

AUTOMATED CAR PARKING SYSTEM USING PLC

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ABSTRACT

The analysis and design of an Automated Car Parking System Using PLC is presented in this project work. The project's major goal is to develop a fully automated car parking system that requires less human interaction. This proposed concept is designed to address the problem of real-time parking in our daily lives. For people, parking space is not a luxury; it is a necessity. Because the population is growing, we need to discover a better way to park our automobile safely in a congested area and avoid traffic congestion. The Automated Car Parking System is a cutting-edge application designed to tackle real-time parking issues. By a large margin, the parking scenario falls short of the country's existing requirements. The problem has escalated to the point that the number of families with automobiles is far greater than the country's capacity to handle. In the parking project, PLC is used as a control mechanism. A Programmable Logic Controller (PLC) is an industrial computer that has been adapted for the control of manufacturing processes such as assembly lines, machines, and robotic devices. PLCs are known for their great dependability and ease of programming. PLC equipped with sensors and motor is used as the backbone to successfully construct the Automated Car Parking System.

Keywords: PLC (Programmable Logic Controller), Motor, Sensor, LED, Automation, Etc.

I. INTRODUCTION

In the 21st century finding a free car parking space is one of the major problems. This type of issue affects everyone on regular basis since the level of uncertainty is so great, and there aren't many viable ways for resolving it that benefit users by saving time, fuel, and maintaining a positive emotional state. The transportation system is incomplete without parking. On any given working day, nearly 40% of the roads in urban areas are used just for car parking. Cities throughout the world are already congested, and on top of that car parking takes up a lot of time. Finding a parking spot might take a long time and consume a lot of fuel. As a result, it may frustrate the drivers, resulting in accidents.

In this magnetic growing world, Vehicle ownership is at high percentage around the globe, therefore car parking as become a perplexing and a difficult task. Parking has become a daily dilemma in malls, railway stations, and market places, among other places. During the weekends or holidays, finding a spare place can take more than 10 minutes. This not only wastes time and fuel, but it also contributes to pollution, which adds to the heinousness of the parking problem. In this context, it is critical to recognise the importance of implementing an Automated Car Parking System in every urban region.

There are two sorts of parking systems in most cases: (1) traditional parking systems and (2) automated parking systems. When compared to traditional parking systems, automated parking systems are anticipated to be more cost effective and simple in the long run. In addition, there is a worldwide trend toward using an automatic parking system to compute the exact amount of space available for cars.

This project works on one of the most advanced industrial automation systems i.e., PLC (Programmable Logic Controller). PLC consist of analog and digital inputs, analog inputs for the continuous monitoring and digital for sensor monitoring, counters, timers and programmable logic relay. A PLC is used for checking the vacancies. The sensor installed in the system gives PLC information regarding the free space as well as when to open the gate and when not. This system automates the entire parking procedure, which reduces human error, best use of available space, and ensures car security. The PLC system keeps track of the entire operation and alerts the operator if anything goes wrong. This initiative also saves fuel and reduces the risk of an accident or damage occurring in the parking area as a result of manual parking.

II. METHODOLOGY

Stepper Motor

A stepper motor, also known as a step motor or stepping motor, is a DC motor. It's a brushless motor that separates a complete revolution into many equal steps. It's an electromechanical device that transforms electrical energy into mechanical energy. Without a position sensor to provide feedback, the motor's position can be directed to move and hold at one of these steps. The stepper motor is a discrete stepper motor that moves in discrete increments. They have a number of coils that are grouped into "phases." The motor will rotate one step at a time by activating each phase in order. Stepper motors are available in a variety of sizes, types, and electrical properties. Positioning, speed control, and low speed torque are all advantages of stepper motors. Low efficiency, limited high-speed torque, and no feedback are the drawbacks of stepper motors. It has a permanent magnet-like rotor in the middle that turns when force is applied to it. This rotor is encased by a number of stators, each of which is coiled with a magnetic coil. The stator is placed close to the rotor to allow magnetic fields within the stators to govern the rotor's movement. When the PLC tells the stepper motor to open or close the gate, it does so.

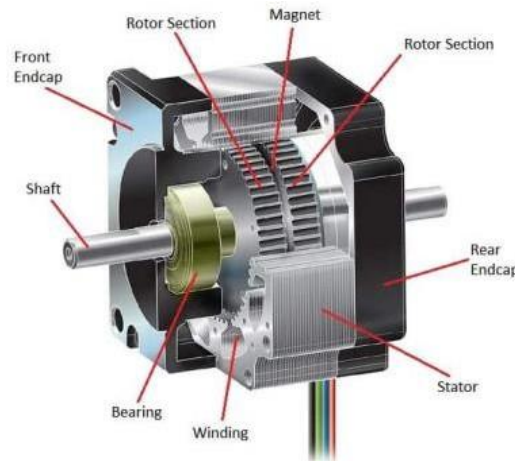


Figure 1: Stepper Motor

Inductive Sensor

Inductive sensors are now a standard component in many machines. These sensors are durable devices that are primarily developed to meet the needs of proximity sensors. A sort of proximity sensor is an inductive sensor. It senses the existence or movement of an object without coming into physical contact with it. They're mostly utilized to find metal things. An inductive sensor is an electrical device that detects or measures objects using the principle of electromagnetic induction. An inductor develops a magnetic field when a current flows through it. A current will flow across a circuit containing an inductor when the magnetic field changes. Metallic objects that interact with a magnetic field can be detected using this effect. These sensors are employed in the field of hygiene and outdoor applications. Because of its touchless position detection and infinite mechanical life, they are widely employed. As a result, an inductive sensor can detect whether or not the car is parked.



Figure 2: Inductive Motor

LED Strips

Product availability has increased, manufacturing has improved, efficiency has increased, and prices have decreased as a result of technology. A semiconductor light source is a light-emitting diode. It emits light when current goes through it. The PLC can easily control it. LEDs are utilised as indicators to direct car drivers to available parking spaces.

The light-emitting diode is today's most energy-efficient and rapidly-developing lighting technology. LED lighting is distinct from incandescent and compact fluorescent lighting. LED lighting can be found in a wide range of residential and industrial products, and the list is growing all the time. LED technology's rapid advancement has resulted in more product availability, improved manufacturing, increased efficiency, and cheaper pricing. A semiconductor light source is a light-emitting diode. When current passes through it, it emits light. The PLC can easily control it. LEDs are utilized as indicators to direct car drivers to available parking spaces.



Figure 3: LED Strips

PLC (Programmable Logic Controller)

The PLC stands for Programmable Logic Controller. It is a ruggedized and adapted industrial computer for controlling manufacturing processes such as assembly lines, machineries, robotic devices, or any activity requiring high dependability, ease of programming, and process fault identification. PLCs have a large number of input and output pins, as well as memory and are easier to programme. Ladder diagram, functional block diagram, instruction list, structural text language, and sequential function chart are the programming languages. The ladder diagram is an example of easy-to-understand and user-friendly terminology.

The SIMATIC S7-1200 PLC is used in our project. Compact, versatile, and scalable automation solutions are required. Standard and failsafe versions of Siemens SIMATIC S7-1200 PLCs are available. With pluggable signal, communication, and module boards, it may be customised to meet specific needs. PLCs automate processes by monitoring inputs and other variable values, making choices based on a stored programme, and controlling outputs.



Figure 4: PLC

III. MODELING AND ANALYSIS

- a) When owner brings the car in front of the gate, the sensor will sense the car & according to the sensor signal the gate will open and car enters into the parking.
- b) System will show the vacant space for the car parking and it will save owners time to find out parking place.
- c) LED's will direct the owner to the vacant car parking space.
- d) An exit gates is also proposed for the ease of parking management.
- e) The Stepper motor is used to open and close the gate.
- f) PLC is used for control mechanism in the parking system.

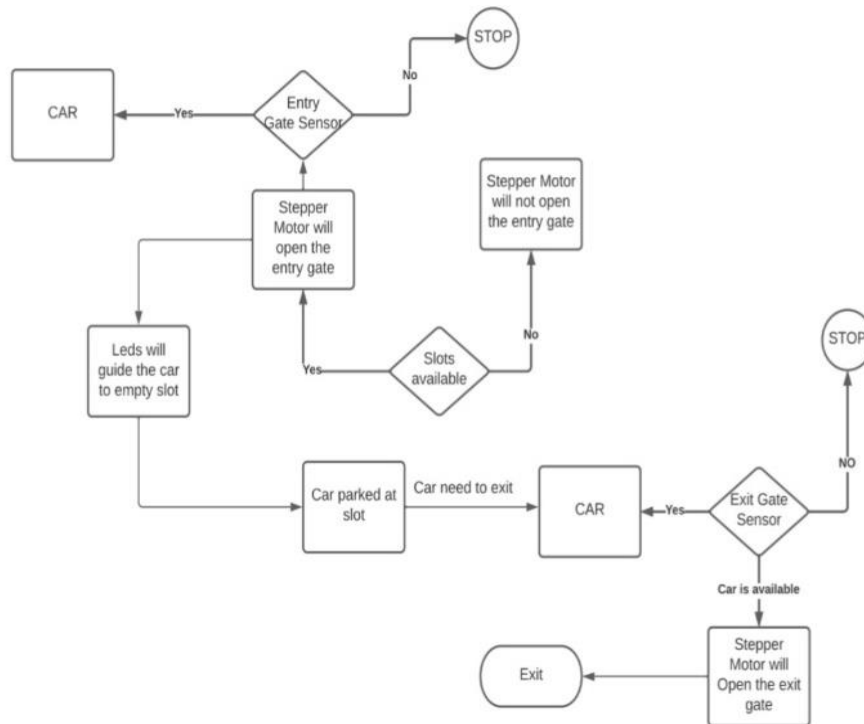


Figure 5: Flowchart

IV. RESULTS AND DISCUSSION

By implementing the Automated Car Parking System, the car owners, the parking supervisor and also our environmental surroundings benefit from it. With this project the software looks for the empty space for parking and guides the driver according to the empty space to park the vehicle efficiently without any trouble.

V. CONCLUSION

By implementing the Automated Car Parking System, the car owners, the parking supervisor and also our environmental surroundings benefit from it. Due to automation, the parking supervisor has less burden of work. While looking at the environment the pollution level can be reduced by decreasing the air pollution. Automation has led to improved safety, higher productive rates and increased productivity, more efficient use of materials and better product quality. The time spent in finding the vacant space for parking the car is reduced which leads to less consumption of fuel, traffic congestion is reduced and also saves time.

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