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ADVANCE CAR AUTOMATION

C.H.Vaidya[1], J.Thomas[2], N.Chimurkar[3],Prof.Ankush Ukride[4].

1, 2, 3: SKN-SITS, Dept. of E&TC, Lonavala
4: Asst. Professor,SKN-SITS,Lonavala

ABSTRACT-Vehicular automation involves the use of mechatronics, artificial intelligence, and multi-agent system to assist a vehicle's operator. These features and the vehicles employing them may be labelled as intelligent or smart. After the invention of the integrated circuit, the sophistication of automation technology increased. Manufacturers and researchers subsequently added a variety of automated functions to automobiles and other vehicles. In road-transport terminology, a lane departure warning system is a mechanism designed to warn a driver when the vehicle begins to move out of its lane (unless a turn signal is on in that direction) on freeways and arterial roads. These systems are designed to minimize accidents by addressing the main causes of collisions: driver error, distractions and drowsiness.

Keywords-Vehicular automation , lane detection

I. INTRODUCTION

The main purpose of the project is to develop a prototype that can be installed into any vehicle. This prototype can be designed with minimum number of circuits. This can contribute to construct safer vehicles and enhancing road status in order to decrease the death rate. Lane marker detection is carried out for vehicle shifting on each lane. This approach is scalable to most freeway surveillance video. Also we are adding sensors to enhance the automation and the security.

The safety of driving cars could be significantly increased by using driver assistance systems which interpret traffic situations autonomously and support the driver. An important component of a driver assistance system is the evaluation of image sequences recorded with cameras mounted in a moving vehicle. Image sequences provide information about the vehicle’s environment which has to be analysed in order to really support the driver in actual traffic situations.

According to a survey done by W.H.O almost every 90 seconds, a person is injured in a drunken driving crash. Breath-based sensors is employed in vehicle. If the driver's blood alcohol is higher than 0.08 - which is the legal limit - the car will stay put.

A gas sensor is used for safely detecting any malfunction of a pressurized gas system in order to prevent accumulation of combustible gases so that damage or explosion due to such an accumulation of gases is prevented.

II. LITRATURE REVIEW

Experiments have been conducted on automating cars since at least the 1920s, promising trials took place in the 1950s and work has proceeded since then. The first self-sufficient and truly autonomous cars appeared in the 1980s, with Carnegie Mellon University's Navlab and ALV projects in 1984 and Mercedes-Benz and Bundeswehr University Munich's Eureka Prometheus Project[5] in 1987. Since then, numerous major companies and research organizations have developed working prototype autonomous vehicles including Mercedes-Benz, General Motors, Continental Automotive Systems, Autoliv Inc., In past progress toward safer cars, devices like seat belts were aimed at protecting you in a crash. Through the use of sensors, cameras and onboard computers, these crash prevention systems warn the driver of a potential accident, better prepare the car and occupants for a collision. Today, new safety technology is moving toward preventing an accident from happening at all.

This literature review covers recent international activities on development, testing, and deployment of vehicular automation. Advanced driver assistance systems, which either alert the driver in dangerous situations or take an active part in the driving, are gradually being inserted into vehicles. Such systems are expected to grow more and more complex towards full autonomy during the next decade. The main bottleneck in the development of such systems is the perception problem, which has two elements: road and lane perception, and obstacle (i.e.vehicles and pedestrian) detection. In this survey we consider the first. Road colour and texture, road boundaries and lane markings are the main perceptual cues for human driving. Various approaches for lane detection systems have been performed. Dickmanns and Mysliwetz performed a recursive 3-D road and relative vehicle’s motion behaviour. LeBlanc proposed a lane keeping assistance system, which warns the driver on unintended lane departures. In fact, he used an existing video based lane detection algorithm and compared different methods to detect lane departure, using several assumptions on driver behaviour in certain situations to distinguish between intended and unintended lane departures. Lane departures are successfully detected by this technique.

III. PROBLEM STATEMENT

Driving under the influence (DUI) renders the driver incapable of operating a motor vehicle safely.Several drowsy driving incidents have resulted in jail sentences for the driver. Multi-million dollar settlements have been awarded to families of crash victims as a result of lawsuits filed against individuals as well as businesses whose employees were involved in drowsy driving crashes. You mistakenly move into a lane without checking to see if a car is in the next lane or passing a car without checking for oncoming traffic, and next thing you know, one of the top causes of car accidents has taken place. All these factors make it all the more important for an automated system to help prevent the accidents due to driver-induced errors.

IV. Objectives

Some of the intended objectives of car automation are stated below :

- The system can help to save lives of thousands of people (both the drivers of the vehicles as well as pedestrians)
- Alcohol sensor can be used in the various vehicles for detecting whether the driver has consumed alcohol or not. Similarly, the eye blink sensor can be used to determine whether the driver is drowsy or not. This ensures the safety of the passengers in the car as well as those outside the car.
- This system can be used under various lane-markings and vehicles for lane boundary recognition and preceding vehicle detection.
- The image-processing rate of the system is more than 20 fps (frame per second), and it meets the requirements of real-time computing in an embedded system.

V. SYSTEM OVERVIEW

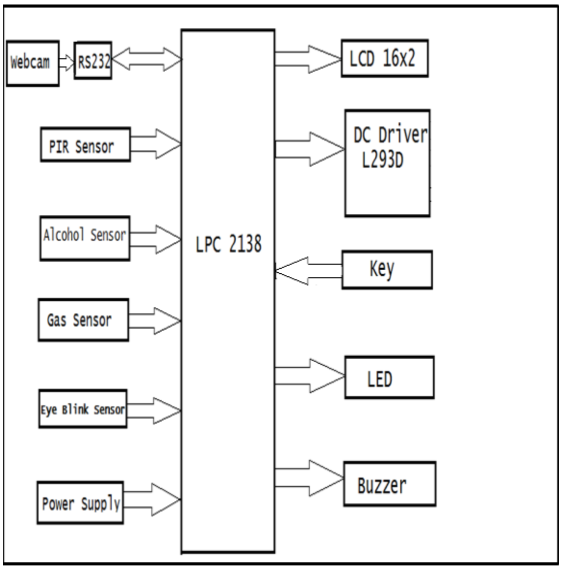

Fig. 1 Functional block diagram of the system.

LPC2138:

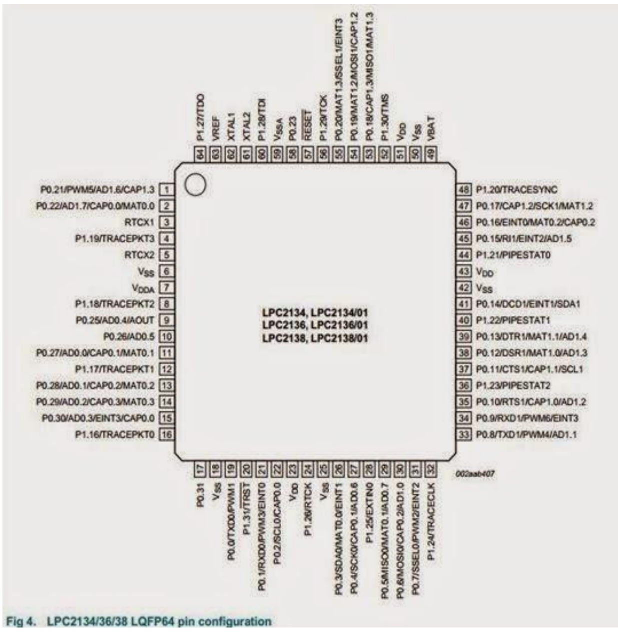

Fig. 2 LPC2138 Pin Configuration

Features of LPC2138 :

- NXP LPC2138 with 10 MHz Crystal Oscillator (With Boot loader Software)

- High Performance 32-bit ARM7TDMI-S™ CPU
- 512 KB Programmable Flash Memory provides minimum of 10,000 erase/write cycles and 10 years of data-retention.
- 32 KB Data Memory (SRAM)
- In-System/In-Application Programming (ISP/IAP) via on-chip boot-loader software.
- Single Flash sector or full chip erase in 400 ms and 256 bytes programming in 1 ms.
- EmbeddedICE and Embedded Trace interfaces offer real-time debugging with the on-chip RealMonitor™ software and high speed tracing of instruction execution.
- Two 8-channel 10-bit A/D with conversion times as low as 2.44 us per channel.
- Single 10-bit D/A converter provide variable analog output.
- Two 32-bit Timers/External event counters.
- Four Capture and four Compare channels.
- PWM unit with six output pins.
- Low power Real-time clock with independent power and dedicated 32 kHz clock input.
- Multiple serial interfaces including two UARTs, two Fast I2C (400 kbit/s), SPI™ and SSP with buffering and variable data length capabilities.
- Vectored interrupt controller with configurable priorities and vector addresses.
- Up to 47 of 5 V tolerant general purpose I/O pins.
- Up to nine edge or level sensitive external interrupt pins.
- 60 MHz maximum CPU clock available from programmable on-chip Phase-Locked Loop (PLL) with settling time of 100us.
- On-chip integrated oscillator operates with external crystal in range of 1 MHz to 30 MHz or with external oscillator from 1 MHz to 50 MHz.
- Power saving modes include Idle and Power-down.
- Individual enable/disable of peripheral functions.
- Processor wake-up from Power-down mode via external interrupt or Real-time Clock.
- Single power supply chip with Power-On Reset (POR) and Brown-Out Detection (BOD:
- CPU Operating Voltage range of 3.0 V to 3.6 V

PIR sensor :

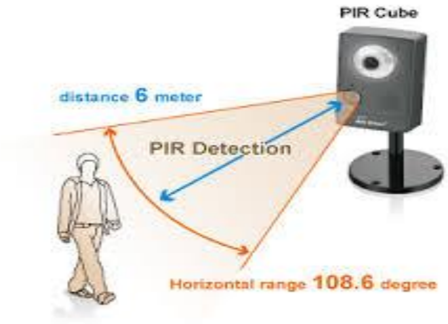

Fig. 3 PIR sensor

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For this reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors. PIRs are basically made of a pyroelectric sensor (which you can see above as the round metal can with a rectangular crystal in the centre), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.

Alcohol Sensor :

Fig. 4 Alcohol Sensor

This MQ-3 alcohol sensor detects the concentration of alcohol gas in the air. The concentration sensing range of 0.04 mg/L to 4. Sensitive material of MQ-3 gas sensor is SnO_2 (Tin dioxide). The sensor can operate at temperatures from -10 to 50°C.

Consumes less than 150 mA at 5 V.It's output is in the form of analog voltage. The sensor measures alcohol molecules in the driver's breath. Breath based alcohol sensors can be employed in vehicles. If the driver's blood alcohol is higher than 0.08, which is the legal limit, the car will stay put.

Gas Sensor:

Fig. 5 Gas Sensor

Gas sensor we are using is MQ-6. Sensitive material of MQ-6 gas sensor is SnO2. The conductivity of the gas sensor is lower in clean air. When the target combustible gas exists, the sensor's conductivity is higher along with the gas concentration rising.MQ-6 gas sensor has high sensitivity to Propane, Butane and LPG, also response to Natural gas. The sensor could be used to detect different combustible gas, especially Methane, it is with low cost and suitable for different application.The MQ-6 can detect gas concentrations anywhere from 300 to 10,000ppm. This sensor has a high sensitivity and fast response time. The sensor can operate at temperatures from -10 to 50°C. Consumes less than 150 mA at 5 V. Gas sensor is an analog sensor and gives the output into form of analog signal. This signal is feed to ADC which will convert it into digital form. Once converted into analog form, the microcontroller can process the digital gas signal as per the application.

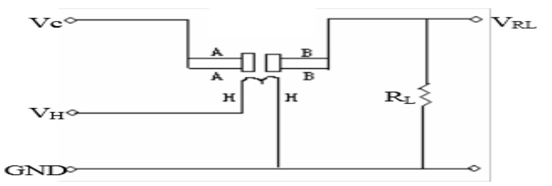

Fig. 6 Circuit Diagram of Gas Sensor

The figure 6 is basic test circuit of the sensor. The sensor need to be put 2 voltage, heater voltage (VH) and test voltage (VC).VH used to supply certified working temperature to the sensor, while VC used to detect voltage (VRL) on load resistance (RL)which is in series with sensor. The sensor has light polarity, Vc need DC power. VC and VH could use same power circuit with precondition to assure performance of sensor.

Camera :

Fig. 7 Camera

The camera is the key element of the 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, trafficsigns 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. The image processing subsystem takes an image from the memory and starts processing it in order to detect the desired lane.

Camera Calibration :The system detects lane markings using a monochromatic CCD camera mounted behind the windshield. Preferred position of the camera is behind the rear view mirror in order to get a clear view through the windshield. The first frame acquired by the camera is processed, and the two (left and right) lane boundaries are obtained automatically. Our coordinate system coincides with image coordinates, and a threshold "x" m separates the near and far vision fields. The choice for "x" m depends on the size of the acquired images and the tilt angle of the camera, and should result in a length of about10m for the near field (in a typical camera installation with resolution of 240 by 320pixels, it is possible to see about 7-10m m ahead with a reasonable definition).

Image Processing and Analysis for Predicting Lane :

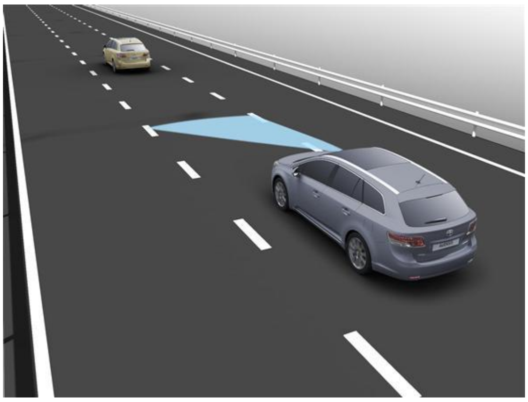

Fig. 8 Lane Detection

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 pre-processing process and then the lane detection process. The goal of lane detection is to detect the desired lane of the vehicle in order to obtain the look-ahead distance. This process is based on the real-time data of video sequences taken from a vehicle driving on the road.

Fig. 9 Input Image for Lane Detection   Fig.10 Processed Image for Lane Detection

The webcam which is used for lane detection, will continuously monitor the path of the car. The lane detection algorithm (LDA) is implemented using MATLAB to detect the driving lane boundaries (painted lane marks).

The lane detection algorithm using the following steps:

1. Detect lane markers in the current frame.
2. Match the current lane markers with those detected in the previous frame.
3. Find the left and right lane markers.
4. Issue a warning message if the vehicle moves across either of the lane markers.

VI. CONCLUSION

We are seeing a rapid shift from passive safety technology to active safety technology in modern cars. “Adaptive Cruise System” (ACS) will even bring the vehicle to a complete halt if the cars ahead stop, making them useful for creeping along in heavy traffic. By tapping into the vehicle's GPS system, “Intelligent Cruise Technology” can analyze the road ahead and adjust your set speed accordingly. For example, if the system sees a curvy section ahead, it may reduce your speed to compensate. Auto safety has evolved from seatbelts and airbags that cradle and cushion the body in an accident to telematics systems that provide automatic crash notification and send help right away. Carmakers can now offer safety technology that intervenes before a crash to help minimize occupant injury and damage to a vehicle — or even avoid an accident altogether. While this system is not a substitute for attentive and careful driving, they can make a substantial difference in the degree of injury to everyone and every vehicle involved in a car accident. They can also help you avoid a crash altogether, ushering in the next evolution in auto safety. A lane detection method has been developed which utilize the human visual properties of far-near adaptation. This approach for safe lane systems has developed a safety system for avoiding lane departures. This is coupled with the use of alcohol sensor, gas sensor for safe commutation. To perfect this technique, it might take several years, but this project is surely a step in the right direction. Prevention is better than cure. So instead of treating patients after an accident, accidents should be prevented by incorporating this system.

VII. ACKNOWLEDGMENT

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