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Design and Implementation of Next Generation Smart Car

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Abstract **In today s date vehicle has become a basic need of every middle class family. But midrange vehicles doesn t provide those facilities that every luxurious and high range vehicle, here focus is on designing a smart car which has all facilities and also affordable to the customer. As per engineers point of view a smart device is a device which is user friendly, realistic and has fast response also considering the designing cost, the hardware should be less expensive and unit price of designed embedded system should be cost effective. Our design have some excellent features such as Tyre Pressure Monitoring System, Smart parking solution, Fuel saving module and accident detection module. The objective of such technologies is the reduction of the burden on driver, improvement of the traffic capacity, and provision of reliable and secure car functions.**

Key word **- Tyre Pressure Monitoring, Smart parking solution, Fuel saving module and accident detection module.**

I. INTRODUCTION

Now a days parking of vehicle is a big issue, in this paper the best solution has been given for car parking mechanism, the wheels are rotated 90° either clockwise or anticlockwise vertically, perpendicular to the road surface so that vehicle can get parked in narrow space also. The fuel consumption is the major problem with increased prices of petrol and diesel, a solution has been developed for reducing the consumption of the fuel during the traffic and when the car is idle (i.e speed of car is zero). This mechanism reduces the fuel consumption up to 10 % per liter. Human safety during driving is another major concern for vehicles. An accident detection module has been developed in such a way that, the device through which the air bag deploys consists of ball and a glass tube. As soon as the ball hits the boundary inside glass tube the sensor detects this signal and gives the exact co-ordinates and the location of the accident can be found.

Remaining paper has been describes the four different design modules for tyre Pressure Monitoring System, Smart parking solution, Fuel saving module and accident detection module. In next section methodology has been given and finally results and future scope has been discussed.

II. SMART PARKING SOLUTION

Proposed design for 90° wheel rotation for electric vehicles : The 360° wheel rotation with chassis design is ready to be implemented in electric wheels in the design. Here the concept of four wheel drive in which all the four [3] wheels are given power to rotate the wheels. The power to the wheels is given by using dc motors and stepper motor used for rotating the wheel assembly 360°.

For implementation such a system and mechanism we need to design such a system and mechanism. The design consists of 6 motors of which 2 are stepper the remaining 4 are dc motors the dc motors are connected to each wheel of the vehicle parallel to its axis. The dc motors are used to rotate the wheels in forward or reverse direction. These dc motors are used in forward motion backward motion and also in moving the vehicle in parking mode[5]. These dc motors are connected to the 2 stepper motors. The front two dc motors are connected to the first stepper motor at the front end placed at the middle between two wheels and the second stepper motor is placed at the rear end of the vehicle placed in between the rear two wheels. The stepper and dc motors are connected through a L shaped shaft followed by a gears and then connected to the stepper motors. The stepper motor is used to rotate the wheel vertically along the axis perpendicular to the axis of the axel the rotation in 90° either in clockwise or in anticlockwise for parking mode. Whenever power is supplied to dc motors the wheels move in forward and in reverse direction. When the power is applied to the stepper motor to rotate the wheel the power is transmitted from the motor to the rotor the rotor transfers the power through the gears to the L shaped shaft this shaft rotates along with the rotation of gears and which rotates the wheel of the vehicle and aligns it in 90° either in clockwise or in anticlockwise thus providing mechanism for parking mode. After entering in parking mode the dc motors are given power through the supply and further operated. When the stepper motor is ON and considering its motion in clockwise direction, it will rotate gear G3 in anticlockwise direction and G1 in clockwise direction thus moving the L shaped shaft and satisfying the condition for 360° wheel rotation. Similar mechanism is done at the rear end. All the mechanical assembly is interfaced with LPC2148 consisting of 6 PWM channels [6] for interfacing of motors and providing required clock pulses for the motors for rotation of wheel for a particular time in a particular direction. The driver used for interfacing the dc motors is L293D [8].The signals from the driver are sent to the dc motor and the dc motor drives the wheels of vehicle. Due to this the vehicle can be moved either in forward direction or in the reverse direction.ULN2003 is an 8 channel driver interfaced with LPC2148,the output from LPC2148 is used to on the driver further the power is transmitted to the stepper motor. The power is transmitted from the stepper motor to the gears followed by the rotating shaft of L shaped. The stepper

motor rotates the wheel vertically perpendicular to the road surface in 3 steps the first is 0°(Normal mode) followed by 45° and finally 90° wheel rotation. After implementation of the parking mechanism the wheels of vehicle can be brought to the normal mode. The objective of such technologies is the reduction of the burden on driver, improvement of the traffic capacity, and provision of reliable and secure car functions. Developing such a mechanism saves the time and fuel consumption. We have tried to design such a system with a best mechanism for mainly parking of vehicle. Design of vehicle is shown in fig. 01 Front view, fig. 02 Isographic view and fig. 03 top view of vehicle. Designing a system inside vehicle which is smart enough to perform a mechanism and complete the task given to it effectively [7]. We are trying to implement the 90° wheel rotation mechanism in the existing vehicle with some modification in the chassis design for which we got very good parking in existing vehicles results. Fig. 04 shows chassis design for smart vehicles.

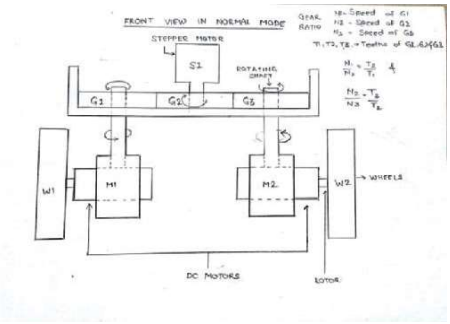

Fig.1 Front view of vehicle

The mechanism of smart parking for parking the vehicle is implemented by using the landing gear mechanism. In this mechanism there are five additional wheels of which four attached to the axel and the remaining one is at the center of the vehicle. The four wheels connected to the axel near the exiting wheels these wheels are idle, the main wheel where the power is to be given is attached to the center of the vehicle. During normal mode of vehicle the additional wheels attached to the axel and the one at center are parallel to the road surface. In case of parking mode the additional wheels are operated using landing gear mechanism these wheels then come in a position perpendicular to the road surface, by hydraulics are pressed down towards the road surface this lifts the vehicle after implementation of such mechanism the power is supplied to the center wheel thus the vehicle can be moved for parking mode hence the four idle wheels supporting the motion for parking of vehicle efficiently [10].

III. FUEL SAVING

There is always inverse relation between available resources and need of fuel. The many people are facing problem of heavy traffic and in traffic signal. In both cases there is lot of time is wasted in seating ideal on road. In such situation the common practice that the driver keeps half clutch engaged. To save fuel in such situation we have found a solution, in which simultaneously we have to check speed of vehicle and also clutch position status. We often have a practice to keep the clutch in engaged position during traffic, when the vehicle is not moving. This increases the fuel consumption of the vehicle [4].

The shaft speed sensor and clutch position sensor will gives the data about the car speed and position of clutch. If this speed of car is less i.e. below 30kmph and clutch is partially engaged, the control valve of fuel injection will operate and the fuel supply will controlled. Many times if there is phone call or something we often get stop for many times for long time and it is bad practice that we keep engine ON. In this case if we cut down the fuel supply for that period and resume it after the pressing clutch again. On highway if vehicle is moving in fast speed, many drivers keep slight leg on clutch. And the due to this clutch is not able to deliver the full power. And fuel is wasted. To save this vehicle we can alert the driver by giving buzzer alarm [9]. Block has been shown in fig. 05.

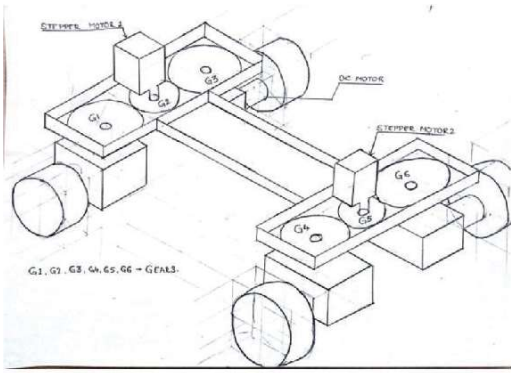

Fig.2 Isographic view of vehicle.

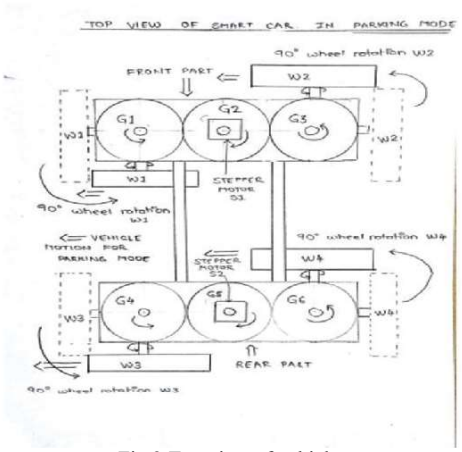

Fig.3 Top view of vehicle

There are three aspects of this module

1. When car speed is zero i.e. it is in idle condition. Using switching mechanism we are making fuel supply cut off to the engine.
2. When we are stuck in traffic and we often a practice to press half clutch and in that case more fuel is wasted. So we do the fuel saving in such case by

providing some mechanism which will regulate the fuel.

Also when we are on highways and there is slight leg on clutch it will consume more fuel and mileage goes down. So in this case we will alert the driver that removes the leg from clutch pedal by giving buzzer. The general instructions are always displayed for driver for care as shown in Fig. 06.

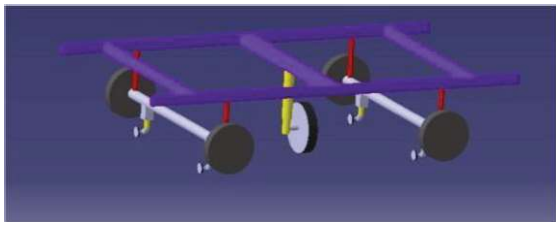

Fig.4 Chassis design for smart parking in existing vehicles

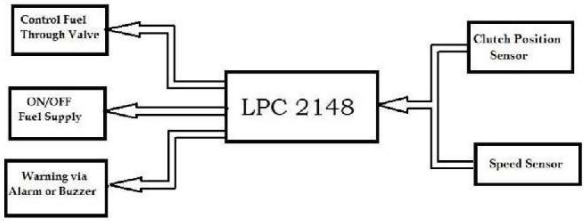

Fig.5 Block diagram for fuel saving

Fig.6 Alert for driver not to keep foot on clutch while no speed

IV. ACCIDENT DETECTION

The airbag system provides safety to the driver and passenger. The airbag system needs to be activated within milliseconds after a crash occurs, to protect of the driver as well as passengers. The airbag is small and keep in compressed area. When there is an accident, the airbags fills up with air very quickly to provide a cushioning for the passenger inside the car [1]. The most important element in air bag system is crash sensor. Today various sensors are designed to tell when the vehicle has been damaged in an accident. Airbag control unit includes different types of sensors measuring wheel speed and other vehicle status indicators are monitored by it and which is located in the front portion of the cabin. The sensors gives signal to the airbag control unit, which analyzes the data and can activates safety features necessary for airbag deployment [2].

The fig. 07 shows block diagram for the accident detection module. The air bag deployment sensors used in cars are electrical and mechanical. Some use an electromechanical "glass and tube" mechanism, which basically consists of a small tube containing a magnetic circuit switch and ball that s held together by a small magnet. If a collision occurs, the ball is disconnected from the magnet and rolls forward in the tube, hitting a switch that completes the electrical circuit.

Working of Airbag in detail:

1. In 0.003 seconds, sensors detect the impact. As the collision sensors attached to the vehicle detects the collision, a signal is sent to the ECU.
2. In next 0.015 seconds, there is evaluation of the impact. The signal sent from the collision sensors to the ECU is processed, and the ECU determines the severity of the impact(percentage of hit impact) based on inputted data. If the ECU detects the deployment of airbag is necessary, it sends a signal to initiate the airbag inflators which are gas emitting devices.
3. In next 0.020 seconds, The airbags go into action The inflators are activated through an ignite, causing a chemical reaction of nitrogen gas that emits gas, resulting in the deployment of the airbag cushion.
4. In next 0.040 seconds, Inflation of the airbag is completed. Due to force of collision passenger experiences hit in forward direction. By this time the airbags are fully inflated and they saves passengers .The inflation of the driver side airbag takes place between 20- 30 milliseconds. For the passenger side airbag, inflation takes 30-40 milliseconds.
5. In next 0.060 seconds, passenger energy due to motion is absorbed, the airbags are fully inflated. This energy is absorbed by crushing of the vehicle, the seat belt load limiter, and the airbags.
6. In next 0.012 seconds, Passenger motion energy is fully absorbed the energy of passenger movement is fully restricted.

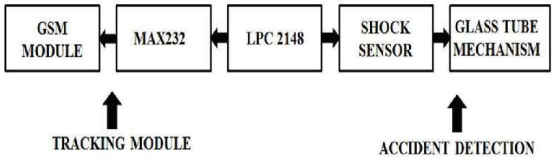

Fig.7 Block diagram for accident detection module

The piezoresistive pressure sensor senses the applied air pressure by tyre or by atmosphere on silicon diaphragm. This pressure will deform the diaphragm and bridge will produce the corresponding analog output. This analog output is converted into digital and stored in microcontroller. Block diagram for tyre pressure monitoring is shown in fig. 9

The stored data is transmitted via RF module. The data transmitted is received at the receiver, processed and displayed on the LCD in psi (Pounds per square inch). The experimental results are shown in fig. 8

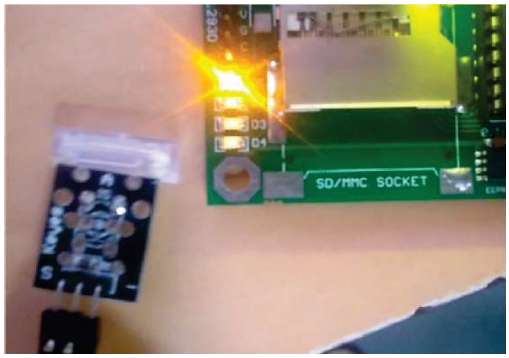

Fig.8 LED glows when shock is detected.

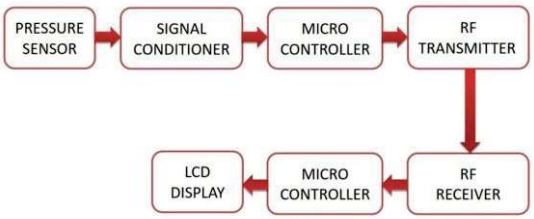

Fig.9 Block diagram of Tyre Pressure Monitoring System

VI. Results and Conclusion

We have focused on designing a smart car which has all facilities and also affordable to the customer, which is called as a NEXT GENERATION SMART CAR Following figures describes the best result obtained after designing.
Smart Parking solution

In this mechanism the wheels are rotated 90° either clockwise or anticlockwise vertically, perpendicular to the road surface.

Fuel saving module

We have developed a mechanism for reducing the consumption of the fuel during the traffic and when the car is idle (i.e speed of car is zero). This mechanism reduces the fuel consumption upto 10 % per liter. It has been proven with experiment results as shown in fig. 10.

Accident detection module:

The device through which the air bag deploys consists of ball and a glass tube. As soon as the ball hits the boundary inside glass tube the sensor detects this signal and gives the exact co-ordinates and the location of the accident can be found.

Tyre pressure monitoring system (tpms)

TPMS is an intelligent system which monitors the air pressure inside tyre electronically and continuously sends the signal to the user and makes him aware of the pressure inside tyre. TPMS is an intelligent device which recognizes whether the air pressure inside tyre is over or under inflated. The data is displayed on dashboard. Designed module has been shown in fig. 11

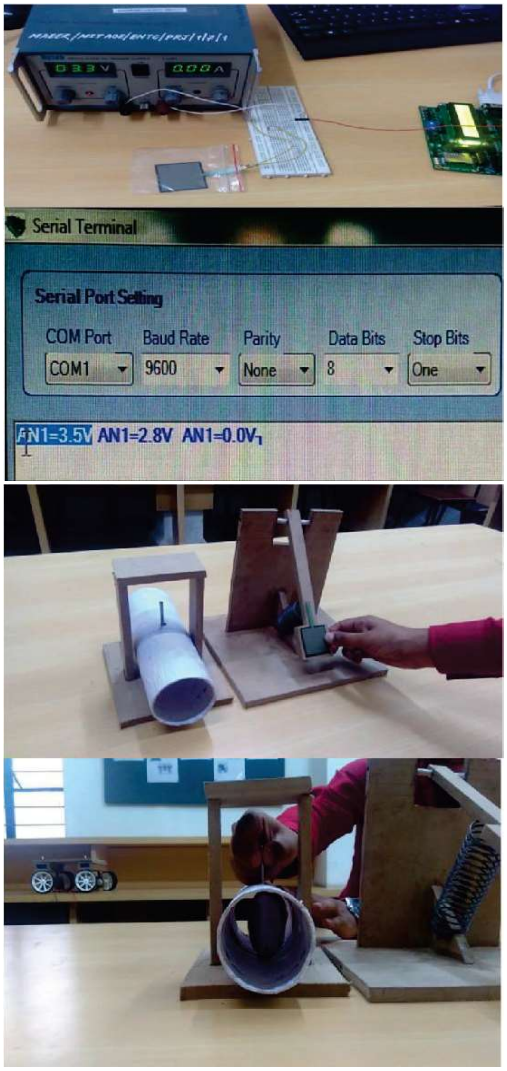

Fig. 10 Experimental results for rotation of wheel

Fig.11 Working model of TPMS.

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