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International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Smart Parking System with PLC

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ABSTRACT -

We propose a smart parking system using PLC technology to reduce parking problems. Now a days, people adopting a modern lifestyle which gives rise in number of private vehicles which causes traffic jams, road accidents. Due to less number of parking space in urban areas & skilled labours, there is global shift towards automated parking system to calculate precise space available for cars & revenue collection as parking fee. We can tackle above problems by implementing smart parking system using PLC. We have discussed about a parking system comprises a PLC equipped with sensor network & DC motor. Our major goal of this project is to construct a fully automated car parking system with the help of PLC.

Initially entry gate of parking is closed. As soon as a car comes near entry point, sensor will sense the appearance of car & will give command to DC motor to lift entry barricade which will give car access in parking & as car moves away from entry point, barricade will automatically close until next car arrives. Indication system will guide driver towards an empty parking slot.

This system was implemented & tested on a small scale prototype & module demonstrate its effectiveness in improving parking process.

Keywords: DC Motor, PLC, Sensors, Smart Parking System, SMPS.

1. INTRODUCTION -

The demand for parking spots has greatly increased due to the rise in the number of automobiles in urban areas. In urban locations, parking is a typical issue that frustrates drivers. In high population cities, the increase of passenger cars is more rapid. [1] Shopping centres, public parking lots, movie theatres, office buildings, hospitals, etc., are the places with the most parking issues.

In public parking lots, drivers face several problems, such as queuing at the entrance gate and wasting time searching for an open parking space. Although finding a spot can be difficult, many places have free parking. [2] The first hour. How many vehicles are now parked in the lot is difficult to count, Counting the number of open spaces is also difficult.

Smart parking technologies that enhance parking management and maximise the utilisation of parking spaces have been created to lessen this issue. One such system makes use of programmable logic controllers and is a smart parking system (PLCs). [3] There is a global shift towards smart parking system that calculates precise parking and collects money in the form of parking fees due to the shortage of parking places and skilled labour.

PLCs are commonly used in industrial automation and control systems due to their dependability, versatility, and programming ease. [4] This new system is simple to adopt because it is so cost-effective, and it enhances and boosts the reliability of the existing parking system. Intelligent parking systems that use PLCs may automate parking operations, handle data effectively, and monitor parking resources in real-time. [5] As a result, the system is capable of finding available parking spaces and directing drivers to them with greater accuracy and dependability.

This study examines the development and application of a smart parking system utilising PLC, enlisting its benefits and features above conventional parking systems. [6] The benefits of utilising PLCs in smart parking systems are also covered by us.

22. BASIC APPROACH / METHODOLOGY -

We have discussed components used in smart parking system in this chapter. [7]

2.1 PLC –

2.2

Fig. (1) Delta PLC

Programmable logic controller is known as PLC. A central processing unit (CPU), input/output modules, and programming software make up PLCs. The input/output modules link the PLC to sensors and actuators while the CPU regulates how the programme is carried out. [8] The logic controlling the system's behaviour is developed using programming software.

In factories, assembly lines, and other automated systems, PLCs are frequently employed. They are made to work in challenging conditions and offer dependable and effective control over equipment and procedures. [10] In comparison to older control systems, PLCs provide a number of benefits, including flexibility, usability, and simple programming techniques. With a smart parking system, a PLC of the delta type is employed as the control mechanism. [9]

2.3 SMPS –

Fig. (2) 24v SMPS

A power source that adjusts the form of an electric current using switching components like transistors or diodes is known as a switching power supply, or SMPS for short. In SMPS, a rectifier circuit is used to change the supply voltage to DC voltage. In supplying constant DC voltage for PLCs and DC motors, modern power converters like SMPS use less energy and produce less heat. [10] Because to its great efficiency and compact design, it is the perfect choice for power sources in modern electronic gadgets. We have used 24v SMPS with PLC for specified power supply.

2.4 Photoelectric sensor –

Fig. (3) Photoelectric Sensor

Cars in parking lots and at entry and exit points are located, measured, and tracked by the picture sensor. [11] A photo sensor beam of light is transmitted from a transmitter to a receiver, typically in the form of infrared or visible light. The receiver notices the change and alerts the control system to the presence of an automobile if it finds one interfering with the beam.

In comparison to other sensors, photoelectric sensors provide a number of benefits, including high accuracy, quick response times, and extended detection ranges. [12] Furthermore resistant to external elements including vibration, dust, and temperature variations, they can be used in tough situations.

2.5 DC Gear Motor –

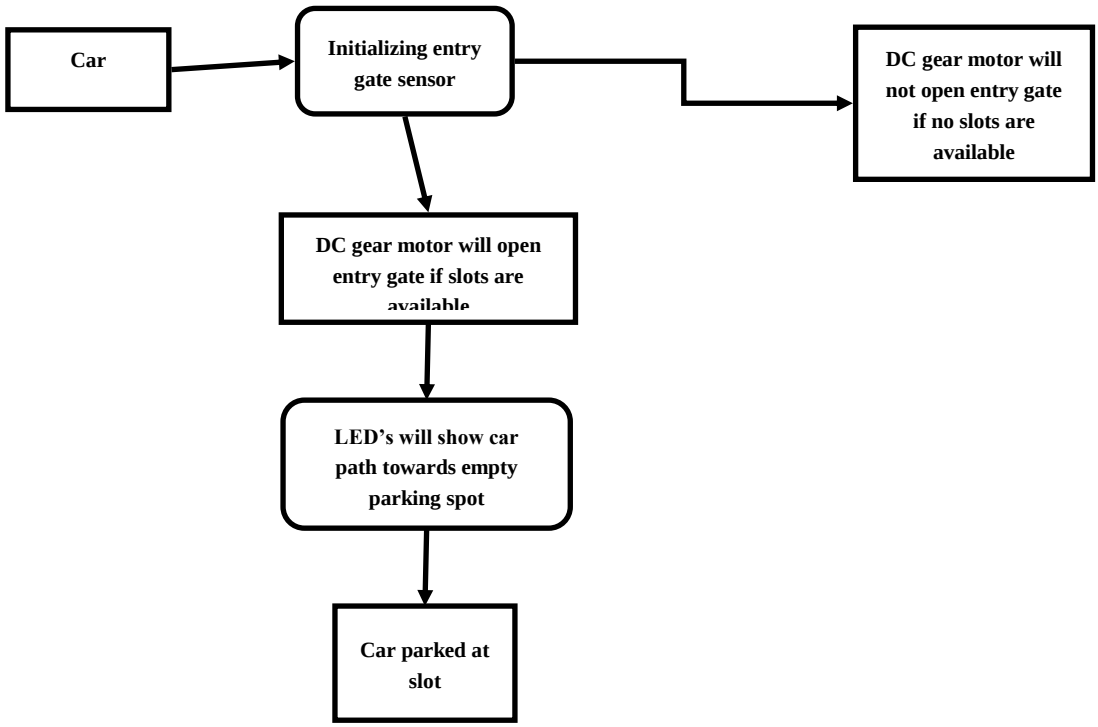

Fig. (4) DC Gear Motor

We selected a DC geared motor with a 12 volt, 10 rpm rating for the entry and exit barricade mechanism since its PLC programming allows for autonomous operation with minimal human effort. When high torque and low speed are required, DC geared motors offer a dependable and efficient solution. [13] They are the favoured option in a multitude of industries, including manufacturing, robotics, and automation, due to their adaptability and flexibility. A mechanical advantage is provided by a DC geared motor, which comprises of a DC motor and a gearbox, by decreasing motor speed while boosting torque output. [14] Several transmission ratios can be used when designing gearboxes to achieve various torques and speeds.

2.6 LED Indicator –

Fig. (5) LED Indicator

LED stands for Light Emitting Diodes which are electronic components that emits light when an electrical current is passed through them. They are commonly used in a wide range of applications, including lighting, displays, and indicators. [15]

Below flow chart show simple work flow of smart parking system while car is entering parking.

Fig. (6) Entry gate & smart parking workflow

Next flow chart shows simple work flow of smart parking system while car needs to exit.

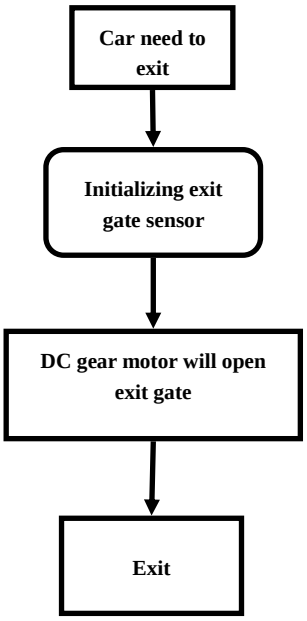

Fig. (7) Exit gate workflow

RESULT –

The results of a smart parking system can be significant, including improved parking availability, enhanced security, increased revenue for parking operators, reduces driver fatigue, less human interaction and improved user experience.

The future scope of smart parking systems is vast and it offers numerous opportunities for innovation and growth.

Overall, implementing smart parking systems can help create a more efficient, sustainable and connected transportation system.

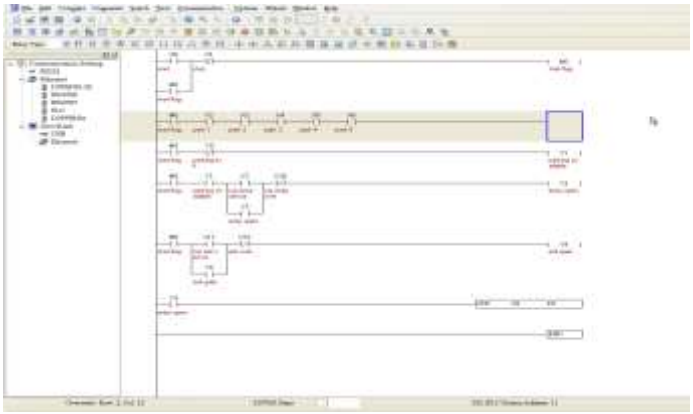

Fig. (8) Ladder diagram of Smart Parking System

- **Ladder Diagram explanation-**

Ladder diagram contains –

1. Rung (1) – It has start, stop & emergency stop feature in case of any emergency condition occ

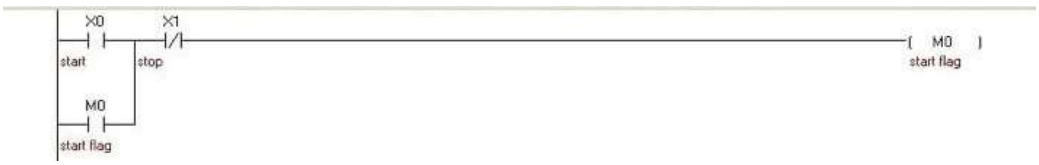

Fig. (9) Rung [1]

2. Rung (2) – It shows number of parking slots denoted as X_1, X_2, X_3, X_4, X_5 & X_6 respectively & Y_0 will indicate condition for all parking slots are full.

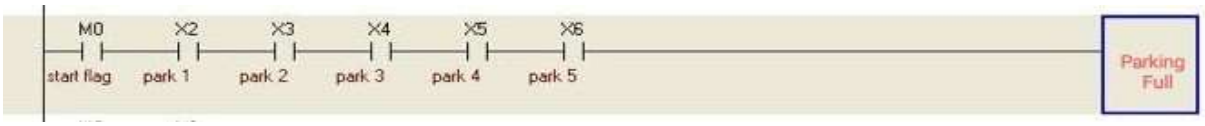

Fig. (10) Rung [2]

3. Rung (3) – This rung indicates the condition for parking slot is available for car.

Fig. (11) Rung [3]

4. Rung (4) – It shows condition when parking slot is available, as car reaches entry point where entry point sensor will sense the car & will open entry barricade automatically. Also as car goes inside parking & barricade will automatically get close until another car appears. That's how car will be easily parked at available spot & counter value will be incremented.

Fig. (12) Rung [4]

5. Rung (5) – It shows the workflow while car needs to exit parking area. When a car comes across exit gate, the exit gate sensor will sense & will open exit gate barricade & car can easily exit the parking area. Counter value will be decremented. Also exit gate will be close after car exit & it will remain close until next car arrives.

Fig. (13) Rung [5]

3. CONCLUSION -

Smart parking technologies can fundamentally change the way we use and park our cars. Using cutting-edge technologies such as IOT, artificial intelligence and PLC, smart parking systems can maximize parking utilization, improve user experience and provide real-time information on parking availability. Smart parking technologies can contribute to a cheaper, more efficient and greener transport system. Smart City components can be combined with smart parking infrastructure to create a more complete and efficient mobility system.

4. FUTURE SCOPE -

- Real time monitoring & reporting can be possible by using this system.
- Smart parking system can be integrate with mobile payment applications to make parking payment more convenient.
- This reduces traffic congestion which will lead to emission reduction & air quality improvement in urban areas.
- We can also implement advance security features such as face recognition camera for security purpose.

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