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Automatic Robot Car Parking System

Asst. Prof Gurudutt Ghadi[1], Keshav P Badiger[2], Abhishek S Nimane[3], Shridhar Gidnavar[4], Vijay N Bhandurge[5]

[1]Dept Mechanical Engineering, S.G.B.I.T College, Belagavi, India
[2,3,4,5]Dept Mechanical Engg, s.g.b.i.t college, bgm, India
[2]Keshavvpb@gmail.com, [3]nimaneabhishek@gmail.com, [4]shashidhagidnvar16@gmail.com, [5]vijaybhandurge21@gmail.com

ABSRTRACT

The rapid expansion of urbanization and the increasing number of vehicles have led to severe parking shortages, necessitating innovative solutions for efficient space management. This research presents the Automatic Robot Car Parking System, an intelligent and automated approach to optimizing parking in congested areas. The system integrates a robotic platform along with DC motors, a toggle jack lifting mechanism, and wireless communication (HC-05 Bluetooth module) to enable precise vehicle parking. Controlled via a smartphone application, the robot can move in multiple directions and adjust the platform height, facilitating multi-level parking and maximizing space utilization.

The proposed system reduces manual effort, minimizes parking time, and enhances efficiency in both public and private parking areas. By leveraging automation and smart control, this system provides a cost-effective, scalable, and user-friendly solution to the growing urban parking crisis. Experimental results demonstrate the feasibility and effectiveness of the system in real-world applications.

1. INTRODUCTION

With rapid urbanization and increasing vehicle ownership, cities worldwide face a growing challenge: insufficient parking spaces. Traditional parking systems require significant manual effort, consume time, and often lead to congestion in densely populated areas. The lack of efficient parking solutions not only increases traffic problems but also contributes to environmental issues such as higher fuel consumption and emissions due to prolonged vehicle idling while searching for parking.

To address these challenges, automated parking solutions have gained attention, leveraging technology to optimize space utilization and improve parking efficiency. One such innovative approach is the Automatic Robot Car Parking System, which integrates robotics, wireless communication, and automation to streamline the parking process. This system utilizes a robotic platform equipped with motors, a toggle jack lifting mechanism, and a Bluetooth (HC-05) module, enabling wireless control via a smartphone application. The robot's ability to move in multiple directions and adjust platform height allows for multi-level parking and effective space management.

This Project explores the design, functionality, and benefits of the proposed Automatic Robot Car Parking System, emphasizing its potential to enhance urban mobility, reduce congestion, and optimize land use. By implementing such automated parking solutions, cities can achieve smarter and more sustainable urban infrastructure

2. LITERATURE SURVEY

1."Design and Development of an Autonomous Car Parking System Using Robotics"

Author: Nisha, K. & Karthikeyan, R.

Year: 2019

Abstract: The system aims to eliminate human intervention for parking and retrieval of vehicles. The study involves the use of a vehicle consisting with sensors to detect available parking place and a lift mechanism to park the vehicle at multi-level parking structures. The paper also discusses the integration of wireless communication (Bluetooth) for controlling the robot's movement and lifting mechanism.

2. "Automated Car Parking System Based on Wireless Technology"

Author: Rehman, M. & Ali, S.

Year: 2018

Abstract: This paper proposes a full of Car parking and management system using wireless technology. The system uses Bluetooth communication for vehicle control, which is linked to an Android-based mobile application. The vehicle driven by motors controlled by a microcontroller, and parking detects and finds available parking gaps by using ultrasonic sensors. The robot is designed to park the car efficiently in narrow parking spaces by using an intelligent algorithm that optimizes parking space.

3. "Design and Implementation of Robotic Car

Parking System Using IoT"

Author: Sharma, V. & Verma, P.

Year: 2020

Abstract: The paper focuses on the implementation of Car parking and management system using Internet of Things (IoT) technology. The system involves a robot that autonomously parks the car in a pre-designated parking spot, with the help of IoT communication. The system allows remote control via a mobile application, which sends commands to the robot. The paper also discusses the integration of cloud computing for data storage and access control.

4. "Smart Car Parking System Using IoT and

Cloud Computing"

Author: Choudhary, R. & Gupta, S.

Year: 2021

Abstract: This paper presents the best car parking & management system with IoT and cloud computing for efficient parking management. The system allows users to check the availability of parking spots through an application, and it uses wireless communication to park the vehicle automatically. The data related to parking spots and vehicle parking status is stored in the cloud, enabling users to access real-time information. The system aims to fasten the time spending searching for parking spaces and improves space utilization.

5. "Autonomous Car Parking System with

Lifting Mechanism"

Author: Singh, A. & Sharma, R.

Year: 2017

Abstract: This system equipped with a lifting mechanism that can lift vehicles to a height and park them in a multi-story parking system.. The vehicle is controlled through a mobile application, and the system is designed to optimize space and reduce the time spent parking. The paper also discusses the application of motors and relay systems for lifting the vehicle.

6. "Intelligent Parking System Using Robotics and Machine Vision"

Author: Zhang, X. & Li, J.

Year: 2016

Abstract: The paper presents thr intelligent park system that will use robotics and machine vision technology to park vehicles. The system employs a robotic arm with an integrated vision system to find parking spaces. The vehicle is autonomously moved into the parking space based on real-time image processing. The study also highlights the using of wireless communication and sensors to ensure safety and efficiency.

7. "Vehicle Parking Robot System with Automated Lift and Slot Detection"

Author: Lee, S. & Kim, Y.

Year: 2019

Abstract: This paper presents the design and implementation of a parking robot that can detect available parking slots and lift a vehicle to the appropriate position. The system consists of different sensors and communication systems to detect the obstacle and determine available parking slots. The robot uses a lift mechanism to elevate the vehicle into the parking slot. The robot is controlled via wireless communication and offers a more efficient alternative to traditional parking methods

3.OBJECTIVE –

• To build a device to lift & park the car at desired location by operating the device through mobile.

• The car can be parked at desired location without the key & driver.

• As the car can be lifted & moved by remote operation, parking can be done safely.

• This will leads to efficient car parking by better utilization of space.

4.COMPONENTS OF THE PROJECT-

1. D C MOTOR

In high-performance systems, with high accelerations, interconnecting shafts and couplings may deflect under the applied torque, such that the various parts may have different instantaneous velocities that can be in opposite directions. Under certain conditions, a shaft may go into torsional resonance.

The primary purpose of a DC motor is to change the energy present in electrical form to the mechanical form. This means it transforms direct current electricity into rotational motion. The versatility of DC motors stems from their ability to provide the control on the speed and the torque required for the efficient working of the equipment. They are commonly found in applications that require adjustable speed, smooth operation, and reliable performance

Fig. D C Motor

2. Toggle Jack:

- A toggle jack is attached to the bottom frame. It is used for lifting the platform.
- Screw mechanism: The screw mechanism attached to the toggle jack allows lifting and lowering of the platform.

3. Rectangular Tube Frame:

The structure that forms the base of the robot. The frame holds various components like motors, wheels, and the toggle jack

4. Relay

A relay is an electromechanical device that controls an electrical circuit by opening and closing switches. It uses a small electrical current to control a much larger current. This makes it useful for various applications. When a small current is applied to the coil, it generates a magnetic field that attracts a movable armature. This movement causes the contacts to open or close, controlling the flow of current in the circuit. Relays are essential components in many electronic devices and systems. They are reliable, versatile, and can be used in various applications

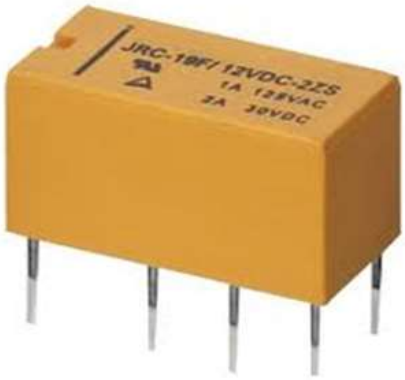


Fig. Relay

5. Battery

Features:

Multi-cell design for installation and maintenance

• Individual valve for each cell

• High quality ABS

• Absorbent Glass Mat (AGM) technology for efficient gas recombination of up to 99%.

• Long life

• Float/cycle use

• Low self-discharge rate

• Use in any position

Fig. Battery

Keep batteries at a comfortable temperature between about 50 and 80 degrees Fahrenheit, and ideally around 75 degrees. Don't let batteries freeze, and keep them off cold concrete floors. If the batteries are kept in the home, they should be in a separate, sealed and well-ventilated space out of reach of children. Promptly recharge partially drained batteries. Some watt-hour meters show the percentage of charge left in the battery (much like most laptop computers). A battery that is only drained to about 90 percent of its capacity will last more than 10 times longer than a battery that is regularly completely drained

6. Motors and Wheels:

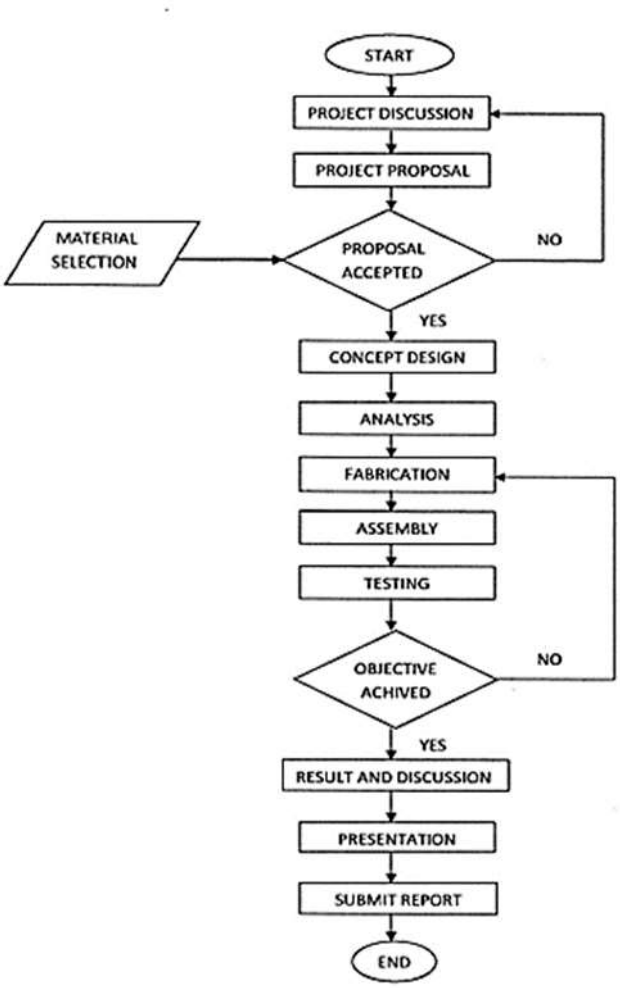
Two motors with wheels: These are used to provide movement (forward, backward, left, and right).

Two caster wheels: These are used for support and easy rotation of the robot, providing stability and smooth movement.

7. HC-05 Bluetooth Module: Enables wireless communication between the robot and a smartphone.

8. Arduino Uno: The microcontroller that processes inputs from the Bluetooth module and controls the motors

5. METHODOLOGY-



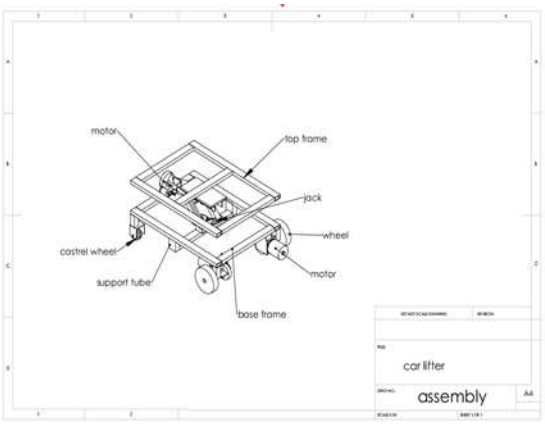
6. RESULTS & DISCUSSIONS

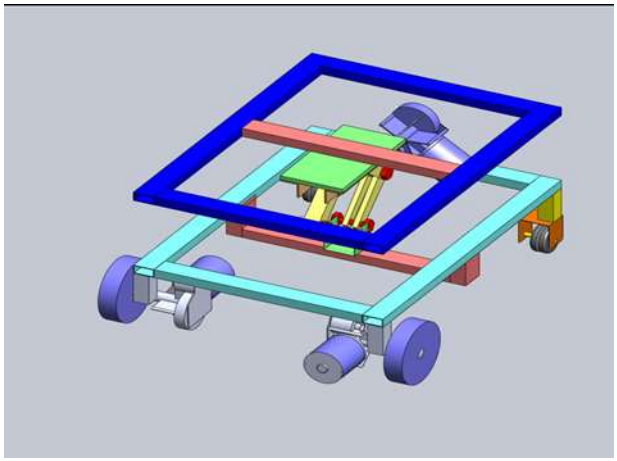
We have taken up this project as real challenge, as we were not experience in the mechanical field. We started our work on this project facing new hurdles initially.

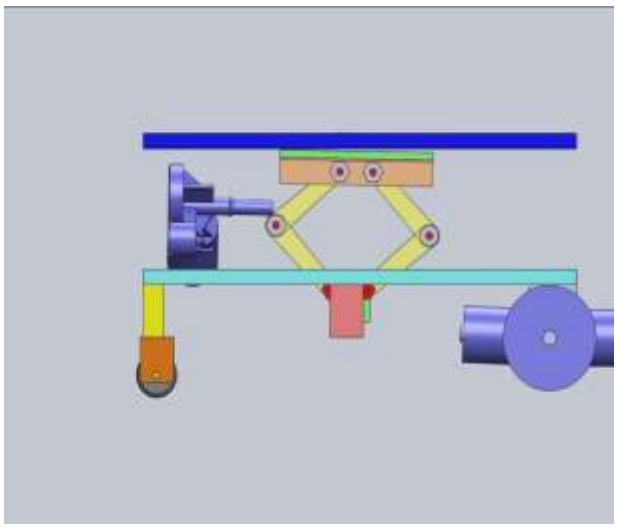
The manoeuvrability of the device is quite good and the handling is quite simple. For commercial purpose one can upgrade the device by upgrading the size and other requirements.

This automatic robot car parking system integrates multiple components such as motors, Bluetooth communication, and a lifting mechanism to create an autonomous platform for parking. The system is controlled wirelessly using a smartphone application, providing convenience and ease of use. The toggle jack screw mechanism efficiently lifts and lowers the platform, enabling parking even in constrained spaces.

7. ASSEMBLY OF THE PHYSICAL PROTOTYPE.







8. FUTURE SCOPE AND CONCLUSION

Automatic robot car parking systems hold significant promise for the future of urban mobility. By automating the parking process, these systems can enhance efficiency, safety, and convenience. They can optimize parking space utilization, reduce parking time and stress for drivers, and improve accessibility for people with disabilities. Additionally, these systems can contribute to safer parking environments by minimizing accidents and enhancing security. As technology continues to advance, we can expect to see further innovations in robotic parking systems, leading to more efficient, sustainable, and user-friendly urban environments.

We have taken up this project as real challenge, as we were not experience in the mechanical field. We started our work on this project facing new hurdles initially.

The manoeuvrability of the device is quite good and the handling is quite simple. For commercial purpose one can improve the efficiency of the device effectively by increasing the size of the device.

This automatic robot car parking system integrates multiple components such as motors, Bluetooth communication, and a lifting mechanism to create an autonomous platform for parking. The system is controlled wirelessly using a smartphone application, providing convenience and ease of use. The toggle jack screw mechanism efficiently lifts and lowers the platform, enabling parking even in constrained spaces.

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