

EMBEDDED SYSTEMS AND AUTONOMOUS CAR

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Abstract: The technical Brilliance and Developments in different fields have led to a drastic change especially in the communication field.. There are many paradigm shifts taking place due to information explosion and the concept of autonomous vehicle is one shift. Devices with intelligence rule the world. Imbibing intelligence to these devices is through a system called Embedded System. Embedded Systems are used in many ways. In business, to track inventories with bar codes and scanners, check the credit status of customers, and transfer funds electronically. In homes, tiny embedded systems in the electronic circuitry of most appliances control the indoor temperature, operate home security systems, tell the time, and turn TV, Players on and off. In automobiles to regulate the flow of fuel, thereby increasing gas mileage, and are used in anti-theft systems.

The car, which is embedded, can simulate the human driver completely and direct the vehicle on the road. Autonomous vehicle is the drastic change in technical brilliance and developments in different fields with Embedded System as pioneer.

Keywords: Embedded System, Simulator.

I. INTRODUCTION

The term embedded system is quite a complex one. It is the evolution or further development of the computing system. Its applications provide marvelous opportunities for ingenious use of computer technology. Almost every new system introduced is an example of Embedded System. These systems are more intelligent and autonomous.

Embedded Systems are combinations of hardware and software that are mounted on compact electronic circuit boards integrated into devices. They are engineered or intended to perform one specific function in a specific environment. An important decision in the design of an embedded system is the selection of the processor(s) around which the rest of the system is to be built. It is a chip that contains a microprocessor, some memory & I/O interface circuitry useful in embedded applications and is often called an 'EMBEDDED PROCESSOR' or 'MICRO CONTROLLER' chips as they perform important control functions, and are based on micro controller.

Simply it is a combination of hardware and software that forms the component of a larger system, this in turn is programmed to perform a range of dedicated functions usually with a minimal operator intervention. In embedded systems the hardware is normally unique to a given application, computer chips are embedded into the control electronics to manage the products functionality.

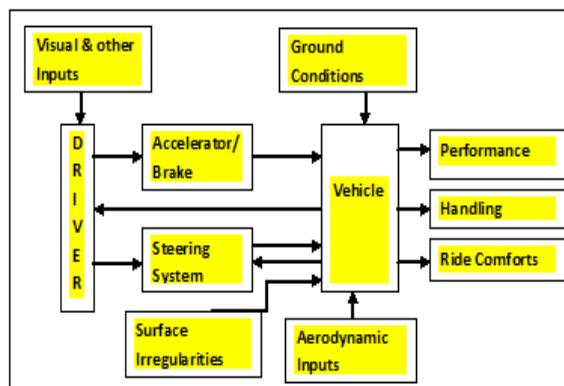
II. THE FINE ART OF AUTOMATION

We load the code of our destination in the dashboard computer and turn the car on, while we remain seated carefree on the rear seats. Then its all the job of the 'unknown' to drive it on the roads, bridges, thought the bazaars, past the crossings to the

destination, without getting challenged even once for traffic rule violations.

A fully computerized car capable of doing almost everything a car lover would want to. Almost all automobiles will interact with computer on dashboards. From ordering pizza to booking tickets at the nearest theatre, things would be as easy as giving orders to your servant. As a matter of fact, vehicles all over the world are now fitted with intelligent devices that make the vehicles to respond to various factors –be it climate control, sudden accelerations or braking or even self-repair of modules.

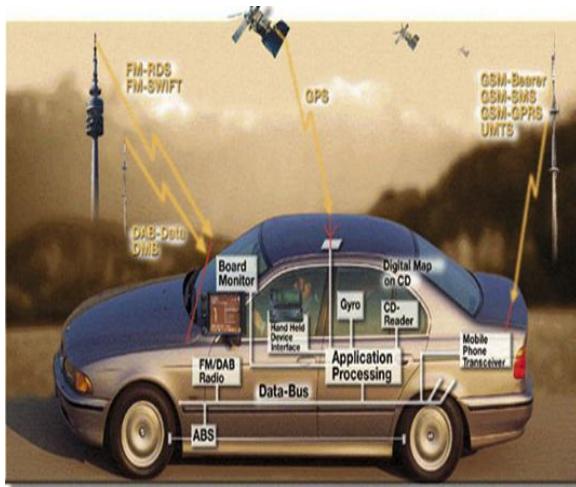
The finger print technologies have been introduced to enter and start your car with the touch of a finger. The fingerprint, which is acting as a key, would trigger a check of the mirrors, steering wheel, radio and temperature to ensure that they're the way you like them. The convenience of fingerprint recognition technology comes with heightened security. Unlike personal identification numbers, passwords and keys, each person's unique fingerprints can't be duplicated, lost or forgotten.



III. DESCRIPTION

As stated above that a vehicle can run by itself with out the intervention of human beings by the embedded intelligence in it. For this purpose Global Positioning System (GPS) using satellites can provide positioning information and proves to be a versatile all-time. For still higher accuracy wide area differential GPS is used, which offers a robust system that readily deals with selective availability errors and satellite clock errors.

The models for GPS also include aiding sensors, e.g. dead reckoning, radar and camera. A computer is simply required to feed destination into a dashboard computer. Highly sensitive actuators simulate a human driver completely and direct the vehicle on the road. The vehicle transmitter broadcasts its position and velocity to other immediate participants for collision-avoidance and lane changing manoeuvres. Forward and reverse motions and u-turns are precisely achieved as per route guidance requirements. Furthermore, an accurate steering control is obtained using Pulse Code Modulation technique and acceleration/braking control is successfully implemented using learning adaptive system.



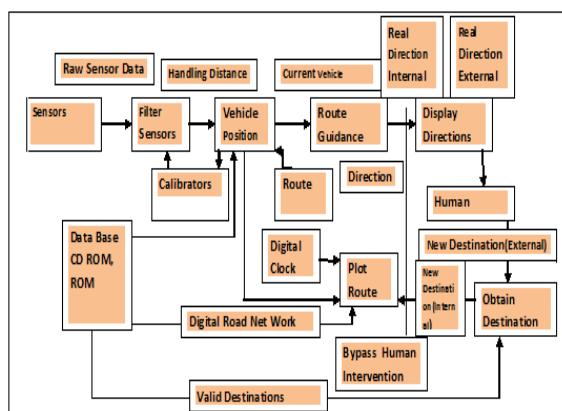
The reliability, efficiency and cost effectiveness of an autonomous vehicle depend mainly on how judiciously its navigation sensors, perception unit and computer control is incorporated.

The driver's activity is influenced by several factors that depend on driver itself and environment such as traffic density, traffic status, time of travel and weather. Thus the driving activity deals with a combined driver vehicle-environment system shown in figure. The vehicle is required to blend its environmental perception capabilities with its intelligent controls in order to affect optimal path-planning strategies that not only avoid obstacles but also minimize criteria such as time of travel, fuel consumption, exposure to pollution/danger, etc. however basic driving functions consists of lane-

keeping, safe distance maintenance, timely lane changing and overtaking. The key to all these driving tasks is collision avoidance.

The Master Control Station (MCS) receives the positioning information from the satellite by employing (WADGPS) concept. The MCS is linked to GPS instrumented position location systems (PLS) installed on the autonomous vehicles through a data link sub system (DLS). The DLS can either use VHF or UHF or L-band, incorporating time division multiple access protocol to handle on the roads. A block forward error correction code is employed to protect and maintain the message integrity.

The desired destination and starting position of the vehicle together with the time of travel, manifest an optimal route on the road network. Once the vehicle commences the journey the sensors continuously keep track of the direction and displacement of the vehicle initial calibration is a little crucial for dead reckoning performance; however a feedback calibration indicated in fig suggested obtaining distance accuracy better than 99.9 percent.



The new generation microprocessors promises further increase in system capabilities while simultaneously shrinking both volume and power consumption of the autonomous vehicle embedded system. The digital road maps, available on CD-ROM's have substantially increased safety of automobiles. These maps along with GPS navigation provide a feasible solution to autonomous vehicle system. The expert system technologies are integrated with digital maps along with the (CCD) camera images, magnetic compass, and the GPS system, for obtaining a real time intelligent decision support navigation package. The integration of GPS and communication suggests an efficient transportation system for increasing the road traffic safety smooth driving without traffic jams and a comfortable driving environment. Furthermore the autonomous vehicle relies on such intelligent system integration that leads to complete collision free in time of real time situation. The internal platform and rate gyro and accelerometer package keeps the vehicles central processing unit (CPU) well informed about the incremental changes in the

vehicles parameters. The wheel odometers provide the vehicle traveling distances by multiplying the number of electronically generated pulses by a constant, depending upon wheels perimeter. The figure in the last gives an indication of all the technologies used in a car.

IV. ADVANTAGES AND COMFORTS

1. The adoptive cruise control (ACC) technology used in the cars from automobile makers keeps advancing to new levels of safety. In microwave radar unit there is a laser transceiver, fixed on the front of the car to determine the distance and relative speed of any vehicle in its path, which keeps safe distances from other vehicles on the busy roads. The driver can set the speed of his car and the distance between his and other cars. When traffic slows down vehicle speed is altered using moderate braking to maintain a constant distance between his and other cars.

2. In advanced systems just in the case the driver over speeds or suddenly falls over and guides the car to a safe halt. And if you have programmed it right, the GPS in the car would take you to your destination so, right from brakes to automatic traction control to air bags and fuel-air mixture control, the intelligence takes over

3. A few advanced car prototypes with embedded systems have been tried and tested where even if a smart thief has managed to break in through the car, the car doesn't start up even if it does the computer of the car would lock the steering wheel and cutoff the fuel injection supply, in the mean time a signal is set to the nearest police station and the owner informing them about the thief.

4. Some designs now include so-called "pre-safe" systems, which sense possible collisions in advance based on emergency braking, skidding, and sudden evasive maneuvers. The idea is to "cradle" the car's occupants for maximum safety.

➤ Indian efforts in embedded system development:-

Our India too entered into the field of embedded systems and had great developments in this field, it got marvelous results in the field of "Telematics" which is a part of technology used in cars.

Total telematics experience is what they are looking for. Simply put telematics is the vehicles capability to communicate with the outside world and or the vehicle operator. It is a combination of telecommunication and computing

Mistral software, which was developed in India, has text-to-speech and speech recognition technologies to give the car occupants the ultimate comfort. So whenever there is a call on your mobile. You need not get jump at the very onset of the call. Relax the computer in the cars dashboard would do the job for you. GPS navigation guides you through

the traffic. The GPS interface in the car pinpoints your exact location on a map. In case the GPS signal cant be received due to high density of tall buildings or other magnetic interface, the 'dead reckoning' technique, which works for short durations guides you effectively. The system is also loaded with GSM/CDMA protocol standards further modified on the (CANBUS) standard to give uninterrupted information.

Another device called the array microphone cuts off the surrounding noise and allows the speaker to communicate effectively. The person at the other end hears the voice of the speaker without any outside interference.

CONCLUSION

With the heights of the technology autonomous car is no more a myth. It's a reality! We would like to present that there must be further developments in this technology to make autonomous car more common all over the world. This can be happened by making the autonomous easy to operate for the user and the designers should concentrate more in producing autonomous cars, which should not cost a lot, they should in the vicinity of customers' budget. With this type of vehicles there will be great advantages in the coming feature. Due to speed control technique, accident free driving is possible and fuel savage is also made possible by the technique, which will make the car to travel through shortest path. In the near future, autonomous car become more common all over the world. Indian efforts in the embedded technology can assure that these autonomous cars will become cheaper and may evolve with many more advantages. So that we could find ourselves using these autonomous cars in the near feature. Deep sub-micron processing technologies have enabled the implementation of new application-specific embedded architectures that integrate multiple software programmable processors (e.g. DSPs, microcontrollers) and dedicated hardware components together onto a single cost-efficient IC. These application-specific architectures are emerging as a key design solution to today's microelectronics design problems, which are being driven by emerging applications in the areas of wireless communication, broadband networking, and multimedia computing. However, the construction of these customized heterogeneous multiprocessor architectures, while ensuring that the hardware and software parts communicate correctly, is a tremendously difficult and highly error prone task with little or no tool support. In this paper, we present an insight about this embedded architecture co-synthesis problem based on an orchestrated combination of automobile architectural strategies, parameterized libraries, and software tool support.

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