

RFID Based Smart Rotary Car Parking

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Abstract This project aims to design, build, and implement a Radio Frequency Identification (RFID) Based Smart Rotary Car Parking which will automatically park and retrieve the vehicles without the driver. Present parking systems have several problems, such as high operation costs, inefficient vehicle management, and, most importantly, the time-consuming process of issuing tokens and collecting money. Therefore, we are trying to resolve the above-stated problems by RFID Based Smart Rotary Car Parking. This project uses several sensors, trays and microcontrollers, and sensing circuits monitored by LCD displaying the entry and exit of vehicles. The vehicles are allowed access only when there is an empty tray, and the valid RFID card on the sensing circuit at the gate is punched. Similarly, the RFID card corresponding to the tray needs to be punched when the vehicle wants to exit. A sensor will determine whether a tray is occupied, and the resulting data will be fed to the display. The number of trays that are either empty or loaded will be prominently displayed on the monitor to aid drivers in making a decision. This automated system process allows the parking system to work efficiently and requires fewer personnel to manage the parking. Through the implementation of the RFID Based Smart Rotary Car Parking system, more cars can be accommodated in the same area and can be applied effectively in almost any city in the world. This resulting efficiency is the driving force in the global adoption of smart, automated car park systems in place of conventional car parking systems. This project focuses on the teamwork and engineering design principles process required for solving this problem. Although this approach works theoretically, the reality is that there are many unforeseen variables relating to technical mishaps, availability of desired components, efficient management and myriad other factors that may hamper this undertaking.

Keywords: robotics, parking automation, microcontroller

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1. Introduction

This project aims to develop RFID based smart rotary car parking and thereby increase the efficiency of existing manual parking systems and, in turn, reduce their operational costs by reducing personnel requirement cost of operation processing speeds at check etc. Completing this project would help tackle the increasing demand for parking facilities by decreasing the capital requirement per car slot. It will also provide a platform for monitoring parking demand at different times of the day by which enough data could be gathered to inform future plans or projects.

Dhaka is a densely-populated city that hosts a population of 16 million. It is the capital and busiest city of Bangladesh and is the hub of education, administration, trade, commerce, etc. Dhaka is constantly attracting people and, therefore, traffic from all corners of the country looking for work or education. The current state of parking spaces is woefully inadequate to cope with worsening traffic and the increasing number of private

cars entering the streets of Dhaka, according to the Bangladesh Roads Transport Authority (BRTA).

Although relatively wealthy individuals and their families mainly use these private cars, they constitute almost 25% of all motorized vehicles registered within Dhaka city. Private cars disproportionately affect traffic compared to other vehicles, such as busses and trucks. It has been found that private cars spend almost 95% of their time on the road, creating persistent and regular times traffic jams on busy roads. [1]

RFID based smart rotary car parking is an important way of solving the traffic jam problems and improving the utilization of present parking spaces. For a long while, planners, politicians, engineers and environmentalists have wrestled with the challenge of stowing away cars from busy roads. Ranging from the earliest parking garages— little more than sheds— to fully automated car parks, the demand for a better parking system has been there. However, a promising but feasible concept is the Smart card car parking — a suite of advanced technologies working in unison to drastically improve the speed and efficiency of locating, reserving, and paying for parking.

The need for such a system is critical in chaotic transportation management scenarios like the one in Dhaka city, where most people prefer to use private cars in busy commercial centers. A study conducted by Rahman K. N. (2007) revealed that 60% of the vehicles parked in Motijheel, the city's busiest commercial area, are private cars. Thus, the viability of these commercial areas depends on the availability of convenient parking facilities adjacent to or readily accessible to desired destinations, especially off-street parking facilities. (2012). The problem is worsened by the absence of an effective parking policy for Dhaka, where there is rampant illegal on-street parking on every busy street. [2]

2. History of Smart Parking System

With the increase in the number of vehicles in high-density urban housing, the problem with a limited amount of parking space became apparent. One of the proposed solutions to this problem is the automatic parking system, with the first such system being created in the United States. Between 1940-1950, the automatic systems used were by Bowser, Pigeon Hole and Roto Park. In the years between 1957 to 1974, Bowser and Pigeon Hole systems were used, but due to frequent mechanical problems and prolonged waiting time for the vehicle, the interest in such a solution waned drastically. The concept, however, saw a

resurgence in popularity since 1990, and in 2012 there were 25 projects planned or in progress, which yielded about 6,000 parking spaces. While until 1990, the interest in the systems was mediocre in Europe and Central America, Asia has been using automatic parking systems since 1970. In Japan, since early 1990, about 40,000 parking spaces based on the automatic parking system paternoster type were created. [3]

A car parking system is a mechanical device that multiplies parking capacity inside a parking lot. Parking systems are generally powered by electric motors or hydraulic pumps that move vehicles into a storage position.

There are two types of car parking systems: traditional and automated. In the long term, automated car parking systems are likely to be more cost-effective when compared to traditional parking garages. Automatic multistorey automated car park systems are less expensive per parking slot since they tend to require less building volume and less ground area than a conventional facility with the same capacity. Both automated car parking systems and automated parking garage systems reduce pollution cars are not running or circling around while drivers look for parking spaces. [3]

3. Block Diagram

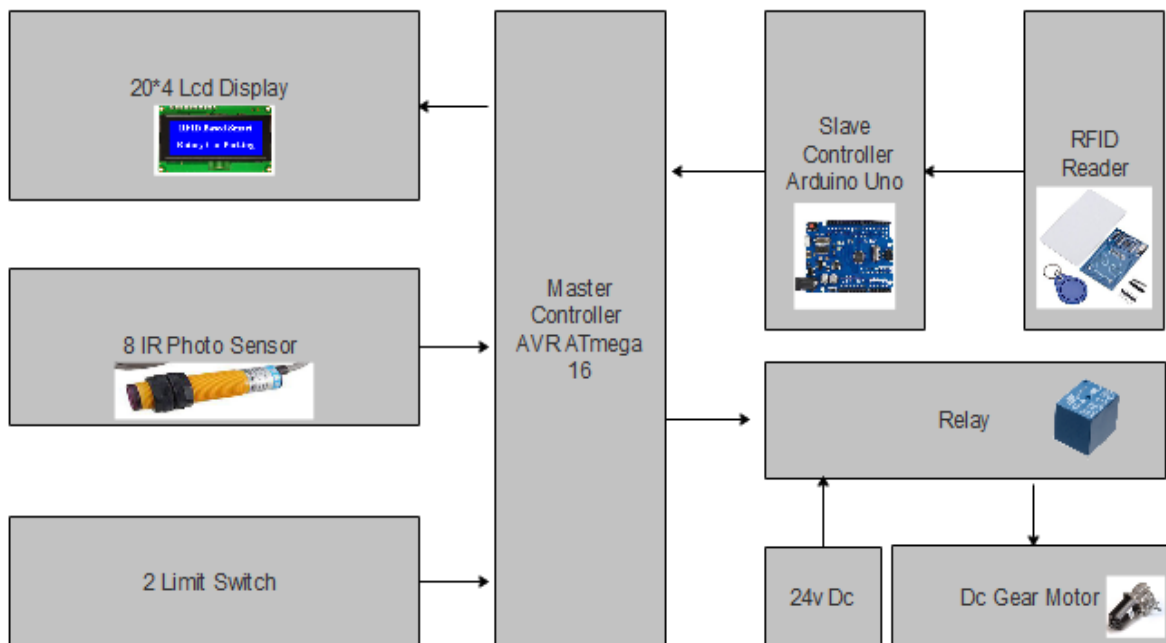


Figure 1. Block Diagram

4. Working Principal

RFID based car parking system is modern and built with safety in mind. Initially, the trays are empty since no cars are loaded. If one car enters the parking, the first tray it enters registers as occupied and the system rotates one at a time, and an empty tray replaces the occupied one's place, ready to receive a new car. The owner of a parked vehicle provides an RFID card in order to release and receive their car. How much rotation occurs is always counted and kept track of by the Master Controller. Here are two limit switches for calculating the cycle and determining the mid-position of the tray. If the two limit switch registers as zero, the tray stays in mid position. When the tray stays mid-point master controller checks car status, RFID etc.



Figure 2. All empty tray



Figure 3. Loading position for car parking

We designed an eight tray-based small car parking system for parking a total of 8 cars. We use an array of 8 IR proximity sensors for Car status checks. If any of the trays are empty, this tray stays in the first position (parking point). If all the trays are occupied by a car, the machine shows a message and stops any new vehicle from parking until at least one car is unloaded.

5. Flow Chart

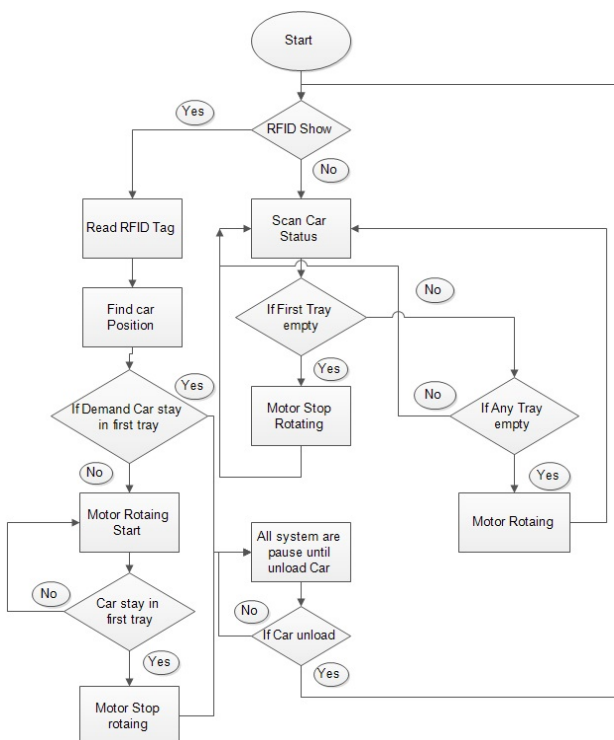


Figure 4. Flow Chart

6. Advantage

Efficiency: RFID based smart rotary car parking provides car parking solutions to accommodate the maximum number of cars in a given space.

Cost-Effective: RFID based smart rotary car parking significantly improves the financial viability of commercial and residential developments.

Saves Time: RFID based smart rotary car parking reduces parking and retrieval time. It saves time spent searching for empty parking slots and the subsequent time spent searching for the parked car.

Easy and Cost-Effective Maintenance: RFID based smart rotary car parking is cost-effective in terms of maintenance and upkeep over conventional parking systems.

Car Safety: RFID based smart rotary car parking provides improved security and safety for the cars. Parked cars are free from theft and damage.

Safer for Drivers: Drivers collect their cars from secure waiting areas and, thus, they do not have to walk through a car park alone and are less vulnerable.

Environment Friendly: RFID based smart rotary car parking uses electricity only when engaged. As drivers don't have to drive around looking for empty slots, cars don't have to be active when parked, thereby reducing fossil fuel consumption.

7. Limitation

1. Maintenance requires highly trained personnel.
2. Quick parking near the entrance is no longer possible; all drivers have to go through the same steps to park and unpark.
3. After entering the RFID card, drivers have to wait to receive their car.
4. Without an RFID card, cars cannot be retrieved. In emergencies like earthquakes and fires, quick evacuation might not be possible.

8. Application

1. Excellent utilization in dense multi-store buildings.
2. Commercial places like shopping malls, hospitals, and corporate offices that see heavy traffic can benefit greatly.
3. This system can be used in educational institutions like schools, colleges and universities.

9. Future Scope

1. In future, it is possible to add more trays for more parking.
2. In our design, we use IR proximity sensors for Car detection, but it has some disadvantages. In future, we can add IR proximity sensors with wet measurement for batter car detection.
3. Stricter security can be implemented by requiring biometrics like eye and fingerprint scanners for car retrieval.

10. Conclusion

The RFID based rotary smart car parking system has been successfully designed and developed. The RFID based rotary smart car parking system is realistic and can control the parking automatically by using the RFID module with RFID smart cards. The total cost of RFID based rotary smart car parking System infrastructure can be reduced. This parking system enables users to operate an unattended parking barrier with controlled parking access privileges. This system is ideal for apartments and condos, gated communities, business parking lots and garages, and university parking areas. The RFID based rotary smart Parking System offers the utmost efficiency, convenience, safety & reliability. It is ideal for today's car parking and traffic problem in cities. The RFID Rotary Smart Car Parking is one of the important factors in traffic areas, multiplexes and apartments etc.

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