Contrived the Collateral Parking System

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Abstract. The parking of car in the smaller space area is very difficult for the driver and it consumes more time. While in the parking, the drivers used to wait for proper place so that engine idle time also becomes more. In this paper we are creating a prototype of the collateral parking so to reduce the parking time, engine running time, reduce the pollution, and reduce occupying the space. The angle of steering systems always having the angle to tilt, but the extreme level of angle at 90° cannot be achieved in normal steering system. To minimize this issue, we have perpendicular rotation of wheels with steering control we can achieve the parking system easier. This collateral parking system makes our vehicle to park in less space area also.

Keywords: Collateral, Relays, Parking, Steering system.

1. Introduction:

Nowadays traffic, vehicles usage is more in all the cities. It creates too much of pollution, space occupation, parking issues. To rectify the parking issues, we have a technique of Collateral parking system. This Collateral parking system steering has an enormous power to reduce the parking difficulties. The vehicles are parked in cities and it is very tough to release back. Its takes too much time and gives high pollution due to running of engine continuously. Collateral parking needs certain moderations in steering system. The normal steering system having the tendency to move with certain angle, the angle is restricted. The power steering system also invented with having the ease of working. In that way, we have Collateral parking system for ease of parking and to reduce human time, engine working time, reduce pollution, expenses. The problem of finding vacant space will come to an end with the introduction of smart parking system [1]. The smart parking was also done with the help of sending short message service which provided a password at the entry and exit to provide authentication for getting inside/outside at the entry/exit point. It was not efficient to consider the human to human interaction for finding the parking lots [2]. The different sensor systems are also used for vehicle detection in the smart parking system. The PGIS system acts as a tool for the drivers to assist in the decision making process to find a vacant for parking their vehicle in their locality [3]. The problem of parking causes many of the traffic congestion and at least it takes about an average of 20 min for finding a parking lot. For improving the computational efficiency the frame differencing to find the changes is done on the predetermined Region of interest within the acquired frame [4]. The smart parking systems help people to optimize their time, reduce the consumption of fuel and reduce the CO2 emissions. Sensors used in smart parking systems have automatic data collection which is a real time data also [5]. The local economy of the nation also not only depends on the road safety and traffic conditions but also on the improvement of parking conditions [6].
2. Objective

The design process applied in car and this process consists of four steps:
1. Needs identification (Collateral parking system)
2. Developing system (Steering control)
3. Design (Materials selection, Parts details)
4. Installation (Fabrication)

The first step is the identification of problem. The problem is in the parking system. The angle of steering wheel need to be rotated more which may give the most flexible parking system for us. The design as per the identification has made. As the design is over the next step was to choose the materials and assembly criteria’s. Then as per the design, the fabrication takes place. The fabrication of model prototype is done and the installation process can be done in future. For developing the parking demand forecasting models various methods like linear regression and least square regression are used [7]. The android application also generates automated parking/un parking without any human intervention [8].

3. Materials Selection

3.1 Mild Steel

Mild steel was used to produce the gear. The materials or parts can be manufactured by either forging process or milling process. The spur gears are manufactured by gear milling process. The motors were purchased as per our design requirements. The steering system runs by using below indicated parts. Casting process also takes place for producing the gear. The raw materials were prepared by using die casting process. Pouring the molten metal into the cavity and making the product is called as die casting process. As well we are also having machining or metal removal process to prepare the gear as per our design criteria.

3.2 Spur Gear

The main purpose of Spur gears is used to transmit the power. The tow axes are available in our Collateral parking steering system, the spur gears are placed in between the motor and steering rods. Once the process takes place then the spur gear rotates on its axis. Then the rotation power is converted into steering unit. Spur gears place a major role in this system and are shown in Fig 1.

3.3 Stepper Motor

The stepper motors are used here to split the rotation into number of equals. Feedback sensors are used here to recollect the signals and stepper motor working as per the signals also.

3.4 Switch

Switches are used in electrical area to transmit the power to one circuit to another circuit. The switches also concentrate in limiting and protecting the power. The power steering system motors are used to run in its movements. The conversion power into the required axis can be done by switches only. Switches are classified into “single-pole, single-throw”, “single-pole, double-throw”, “double-pole, double-throw”, which are more often abbreviated down to
SPST, SPDT, and DPDT, respectively. The interfacing of sensors and actuators can be done by implementing the software programs and algorithms [9].

3.5 Double Pole Double Throw (DPDT) Switch

The DPDT switch is shown in Fig. 2. A Double Pole Double Throw (DPDT) switch is having two in put & four out puts. All the input have two outputs and all of them can be connected.

![DPDT Switch](image)

**Fig 2:** DPDT Switch

The terminals of switch have double pole with two inputs & get connected with four outputs also. DPDT and relays are used here. It is having various volts of six, nine, twelve and twenty four and it works in high voltage also. It avoids current circuit shortage. Due to this switch the connection will be easily achieved. It is also activated by double pole double throw relay. Relay is an electromagnetic device used to separate two circuits electrically and connect them magnetically. These kinds of switches can be used as an electronics interface also. The working principle of DPDT switch and DPDT relay is shown in Fig 3. and Fig 4. below respectively.

![Principle of DPDT Switch](image)

**Fig 3:** Principle of DPDT Switch

![DPDT Relay](image)

**Fig 4:** DPDT Relay

Here the twelve volt battery has the connection of positive point as T1 and the negative at T2. There is connection between switches, coil and relay and due to that the motors are working as per our required state. The motors can also get change in its direction also. Altogether, the motors used to steer our wheeling system into 90 degree angle with the help of spur gear. The parts required for making the prototype with the required quantity and the material which it is made up of is given in Table 1.
Table 1: Parts required for making the prototype model

| PARTS            | QUANTITY | MATERIAL       |
|------------------|----------|----------------|
| Gear             | 8 Nos.   | Mild Steel     |
| Motor            | 5 Nos    | -              |
| Jumper Wire      | 2 metres | -              |
| DPDT Switch      | 1 Nos    | -              |
| Soldering Can    | -        | -              |
| Square Tube      | 6 metres | Mild Steel     |
| Cutter Blade     | 1 No     | High Speed Steel|
| Battery 12 Volts | 1 No     | -              |

4. Working Principle

The Spur gears are used to engage with the steering system for rotating the wheels into its extreme angle. The system uses seven gears. Driving gear is for wheel steering action & the other six gears are meshed with the steering. The driving gear is used to drive the connected gears and this will transmit the power to the other wheels for rotation. The stepper motor is used to drive the driving gear and the stepper motor works on the basis of stator, rotor and coil windings.

Fig 5: Prototype of the Parking system

4.1 Collateral Parking System

The prototype of the Collateral parking system and is shown in Fig 5, and the position of the gears used is shown in Fig 6. The cars are used to park in the roads or any open area near to traffic places. At that time, it is difficult to have more space to take angle cut by using normal steering system. Due to this more number of cars can’t be able to park in smaller space area. Sometime it is not possible to take reverse also. Even if there is no option to take reverse and front but it can be parked or taken away by using the collateral parking system. If the angle of wheels leads to its perpendicular position or 90 degree then in smaller area also it can be parked and well equipped by using this system. We can avoid more amount of space used and unnecessary fuel consumption.
In normal parking system the wheels are used to rotate up to 30 degree angle and so that the parking space required is more. The way in which the parking is done in normal parking system is shown in Fig 7. As described in figure the area for parking the vehicles requires more space when the angle of tilt is less. The angle parking system which helps in reducing the space required for parking is shown in Fig 8.

The Collateral parking system which uses the tilt angle for reducing the space required is shown in Fig 9. In future the IOT also provides a wireless access to the system and the user can keep a track of the availability of the parking area [10].
Fig 9: Collateral parking system

5. Conclusion:

Normal steering system has the front wheels to drive the cars and is also used to turn the vehicle in required angle. In tight space 30 degree angle of rotation is difficult. In our paper, we have the modified steering system with the spur gear attachment and its makes our wheel to rotate up to 90 degree and the switches are used here to choose whether to rotate the wheels in collateral parking system mode or not. In this mode, the attached spur gear rotates with motor and it is connected with the wheels due to which we can achieve its extreme angle. So cars can be moved Collateral tight space also. In this paper we modified the steering system of a four wheeler in such a way that all four wheels of the car can be steered while parking. Due to this it is very easy to park the vehicles in tight space. Collateral parking system can drive the cars in perfect angle and can do estimation of movement easily. The position and orientation of movements also can be calculated. So the parking issues are rectified and we can park our vehicles wherever required. Major cities cars are trying to use this parking system to minimize the consumption of space and time in future by using sensors we can predict the space area with our collateral parking system. Here we have created a prototype and in future we can start the fabrication process depending on the funds available.

6. References

[1] Pranav Sahni et al., 2016, Review Of Smart Parking System And Different Sensors, International Journal of Industrial Electronics and Electrical Engineering, Volume-4, Issue-6 57-59.
[2] Faiz Shaikh et al., 2015, A survey on “Smart Parking” system, International Journal of Innovative Research in Science, Engineering and Technology, Volume-4, Issue 10, 9933-9939.
[3] M.Y.I. Idris et al., 2009, Car park system: A Review of smart parking system and its technology, Information technology journal, 8 (2), 101-113.
[4] Muhammad Alam et al., 2018, Real-Time Smart Parking Systems Integration in Distributed ITS for Smart Cities, Journal of Advanced transportation, https://doi.org/10.1155/2018/1485652.
[5] Jhonattan J. Barriga, 2019, Smart Parking: A Literature Review from the Technological Perspective, Applied Sciences, 9, 4560; doi:10.3390/app9214569.
[6] Patel Krupali et al. 2017, Literature review on planning proposal for parking facility, International Journal of Advance Engineering and Research Development, Volume 4, Issue 3,299-302.
[7] Janak Parmar et al., 2020, Study on demand and characteristics of parking system in urban areas: A review, Journal of Traffic and transportation engineering, 7 (1), 111-124
[8] Deepthi. S et al., 2016, A Survey on Smart Parking System Based on Internet of Things, International Journal of Engineering Science and Computing, Volume 6 Issue No. 11, 3175-3178
[9] Ayaskanta Mishra et al., 2019, Low Cost Parking System For Smart Cities: A Vehicle Occupancy Sensing And Resource Optimization Technique Using IoT And Cloud PaaS, International Journal Of Scientific & Technology Research, Volume 8, Issue 09, 115-122
[10] Elakya R et al., 2019, Smart Parking System using IoT, International Journal of Engineering and Advanced Technology, Volume-9 Issue-1, 6091-6095.