SYSTEM

[1]Barsha Nayak, [2]Anjana Rout, [3]Asit Mohapatra, [4]Anil Manohar Panda, [5]Swadhin Sahoo
[6]Saruk Mallick
B-Tech Civil Engineering Students-Raajdhani Engineering College, BBSR (1, 2, 3, 4,5)
Assistant Professor Dept. of Civil Engineering-Raajdhani Engineering College, BBSR (6)

ABSTRACT
The Automated Highway System (AHS) concept defines a new relationship between vehicles and the highway infrastructure. AHS refers to a set of designated lanes on a limited access roadway where specially equipped vehicles are operated under completely automatic control. AHS uses vehicle and highway control technologies that shift driving functions from the driver/operator to the vehicle Throttle, steering, and braking are automatically controlled to provide safer and more convenient travel. AHS also uses communication, sensor and obstacle-detection technologies to recognize and react to external infrastructure conditions. The vehicles and highway cooperate to coordinate vehicle movement, avoid obstacles and improve traffic flow, improving safety and reducing congestion. In sum, the AHS concept combines on-board vehicle intelligence with a range of intelligent technologies installed onto existing highway infrastructure and communication technologies that connect vehicles to highway infrastructure

Introduction
The idea of automated driving dates back to almost50 years ago when General Motors(GM) presented a vision of ―driverless‖ vehicles under automated control at the 1939 World fairs in New York. In the 1950's research by industrial organizations conceptualized automated vehicles controlled by mechanical systems and radio controls. After the first appearance of the computers in the 1960's, researchers began to consider the potential use of computers to provide lateral and longitudinal control and traffic management. The fully automated highway concept was initially examined by GM with sponsorship from the US department of Transportation (DOT) in the late1970's. During these times, focus was laid on automated vehicles on a highway as computers were not powerful enough to consider a complete fully automated highway system.

Today's Vehicle-Highway System Faces Growing Problems
Today 's vehicle-highway system-with its 4 million miles of streets, roads, and highways and its 190 million vehicles-functions surprisingly well However, it is not keeping pace with society 's increasing transportation needs. The total vehicle miles traveled (VMT) in the Nation is predicted to nearly double by the year2020,and ourpopulation will behalf again as large by the middleofthe21stcentury].
The vehicle-highway system, then, must continue to be improved for the foreseeable future. The system must be able to address a number of problem areas; many of today's transportation problems will continue to grow with the increasing demand unless steps are taken to resolve them:
Safety - although traffic fatalities continue to decrease, there are still approximately 40,000 lives lost annuallyon the Nation's roads and highways, and there are over
Ar Quality-as population mounts, traffic volume and congestion will worsen, and clean air requirements willbecome more stringent.
Trip Quality - trip quality for many United States drivers and passengers continues to erode. The reasons for this erosion include safety concerns, driver frustration and discomfort as congestion increases, and lack of predictable trip times.
The AHS represents a natural evolution of these ITS vehicle communications and control technology investments. The AHS program addresses the causal factors of today's crashes such as driver reaction times, visual abilities, inattentiveness, and fatigue. These are major contributors to collisions and congestion on ourNation's highways, accounting for about 90 percent of today's crashes [Indiana Tri-Level Study]; and they limit lane flow rates to today's levels.

Vehicle/ Highway Automation Will Address These Problems

A significant body of research strongly suggests that the application of modem technologies to automated vehicle control on our highways will dramatically impact our Nation 's vehicle- highway transportation system by improving the safety and efficiency of highway travel for a broad spectrum of vehicle types, including passenger vehicles, heavy trucks, and transit vehicles. Projections of double or triple the safety and efficiency of today's highways have been made [Calspan]. This impact would be comparable to that of the jet engine on aviation 40 years ago, or that of the word processor on the office 15 years ago. In sheer economic terms, if the AHS even approaches these kinds of benefits, this program will represent one of the most productive Federal investments ever made.

2.3.3 Fuel Consumption and Emissions Can Be Reduced

The AHS, when coupled with policies that are aimed at limiting growth of VMT, will help meet the Nation's long-term air quality goals. The AHS will be used by environmental and transportation professionals to (1) reduce emissions per VMT,and(2)enhancetheoperationofotherpollution-reducingtransportationapproaches.

Specific goals include the following Ensure reduced fuel consumption and tailpipe emissions per VMT for internal combustion engines through smoother vehicle operation (fewer accelerations and decelerations), reducedcongestion.

The Automated Highway System Will Provide Major Benefits to All Stake holders2.4.1Users

The AHS will make travel more desirable to users than travel on today's highways. It will do so by providingthe benefits of safety and trip quality that were previously describe.

Automated Highway System Program Overview

3.1 Program Strategy

The US DOT strategy is to use a public/private partnership between the US DOT and a consortium of the key AHS stakeholders to select the AHS concept and approach for operational testing and eventual national deployment in the United States. The intensity to build upon AHS research to date, and to make maximum use of state-of-the-art technologies in information systems, communications and sensors developed for the defense/aerospace industry or others. This Nation is riding the crest of an information technology wave that is revolutionizing virtually every aspect of American life, including how we work, entertain, and travel. The AHSis a recent, but very important addition to this information technology revolution. It will use this technology to solve some of the Nation's major highway transportation problems. As part of ITS, AHS will be compatible with, and operate within the National ITS Architecture being developed under US DOT's National ITS Architecture programme

AUTOMATEDHIGHWAYSYSTEMS

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Figure 2.1 –AconceptdrawingofanAutomatedHighwaySystemwithdedicatedlanesinthe centre of the highway.

4 CONTROL DESIGN OF AN AUTOMATED HIGHWAY SYSTEM

The Control design of an Automated Highway system can be looked upon the basis of a 5 layer theory whichtogether comprise the two systems viz.

The On-board Vehicle System and the Roadside System .The control designs explained with the aid of the figure4.1:

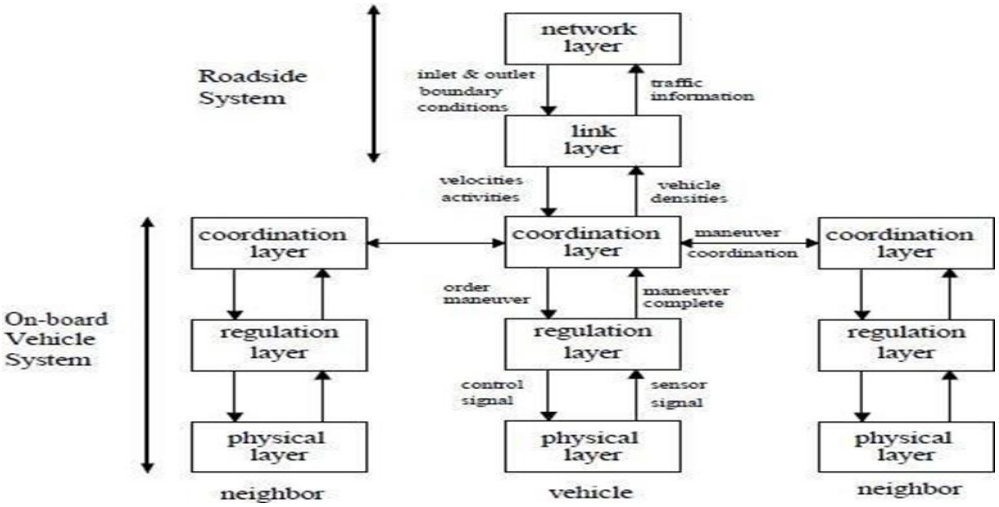

Figure4.1–The Control Design of an Automated Highway System

POTENTIALBENEFITS

Researchers have attempted to estimate benefits that might accrue from the implementation of automated highway systems. Table 2 summarizes potential benefits. Many of the benefits shown in

the table are fairly speculative; the systems they would depend upon are not yet in existence and there is no clear evidence that thesystem can produce the following benefits in reality

SOCIAL AND INSTITUTIONAL CHALLENGES FOR AUTOMATED HIGHWAY SYSTEMS

The introduction of new technologies often creates social tensions .For instance, although talking on the phonewhile walking. Or driving is common place now a days, there are concerns about it is safety, and debates continue over whether it is rude to use a cell phone in public places such as restaurants or on a bus. Similarly, mature technologies experienced
social challenges when they were introduced. The first automobiles were seen as rich people's toys, and former President Woodrow Wilson, then head of Princeton College, warned students about showing off their vehicles before the townsfolk, who he presumed would never have cars.

VEHICLEPLATOONING

Theeight-vehicleplatoondemonstrationattheNationalAutomatedHighway Systems Consortium Technical Feasibility Demonstration, held in San Diego from August 7-10, 1997, shown in figure 7.1, successfully demonstrated the technical feasibility of operating standard automobiles – Buick Le Sabres– under precise automatic control at close spacings, at highway speeds. Riders experienced real travel in a fully automated AHS vehicle, and were shown that comfortable, high

CONCLUSION

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 thefunctions 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 entitiesthat 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
Though it has been said so, the reasons why many federal programs like the National Automated Highway System Research Program (NAHSRP) failed was that the program was trapped in technology- optimism. Several U.S. DOT reports on AHS show that there are no technical and non-technical showstoppers. However, legal, institutional, and societal challenges just as critical as technical issues. Moreover, these institutional and societal issues cannot be settled in one day, because they are much to do with people's perception, behavior, consensus and social changes based on those

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