

Design and Fabrication of Anti-Theft Steering System with Vehicle Accident Information System through SMS

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ABSTRACT: The objective of this research work is to design and fabricate an anti lock steering control system with vehicle information system through SMS. Preliminary modeling and simulation work considers a quarter cars initially followed by natural progression to the half car and full four wheel station cases. The model is to be constructed in modular form thus allowing the replacement/ interchange of the various blocks and their associated technologies. Upon completion of the full vehicle braking model, sensitivity analyses will be carried out. Frame work for integration of sensors and control module in a scalable multi-agent system is provided .A SMS which contains the current GPS location of the vehicle is sent via a GSM module to the police control room to alert the police. The system is foolproof and the driver cannot tamper with it easily.

KEYWORDS : Vehicle information system, GPS and GSM, Short message service (SMS), Anti theft steering system.

I. INTRODUCTION

Nowadays Automation occupies various electronic sections by its comfortable nature. This is an era of automation where it is broadly defined as replacement of manual effort by electronic power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

Degrees of automation are of two types, viz.

- 1) Full automation.
- 2) Semi automation.

In semi automation a combination of manual effort and electronic power is required whereas in full automation human participation is very negligible.

Need For Automation:

Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources; electronics form an attractive medium for low cost automation. The main advantages of all electronics systems are economy and simplicity. Automation plays an important role in mass production.[1]

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(An ISO 3297: 2007 Certified Organization)

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- To achieve quick response
- To prevent the accident by alarm indication
- To reduce the work load
- To reduce the fatigue of workers
- To achieve good quality
- Less Maintenance

Safety System:

There have been considerable advances in modern vehicle braking system in recent years. For example, electronically controlled ABS for emergency braking, electronically controlled hydraulically actuated individual brake by wire (BBW) systems for saloon cars and electronically controlled pneumatically actuated system for heavy goods vehicles. [3]The work of recent years shall form the basis of a system design approach to be implemented. The novelty of the proposed research programmed shall lie in the design and evaluation of control system for achieving individual wheel motion control facilitated by BBW.

Preliminary modelling and simulation work considers a quarter cars initially followed by natural progression to the half car and full four wheel station cases. The model is to be constructed in modular form thus allowing the replacement/ interchange of the various blocks and their associated technologies. Upon completion of the full vehicle braking model, sensitivity analyses will be carried out. Once preliminary simulation model has been thoroughly benchmarked and existing control system strategies evaluated, an audit of the technology used is to take place and this will provide a basis for comparison of iterative technologies / technique.

The new modern vehicle shall include:

- Development of improved ABS control system.
- Development and assessment of an electro-hydraulic-BBW (EH-BBW) system.
- Individual wheel braking combined with traction control.
- Assessing sensor failure and fault tolerant control system design.
- Preliminary studies into an electrically actuated system
- Re-engineering using simplified models.[2]

Antilock Braking System:

Anti-lock braking systems were first developed for aircraft. An early system was Dunlop's Maxaret system, introduced in the 1950s and still in use on some aircraft models. This was a fully mechanical system. It saw limited automobile use in the 1960s in the Ferguson P99 racing car, the Jensen FF and the experimental all wheel drive Ford Zodiac, but saw no further use; the system proved expensive and in automobile use somewhat unreliable. A purely mechanical system developed and sold by Lucas Girling was factory-fitted to the Ford Fiesta Mk III. It was called the Stop Control System.

The German firm of Bosch had been developing anti-lock braking technology since the 1930s, but the first production cars using Bosch's electronic system became available in 1978. They first appeared in trucks and German limousines from Mercedes-Benz. Systems were later introduced on motorcycles.

Car Safety:

Car safety is the avoidance of automobile accidents or the minimization of harmful effects of accidents, in particular as pertaining to human life and health. Special safety features have been built into cars for years, some for the safety of car's occupants only, and some for the safety of others. Every year tens of thousands of people are killed in road accidents.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 1, January 2015

Major factors in accidents include driving under the influence of alcohol or other drugs, inattentive driving, driving while fatigued, reckless driving, or encounters with road hazards such as snow, potholes and crossing animals. Despite technological advances, the death toll of car accidents remains high: about 40,000 people die every year in the US, a number which increases annually in line with rising population and increased travel (although the rate per capita and per distance traveled decreases steadily), and a similar number in Europe. A much higher number of accidents result in permanent disability.

When pregnant, women should continue to use seatbelts and airbags properly. A University of Michigan study found that "unrestrained or improperly restrained pregnant woman are 5.7 times more likely to have an adverse fetal outcome than properly restrained pregnant women." If seatbelts are not long enough, extensions are available from the car manufacturer or an aftermarket supplier.

Car safety is especially critical for young children, as car safety is generally designed for normal sized adults. Safety features that could save an adult can actually cause more damage to a child than if the feature was not there. It is important to review with others, who may be supervising your child, your rules for car safety. All children age 12 and under should ride in the back seat.[4] This is especially the case if there are airbags in the front seat, as airbags are only designed to protect adults and may injure children.

Child safety locks prevent children from accidentally opening doors from inside the vehicle, even if the door is unlocked. The door, once unlocked, can then be opened only from the outside.

Newborn babies should be put in a car seat until they weigh at least 20 or 22 pounds (10 or 11 kg). These carriers are designed to be placed in the rear seat and face towards the rear with the baby looking towards the back window. Some of these carriers are "Convertibles" which can also be used forward facing for older children. With infants, these should only be used facing the rear. Harness straps should be at or below shoulder level. Toddlers over 1 year old and between 20 and 40 pounds (10 and 20 kg) should be placed in forward facing child seats or convertibles placed in the rear seat. Harness straps should be at or above the child's shoulders.

Children, who weigh less than 80 pounds (40 kg), are younger than 8, or are shorter than 4 ft 9 in (1.4 m) are advised to use belt positioning booster seats which raise them to a level that allows seat belts to work effectively. These seats are forward facing and must be used with both lap and shoulder belts. Booster seats must be used with both lap and shoulder belt. Make sure the lap belt fits low and tight across the lap/upper thigh area and the shoulder belt fits snug crossing the chest and shoulder to avoid abdominal injuries.[6]

There are two main types of booster seats. If your car's back seat is lower than your child's ears, use a high back booster seat to help protect your child's head and neck. If your car's seat back is higher than your child's ears, you can use a backless booster seat.

Safety features:

Avoidance

To make driving safer and prevent accidents from occurring, cars have the following safety features:

Turn signals and brake lights, including Center High Mounted Stop Lamps (CHMSL).

Anti-lock braking system (ABS) with EBV (Electronic brake pressure distribution), which prevents the brakes from locking and losing traction while braking. This shortens stopping distances in almost all cases. See also: Emergency Braking Assistance (EBA).

Electronic stability controls, which use various sensors to intervene when the car senses a possible loss of control. The car's computer can reduce power from the engine and even apply the brakes to prevent the car from under steering or over steering

Traction control(TCS)

Dynamic steering response (DSR).

Electronic Skid Prevention (ESP), with Acceleration Slip Regulation (ASR) and Electronic differential lock (EDL).

Lane Departure Warning System (LDWS).

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 1, January 2015

Directional headlamps.

Damage control:

When an accident occurs, various systems work together to minimize damage to those involved. Much research has been done using crash test dummies to make modern cars safer than ever. Recently, attention has also been given to the cars design regarding the safety of pedestrians in car-pedestrian collisions. Controversial proposals in Europe would require cars sold there to have a minimum/maximum hood height. This has caused automakers to complain that the requirements will restrict their design choices, resulting in ugly cars. Others have pointed out that a notable percentage of pedestrians in these accidents are drunk.

Seatbelts (or safety belts) keep a person from being thrown forward or ejected from the vehicle.

Airbags

- Front airbags inflate in a medium speed head on collisions to cushion the blow of a head on the dashboard or steering wheel.
- Side airbags inflate in a side (T-bone) collision to cushion the torso
- Curtain airbags protect the heads of passengers in a side collision
- Crumple zones absorb the energy of an impact when the car hits something
- Cage construction is designed to protect vehicle occupants. Some racing vehicles have a tubular roll cage
- Reinforced side door structural members Fuel pump shutoff devices turn off gas flow in the event of a collision for the purpose of preventing gasoline fires.[8]

II. COMPONENTS AND DESCRIPTION

The major components are,

- Pneumatic cylinder
- Solenoid valve
- Flow control valve
- Microcontroller

1. Pneumatic Cylinder:

Cylinder is a device which converts fluid power into linear mechanical force and motion. These cylinders are widely used in industrial pneumatic systems. These cylinders are also called as linear motors and reciprocating motors pneumatic cylinders are designed for a variety of services. Pneumatic cylinders are designed for a variety of services. Pneumatic cylinders transforms the flow of pressured fluid into a push or pull of the piston rod since out system uses double acting cylinders we shall see some details about them.

Double acting cylinders are in one in which fluid force can be applied to the movable element in two directories. The force exerted by the compressed air moves the piston in two directories in a double acting cylinder. They are used particularly.[5] The piston is required to perform work not only on the advance movement but also on the return.

In principle, the stroke length is unlimited, although bucking and bending must be considered before we select a particular size of piston diameter, rod length and stroke length. The main component of any pneumatic system is the cylinder, which receives air under pressure and the pressurized air helps to move the piston to and fro. The force acting on the piston will be equal to the product of the pressure of air and the area of the cylinder. The amount of air delivered into the cylinder into the cylinder decides the rate of doing work. A cylinder is a hollow circular section with the top and bottom flange provided to prevent the leakage of air. [7]

The compressed air is used to actuate the piston. In order to move the piston to and fro, the air is supplied to the top and bottom of the cylinder alternatively.

Cylinder is mainly classified into two types namely,

- Single acting cylinder.
- Double acting cylinder.

In single acting cylinder, using the spring provided around the piston rod attains the return stroke, but it is not efficient. So, the double acting cylinder is used in which the return stroke is attained using compressed air

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 1, January 2015

2. Solenoid Valve with Control Unit:

The directional valve is one of the important parts of a pneumatic system. Commonly known as DCV, this valve is used to control the direction of air flow in the pneumatic system. The directional valve does this by changing the position of its internal movable parts. [9]

This valve was selected for speedy operation and to reduce the manual effort and also for the modification of the machine into automatic machine by means of using a solenoid valve. A solenoid is an electrical device that converts electrical energy into straight line motion and force. These are also used to operate a mechanical operation which in turn operates the valve mechanism.

Solenoids may be push type or pull type. The push type solenoid is one in which the plunger is pushed when the solenoid is energized electrically. The pull type solenoid is one in which the plunger is pulled when the solenoid is energized. The name of the parts of the solenoid should be learned so that they can be recognized when called upon to make repairs, to do service work or to install them.

3. Frame

The solenoid frame serves several purposes. Since it is made of laminated sheets, it is magnetized when the current passes through the coil. The magnetized coil attracts the metal plunger to move. The frame has provisions for attaching the mounting. They are usually bolted or welded to the frame. The frame has provisions for receivers, the plunger. The wear strips are mounted to the solenoid frame, and are made of materials such as metal or impregnated less fiber cloth.[11]

Sl. No.	PARTS	Qty.	Material
i.	Pneumatic Cylinder	1	Aluminium
ii.	Solenoid Valve	1	Aluminium
iii.	Microcontroller	1	Electronic
iv.	Relay driver	1	electronics
v.	Pedal arrangement	1	Mild Steel
vi.	Flow Control Valve	1	Aluminium
vii.	LCD display	1	Cast Iron
viii.	Connecting Tube	-	Polyurethene
ix.	Hose Collar and Reducer	-	Brass
x	Stand (Frame)	1	Mild steel
xi	Steering	1	Rubber

III. DESIGN CONCEPT

CAD/CAE:

Computer aided design or CAD has very broad meaning and can be defined as the use of computers in creation, modification, analysis and optimization of a design. CAE (Computer Aided Engineering) is referred to computers in Engineering analysis like stress/strain, heat transfer, flow analysis. CAD/CAE is said to have more potential to radically increase productivity than any development since electricity. CAD/CAE builds quality form concept to final product. Instead of bringing in quality control during the final inspection it helps to develop a process in which quality is there through the life cycle of the product.

CAD/CAE can eliminate the need for prototypes. But it required prototypes can be used to confirm rather predict performance and other characteristics. CAD/CAE is employed in numerous industries like manufacturing, automotive, aerospace, casting, mould making, plastic, electronics and other general-purpose industries. CAD/CAE systems can be broadly divided into low end, mid end and high-end systems.

Low-end systems are those systems which do only 2D modelling and with only little 3D modelling capabilities. According to industry static's 70-80% of all mechanical designers still uses 2D CAD applications. This may be mainly due to the high cost of high-end systems and a lack of expertise. Mid-end systems are actually similar high-end systems with all their design capabilities with the difference that they are offered at much lower prices. 3D sold modeling on the PC is burgeoning because of many reasons like affordable and powerful hardware, strong sound

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 1, January 2015

software that offers windows case of use shortened design and production cycles and smooth integration with downstream application. More and more designers and engineers are shifting to mid end system.

High-end CAD/CAE software's are for the complete modeling, analysis and manufacturing of products. High-end systems can be visualized as the brain of concurrent engineering. The design and development of products, which took years in the passed to complete, is now made in days with the help of high-end CAD/CAE systems and concurrent engineering.[10]

Modeling:

Model is a Representation of an object, a system, or an idea in some form other than that of the entity itself. Modelling is the process of producing a model; a model is a representation of the construction and working of some system of interest. A model is similar to but simpler than the system it represents. One purpose of a model is to enable the analyst to predict the effect of changes to the system.

On the one hand, a model should be a close approximation to the real system and incorporate most of its salient features. On the other hand, it should not be so complex that it is impossible to understand and experiment with it. A good model is a judicious trade off between realism and simplicity. Simulation practitioners recommend increasing the complexity of a model iteratively. An important issue in modelling is model validity. Model validation techniques include simulating the model under known input conditions and comparing model output with system output. Generally, a model intended for a simulation study is a mathematical model developed with the help of simulation software.

Software for modelling:

- Solid works
- Creo
- CATIA
- Unigraphics, etc

CREO:

Creo Elements/Pro (formerly Pro/ENGINEER), PTC's parametric, integrated 3D CAD/CAM/CAE solution, is used by discrete manufacturers for mechanical engineering, design and manufacturing. Created by Dr. Samuel P. Geisberg in the mid-1980s, Pro/ENGINEER was the industry's first successful rule-based constraint (sometimes called "parametric" or "variational") 3D CAD modeling system. The parametric modelling approach uses parameters, dimensions, features, and relationships to capture intended product behaviour and create a recipe which enables design automation and the optimization of design and product development processes.

This design approach is used by companies whose product strategy is family-based or platform-driven, where a prescriptive design strategy is fundamental to the success of the design process by embedding engineering constraints and relationships to quickly optimize the design, or where the resulting geometry may be complex or based upon equations. Creo Elements/Pro provides a complete set of design, analysis and manufacturing capabilities on one, integral, scalable platform.

These required capabilities include Solid Modeling, Surfacing, Rendering, Data Interoperability, Routed Systems Design, Simulation, Tolerance Analysis, and NC and Tooling Design. Like any software it is continually being developed to include new functionality. The details below aim to outline the scope of capabilities to give an overview rather than giving specific details on the individual functionality of the product.

Creo Elements/Pro is a software application within the CAD/CAM/CAE category, along with other similar products currently on the market. Creo Elements/Pro is a parametric, feature-based modeling architecture incorporated into a single database philosophy with advanced rule-based design capabilities. It provides in-depth control of complex geometry, as exemplified by the trajpar parameter. The capabilities of the product can be split into the three main headings of Engineering Design, Analysis and Manufacturing.[12]

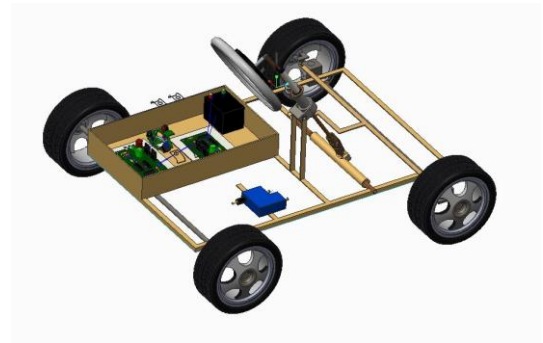
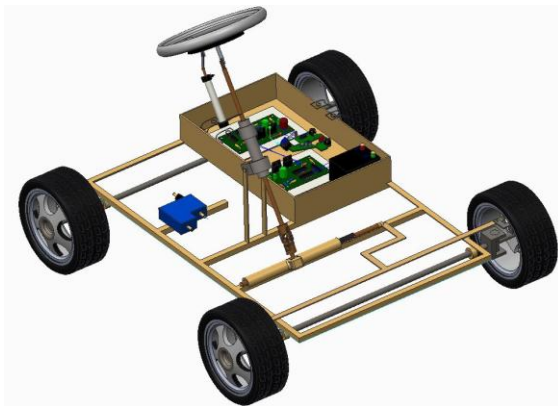
International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 1, January 2015

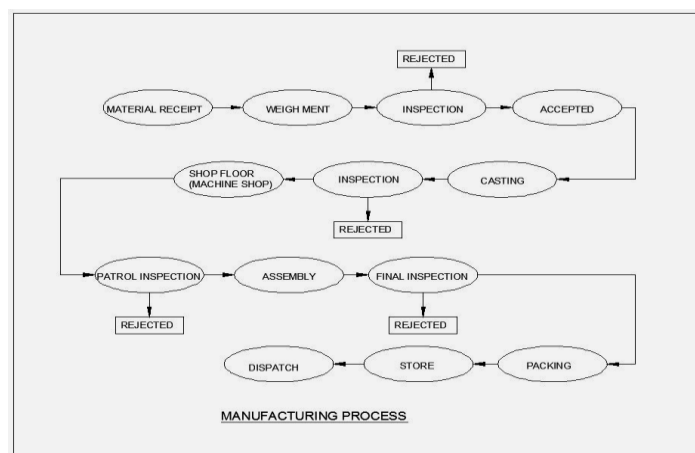
Engineering Design:

Creo Elements/Pro offers a range of tools to enable the generation of a complete digital representation of the product being designed. In addition to the general geometry tools there is also the ability to generate geometry of other integrated design disciplines such as industrial and standard pipe work and complete wiring definitions. Tools are also available to support collaborative development. A number of concept design tools that provide up-front Industrial Design concepts can then be used in the downstream process of engineering the product. These range from conceptual Industrial design sketches, reverse engineering with point cloud data and comprehensive free-form surface tools.[13]
We created 3D model of this project by using CREO software. The models are shown below...



IV. MANUFACTURING PROCESS

Manufacturing processes are the steps through which raw materials are transformed into a final product. The manufacturing process begins with the creation of the materials from which the design is made. These materials are then modified through manufacturing processes to become the required part. Manufacturing processes can include treating (such as heat treating or coating), machining, or reshaping the material. The manufacturing process also includes tests and checks for quality assurance during or after the manufacturing, and planning the production process prior to manufacturing.[14]



International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 1, January 2015

Working Principle:

It is constructed with microcontroller. This research work is very useful for anti theft, because steering unit is locked when vehicle is in parking condition. Steering is released when the finger print is matched with the owner's print, then only anti lock steering is released. Then we put key to vehicle on and OFF. If the password and the card is mismatched a message will be send to the phone of the car owner. When vehicle is parked anti lock steering is activated by the microcontroller.

Merits:

- It requires simple maintenance cares
- The safety system for automobile.
- Checking and cleaning are easy, because of the main parts are screwed.

- Easy to Handle.
- High security.
- Repairing is easy.
- Replacement of parts is easy.

Demerits:

- Initial cost is high.
- Air tank is required for this operation.

V.APPLICATIONS

- It is very much useful for Car Owners & Auto-garages.
- Thus it can be useful for the following types of vehicles;
 - 1) MARUTI
 - 2) AMBASSADOR
 - 3) FIAT
 - 4) MAHINDRA
 - 5) TATA

VI.CONCLUSION

The Antitheft steering system and vehicle information system through SMS serves as a best safety and convenience system for the vehicle users to protect themselves from impending danger. This research work widens the area of safety and comfort systems in the field of automobile engineering providing various benefits such as accident prevention and passenger safety installations.

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