Low Cost Smart Vehicle Design and Implementation

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Abstract : *Automation in car is trending and became next generation in smart cars. This automation gives rider a comfortable and ease of driving as well as travelling experience. This given paper describes the details of designing and implementation of the low cost vehicle automation. This automation in any vehicle provides a customized feature which can connect vehicle through android application. GSM and GPS modules with few advanced sensors the vehicle get high level connectivity between android application and user or driver. This system also insures the vehicle security to owner of the car and driver too. The main aim to design such physical system which make driving safe, easy and comfortable.*

IndexTerms GPS tracking system, GSM module, Sensors, android application

I. INTRODUCTION

In last few years, there are many on road accidents which occurs due restlessness of driver in crowded areas and on highways. To avoid such incident person who is driving must be relax and comfortable, also compatible with vehicle's features.

Improper driving and unfollowed traffic rules leads to affect human lives. Automation in vehicles overcome all difficulties and make driving efficient. This presented automated features in given vehicle minimises the efforts of driver and make driving comfortable and safe.

Fig -1: Google's autonomous car.

Various research and innovations are also going to overcome the driving related issues. Most famous vehicle manufacturing industries like Tesla and Nissan have already started working on automated and smart cars.

The concept of "smart driverless car" is innovated by 'Google', which is named as "Google's driverless car" which is also known as unmanned vehicle or autonomous cars. Highly automated cars are now in service in Europe, USA and many other foreign countries. Highly automated cars have fully customized features which also follows all the rules and regulation of driving safety measures and traffic.[1]

II. LITERATURE SURVEY

2.1 Smart vehicle automation [2]

In this paper different development and trends in automation of vehicle which can be collision controlled detection of vehicle. this paper explains the initiatives for automation in different level of Transportation system on vehicle level automation. it focuses on driver's comfort increase safety is the important factors while doing the automation.

2.2 Internet of Things (IoT) In The Smart Automotive Sector [3]

In this paper author has been explained and outlines all developments on IoT in Automotive sectors such as vehicle communication connected cars to the services as well as applications usages of IoT in intelligent transportation. Automotive supply chain management based on IoT is creatively described in given paper, this paper is also focus on the new and updating generation in the cars. Paper have described the connectivity of cars with other car through application and Smartphones, its focus is on the

vehicle and smartphone intelligent interaction, onboard Diagnostic of predictive maintenance, safety through real-time driver monitor are explained in detail.

2.3 "Global status report on road safety 2018" prepared by World health organization [4]

- According to this report about road accidents, following statistics are coming in to the pictures:
- Nearly 1.25 million people die in road crashes each year, on average 3,287 deaths a day.
- Nearly 1.25 million people die in road crashes each year, on average 3,287 deaths a day.
- An additional 20-50 million are injured or disabled.
- More than half of all road traffic deaths occur among young adults ages 15-44.
- Road traffic crashes rank as the 9th leading cause of death and account for 2.2% of all deaths globally.
- Road crashes are the leading cause of death among young people ages 15-29, and the second leading cause of death worldwide among young people ages 5-14.
- Each year nearly 400,000 people under 25 die on the world's roads, on average over 1,000 a day.
- Over 90% of all road fatalities occur in low and middle-income countries, which have less than half of the world's vehicles.
- Road crashes cost USD $518 billion globally, costing individual countries from 1-2% of their annual GDP.
- Road crashes cost low and middle-income countries USD $65 billion annually, exceeding the total amount received in developmental assistance.
- Unless action is taken, road traffic injuries are predicted to become the fifth leading cause of death by 2030.

2.4 The prospect of smart cars: intelligent structure and human machine interaction [4]

In this paper the current robotized Technologies and intelligent Technologies applied in electric vehicle have been discuss in detail. Here different methods are analyzed for vehicle structure design and Motion Control such as anti-slid four wheel steering method.

While explaining smart structure and Motion Control author introduced two systems are vehicle steering system which includes front wheel steering and four wheel steering systems. The control purpose is to decrease the lateral acceleration, rate of fluctuation amplitude and overshoot, so as to reduce the dynamic response time before entering the steady state and the lateral angle of vehicle body, it will provide high performance as well. A vehicle driven control and structure design is also discussed by author. Intelligent driving Strategies and human machine interaction technologies are also investigated by author.

III. SYSTEM IMPLEMENTATION

proposed system is implemented by using hardware as well as software components. Block diagram for the same is as given below:

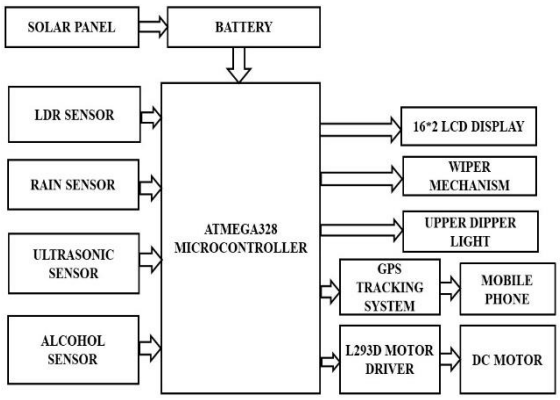

Fig -2: Functional block diagram.

Given system is powered by using rechargeable battery, which can be charged using solar panel connected to it. Microcontroller is the heart of the system which process the inputs from different sensors and gives signals to connected output devices.

Here we have used four input sensors which can sensed the inputs from the surroundings of the vehicle and give inputs to the microcontroller. Inputs from surroundings like intensity of the light fallen on the vehicle from other vehicle, object sensing from the surroundings, level of alcohol consumption by driver, object in front of the vehicle and raining from surrounding are collected by using different types of sensors.

Inputs from these sensors got processed by the microcontroller and according to the system programming it given to the desire output device like wiper mechanism, upper dipper light mechanism, or the dc motors. At the same time vehicle also inform the status on the LCD display and mobile phone.

IV. HARDWARE INTERFACE

4.1 ATMEGA 328 MICROCONTROLLER

Microcontroller is the heart of the system which processed the inputs from the sensors connected to it. After processing the given input signal, it provides input to the desired output mechanism. Here for implementation ATMEGA328 microcontroller is used.

This is 8-bit AVR RISC-based microcontroller combines 32 kB ISP flash memory with read-while-write capabilities and having 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines, 32 general purpose working registers. There are three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART present in it. A byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes are also integrated on same chip.

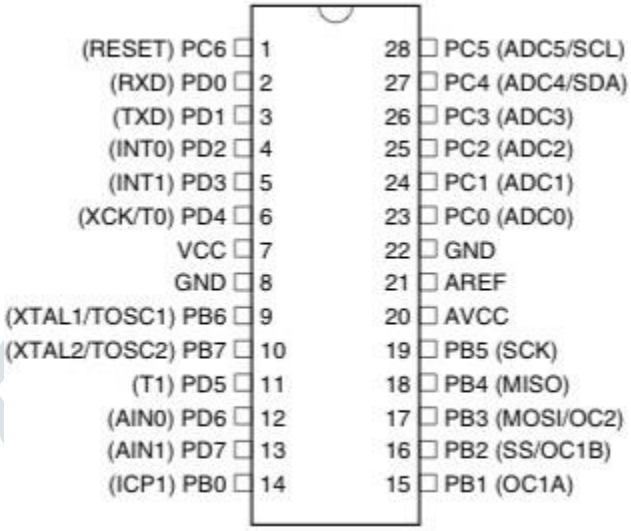

Fig -3: ATMEGA 328 pin diagram.

The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz.

4.2 LDR SENSOR

An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits.

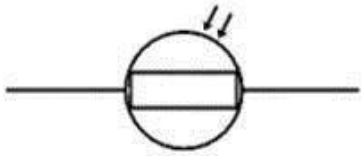

Fig -4: LDR Circuit Symbol

Fig -5: A typical LDR

The most common type of LDR has a resistance that falls with an increase in the light intensity falling upon the device (as shown in the image above). The resistance of an LDR may typically have the following resistances:

Daylight

= 5000Ω
Dark
= 20000000Ω

therefore, see that there is a large variation between these figures. If you plotted this variation on a graph you would get something similar to that shown by the graph shown below.

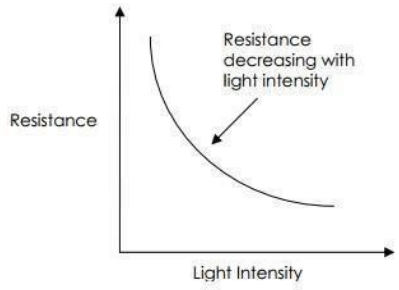

Chart-1: Typical LDR resistance vs light intensity graph

here in the implementation of given system we are using the properties of LDR to detect the light intensity of vehicle in front of the car, so that according to the processed input upper-dipper light mechanism will work.

4.3. MQ135 ALCOHOL SENSOR

An alcohol sensor is placed inside the vehicle which, detects the attentiveness of alcohol gas in the air and an analog voltage is an output reading. The sensor can activate at temperatures ranging from -10 to 50° C with a power supply is less than 150 Ma to 5V. The sensing range is from 0.04 mg/L to 4 mg/L, which is suitable for breathalyzers.

Fig -6: MQ135 Alcohol Sensor

The MQ series of gas sensors utilizes a small heater inside with an electro chemical sensor these sensors are sensitive to a range of gasses are used at room temperature. MQ135 alcohol sensor is a Sno2 with a lower conductivity of clean air. When the target explosive gas exists, then the sensor's conductivity increases more increasing more along with the gas concentration rising levels. By using simple electronic circuits, it convert the charge of conductivity to correspond output signal of gas concentration.

4.5 RAIN SENSOR SN-RAIN-MODEL

In this system we are using rain sensor module (Product code: SN-RAIN-MOD) is used to detect the amount of water present on the sensor and with a controller, it can further control output. The rain sensor module consists of two parts, that is the sensor probes and the module board.

Fig -7: Rain sensor SN-RAIN-MOD.

Hardware required to implement rain module is Rain sensor module Arduino UNO and Buzzer with software named as Arduino. When this sensor board is exposed in open space where not roof blocking the rain. When the sensor detects water droplets on it, it will change the analog voltage that is being read by the controller, in this case the Arduino. Arduino will further activate the buzzer to alert that there is rain. In addition, the sensor can be digital (present or absence of water droplets) or analog (how much water droplets on the sensor). After detecting this signals from rain signal microcontroller actuate the wiper mechanism.

4.6 ULTRASONIC SENSOR

Ultrasonic sensors are based on measuring the properties of sound waves with frequency above the human audible range. They are based on three physical principles: time of flight, the Doppler effect, and the attenuation of sound waves. Ultrasonic sensors are non-intrusive in that they do not require physical contact with their target, and can detect certain clear or shiny targets otherwise obscured to some vision-based sensors. On the other hand, their measurements are very sensitive to temperature and to the angle of the target.

Ultrasonic sensors "are based on the measurement of the properties of acoustic waves with frequencies above the human audible range," often at roughly 40 kHz . They typically operate by generating a high-frequency pulse of sound, and then receiving

and evaluating the properties of the echo pulse. Three different properties of the received echo pulse may be evaluated, for different sensing purposes. They are: Time of flight (for sensing distance), Doppler shift (for sensing velocity)

Fig -8: Ultrasonic sensor

A short ultrasonic pulse is transmitted at the time 0, reflected by an object. The senor receives this signal and converts it to an electric signal. The next pulse can be transmitted when the echo is faded away. This time period is called cycle period. The recommend cycle period should be no less than 50ms. If a 10μs width trigger pulse is sent to the signal pin, the Ultrasonic module will output eight 40kHz ultrasonic signal and detect the echo back. The measured distance is proportional to the echo pulse width and can be calculated by the formula above. If no obstacle is detected, the output pin will give a 38ms high level signal.

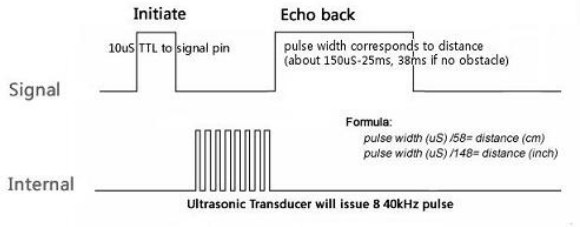

Fig -9: Ultrasonic sensor pulse diagram**.**

This mechanism of ultrasonic sensor is used to detect weather the obstacle ispresent infront of the vehicle or not. When there is ni obsctacle infront of the vehicle then motors get signal from microcontroller and vehicle start in same direction otherwise the vehicle got stopped untill obstacle get cleared .

4.7 16*2 LCD DISPLAY

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix.

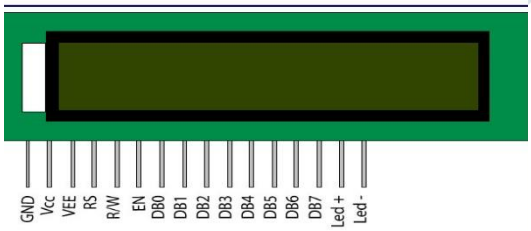

Fig -10: 16*2 LCD display.

Here this display is used to display the status of actuated output devices like range of alcohol detection and obstacle detection. Following table shows the pin description of LCD display.

Table -1: Pin description of LCD module.

PIN NO	FUNCTION	NAME
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select

5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7-15	8-bit data pins	DB0-DB7
16	Backlight V_{CC} (5V)	Led+
	Backlight Ground (0V)	Led-

4.8 GPS TRACKING SYSTEM

GPS tracking system consist of GPS and GSM module which help to detect the location of vehicle. With the help of GSM module this will send the coordinate of location to registered mobile phone. This system insures security of the vehicle to the owner.

Fig -11: GPS tracking System.

4.9DC MOTORS AND MOTOR DRIVER IC

Here 200RPM 12V DC motor with gearbox is used to move the vehicle. This DC motor is having 3000RPM base motor with 6mm shaft diameter with internal hole of 125gm weight. DC motor is having 0.5kgcm torque and having No-load current up to 60 mA(Max) and Load current up to 300 mA(Max).

Fig -12: DC motor.

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin

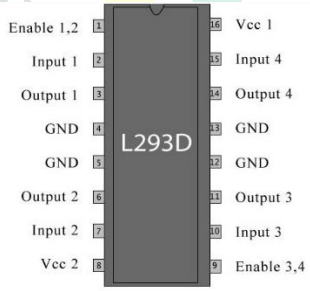

Fig -13: Motor driver IC L293D

IC which can control a set of two DC motors simultaneously in any direction. The L293D is a 16 pin IC, with eight pins, on each side, dedicated to the controlling of a motor. There are 2 INPUT pins, 2 OUTPUT pins and 1 ENABLE pin for each motor. L293D consist of two H-bridge. H-bridge is the simplest circuit for controlling a low current rated motor.

4.10 SG90 Servo Motor

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration..

Fig -14: Servo motor.

It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system

Here in this given system servo motors are used for wiper mechanism according to the system processed output these servomotors are actuating to wipe water from glass. These servomotors receive the input processed from rain sensor.

4.10 BATTERY AND SOLAR PANEL:

The whole system is powered through the rechargeable battery of 12V.

Fig -15: Rechargeable Battery

Features of this battery are given below:

Table -2: Features of battery.

Brand	Expert Power
Model	EXP1213
Item Weight	585 g
Product Dimensions	9.2 x 3.8 x 4.6 cm
Item model number	EXP1213
Included Components	Product
Color Screen	No
Voltage	12 Volts
Batteries Included	Yes
Includes Rechargeable Battery	Yes
Includes Remote	No

This battery can charge through the electric power as well as the solar panels are used to store the energy from sun and store this into battery, which will help battery to get charged.

Fig -16: Solar panel

Here the table is showng the feature of solar panel used for desiginimg of given system:

Table -3: Features of solar panel.

Brand	STARVIN
Part Number	VI-6vsolar-05
Height	10 Centimeters
Length	10 Centimeters
Width	10 Centimeters
Weight	200 Grams
Number of Items	1
Colour	blue

Material	Plastic, Glass, Metal, Others, Bakelite
Batteries Included	No
Batteries Required	No
Type of Bulb	LED

IV. SOFTWARE INTERFACES

5.1 Arduino Software (IDE)

Arduino Software has text editor which is used to writing code and the programs, called as sketches. These sketches along with the extension '.ino' are stored in a standard place called sketchbook. After complete the program writing the IDE software compile it upload the program on the controller. IDE also used as simulator for some application. Prototype for the proposed system is shown in figure given below

Fig -18: Prototype of proposed system

VI. RESULT AND ANALYSIS

Functional testing verified against the system functional requirements specifications. The following functionalities tested successfully on the system prototype.

I. When obstacle is there in front of the vehicle, signals received from the ultrasonic sensor, stops vehicle and stops until the obstacle gets cleared from the front of the vehicle.

II. The signals received from rain sensor, turn ON the wiper mechanism.

III. The signals received from LDR sensors, automatically Turn O and OFF the Upper-Dipper lights of vehicle.

IV. GPRS tracking system send the current location of vehicle to driver as well as owner of the car after every request.

V. Alcohol sensors sense the alcohol level and readings are displayed on LCD display, and its simultaneously checks the alcohol level and stops the vehicle automatically.

Typical security requirements testing based on non-functional requirements which include specific elements like confidentiality, integrity, authentication, availability, authorization and non-repudiation. This system has been constructed that in such a way that the location of the vehicle is shared by system using GPRS and GSM module to user as well as owner. Also the alcohol sensor sense the alcohol level and displays it on LCD display.

This project can act as a curtain raiser for others to see outside in a sense that, its solid foundation leaves a room for plenty of further developments in improving the system so as to make it serve the people better. Integrating the software with good quality sensors and modules this proposed system can function well with higher accuracy.

VII.CONCLUSIONS

The designed system is helpful to make driving comfortable and safe. As the system designed in low cost compare to other system with same efficiency. Features like obstacle detection, automatic wiper mechanism based on rain sensor input, detection of alcohol level makes the driving easier, comfortable and safe. GPS tracking system in the given prototype also insures the security to the owner by receiving the location of the car on mobile phone. While driving accidents are happened and some another issues are coming. So to avoid these we made a car which providing driver special features, security, luxurious and comfortable traveling by using some features and by this driver will follow the rules and get relax and it will be easy, safe and efficient driving.

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