IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE)
e-ISSN: 2278-1676,p-ISSN: 2320-3331, Volume 13, Issue 1 Ver. III (Jan. – Feb. 2018), PP 18-22
www.iosrjournals.org

Intelligent Secured Garage for Smart Buildings

C.Mahalakshmi[1], S.Malaika Afra Taj[2], S.Syed Ali Fathima[3],
M.Gayathri[4],M.Kayalvizhi[5], P.Prashanth[6]
UG Scholar[1,2,3,4], Assistant Professor[5],
Department of Electronics and Instrumentation Engineering,R.M.K. Engineering College
Engineer – FAC[6],
Mitsubishi Electric India Private Limited
Corresponding Author: C.Mahalakshmi

Abstract: *Huge traffic in INDIA is due to improper parking system at various places like theatres, apartments, supermarkets etc. This forces the people to park their vehicle on roads. The present project work deals with the automated rotary car parking system that provides an effective solution for the above mentioned problem. This parking system can be easily constructed in a small area, just requiring a simple concrete base and is less expensive when compared to other automated parking systems. As it involves the usage of many automation products like Programmable logic controller for high efficiency in operating the entire process and Human machine Interface for both monitoring and controlling the parking setup. A unique identity for each vehicle is provided by RF card reader. Automated car parking through dedicated Mobile Apps has got a huge potential in our country as many smart city projects are coming up in our nation and a huge investment has already been lined up.*

Keywords: *Automation, PLC, HMI, Radio Frequency (RF) card reader, Rotary car parking system, mobile app(IoT).*

Date of Submission: 20-01-2018 Date of acceptance: 13-02-2018

I. Introduction

The car has been a common mode of transport in all the countries. As a result, the car parking system has become mandatory in every mall, theatre, residential apartments and so on. Our main idea is to improve the parking system in busy places where they use various types of parking systems namely multi-level automated car parking system, Volkswagen car parking and many more. The Rotary automated car parking system (RACPS) belongs to the class of rotary smart car parking system. The traditional parking system such as multilevel or multi-storey car parking system, robot car parking system, automated multilevel car parking system etc have been implemented on a huge scale. But these systems have a major disadvantage of large space consumption which is successfully eliminated with the use of rotary car parking system[1].The present project work is to augment the parking system as rotary car parking system, in which we use Programmable Logic Control (PLC) for performing overall operations. The Internet of Things (IoT) concept is implemented in rotary car parking system which makes it highly advantageous as it provides a reliable and secured parking system. In juncture with this, we are introducing a mobile app that is interfaced with PLC through which we can easily locate our vehicles. For security reasons an electronic identity chip is used that is interfaced with the mobile app. The chip includes a unique ID no for each vehicle that is read by the RF card reader. The user can access the entire parking zone with the help of the mobile app only if he/ she enter the exact OTP.With the help of this facility we can avoid car theft. Full security system is provided to the car.In addition to this, the HMI touch screen is also placed in the parking zone through which the operator can manually troubleshoot the parking system in case of any technical failure. The time for which the vehicle was parked is automatically calculated through IOT concept and the proportioned parking fee is automatically deducted from the authorized user's electronic identity chip. By usage of proximity sensors the entry and exit path is properly synchronized. Therefore, this system does not require a parking attendant and is extremely time efficient. In this process the space required is minimal in comparison with other automated parking systems.

II. Proposed SYSTEM

In our current proposal, we can place 8 cars in a rotary manner. The objective of our project is to park many cars in a limited space. This entire rotary system can be placed in a space, where only 2 cars can be parked in a normal parking system. A Radio Frequency (RF) card reader is being incorporated in the parking zone, which will read the identity of the car when it enters and exits the parking zone. A dedicated web app is

developed through which the user can access the entire parking zone only if he/she enters the exact OTP, which is sent to the registered mobile number. At the entry end of the parking zone, the user can select the vacant parking slots with the help of mobile app. The IoT will send the request of the user to PLC which will respond by bringing down the requested slot through servo motor. Similarly the user can enter the unparking request through the mobile app. Again the IoT will send appropriate signal to the PLC which will place the car at the appropriate position waiting readily for the user to unpark his/her car. In addition to this the total parking time is calculated and proportioned parking fee is automatically deducted from the unique electronic identity chip that this incorporated in each car. The operator can manually troubleshoot the parking system with the help of HMI screen in case of any technical failure. Both monitoring and controlling the overall process can be done with the help of Human Machine Interface. This reduces the complexity of the system. Thus IoT is the master control at user's end and PLC is the master control at machine's end.

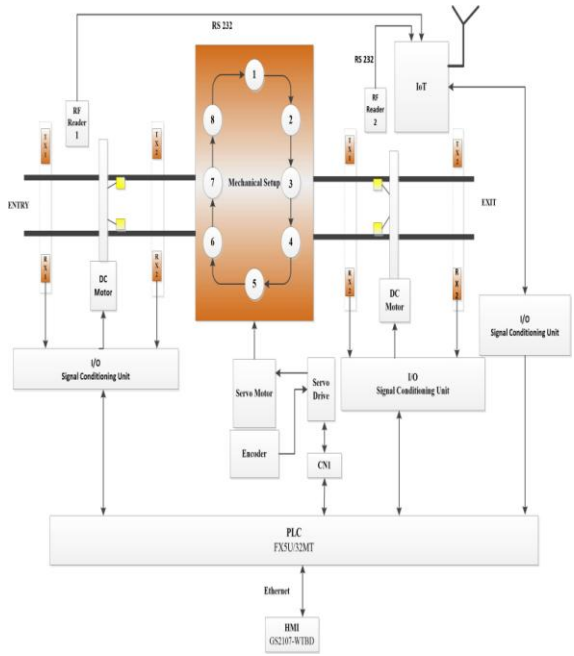

Fig. 1: *Block diagram*

Input Devices: The input devices connected to PLC are as follows: IR Sensors response, IOT response, Servo motor. Gate Control.

Output Devices: The outputs connected to PLC are as follows: Servo drive, IOT, Lamps, Relay Switch and some common connections.

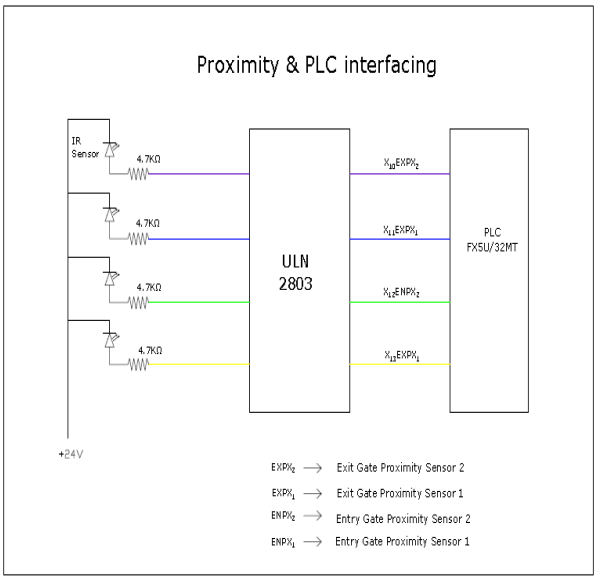

Fig. 2: *Wiring diagram for PLC and Sensor interface*

In our proposal, PLC plays a vital role in controlling the entire mechanical setup by effectively communicating with PLC and Servo drive. The overall functioning of PLC is discussed below:

At the ideal stage the stage value and IoT value is assigned to zero. When the car enters the parking zone, the IR receiver 1 at entry side gets low triggered and passes the signal ENPX1 (Entry Proximity Sensor 1) to X13 of PLC. Now the stage value becomes 1.

The IoT increments to 1 as soon as it gives feedback regarding the authorization of Electronic Vehicle Identity (EVID), which is read by RF, card reader. Now the stage value is 2.

Then the clock input is given to Y17 pin of PLC that issues the command ENGOR (Entry Gate Open Relay) to open the entry gate. After the entry gate is opened, the PLC is informed by passing the signal ENGOL (Entry Gate Open Limit) to input X17.

Now the stage value becomes 3. The IR receiver 2 at entry end is low triggered and stage value becomes 4. After the IR receiver 2 is high triggered indicating that the car has completely crossed the entry gate, the signal ENPX2 (Entry Proximity Sensor 2) is passed to X12 of PLC. Now the stage value is 5.

Then the clock input is given to Y16 pin of PLC that issues the command ENGCR (Entry Gate Close Relay) to close the entry gate. After the entry gate is closed, the PLC is informed by activating the signal ENGCL (Entry Gate Close Limit) to input X16. Now the stage value becomes 6.

The appropriate slot requested by the user through mobile app is brought to the exact position by PLC. This is achieved by effective communication of PLC with IoT and Servo drive through appropriate I/O pins.

During the unparking process, when the car is removed from the slot the IR receiver 1 at the exit side is low triggered and passes the signal EXPX1 (Exit Proximity Sensor 1) to X11 of PLC. Now the stage value is 7.

The IoT increments to 2 as soon as it gives feedback regarding the authorization of Electronic Vehicle Identity (EVID), which is read by RF, card reader. Now the stage value is 8.

Then the clock input is given to Y15 pin of PLC that issues the command EXGOR (Exit Gate Open Relay) to open the exit gate. After the exit gate is opened, the PLC is informed by passing the signal EXGOL (Exit Gate Open Limit) to input X15. Now the stage value becomes 9.

The IR receiver 2 at exit end is low triggered and stage value becomes 10. After the IR receiver 2 is high triggered indicating that the car has completely crossed the exit gate, the signal EXPX2 (Exit Proximity Sensor 2) is passed to X10 of PLC. Now the stage value is 11.

Then the clock input is given to Y14 pin of PLC that issues the command EXGCR (Exit Gate Close Relay) to close the exit gate. After the exit gate is closed, the PLC is informed by activating the signal EXGCL (Exit Gate Close Limit) to input X14.

After the exit gate is closed, the stage value and IoT value is reset to 0.

The above mentioned sequence is indicated with the help of traffic lights for the user to understand. The red, yellow and green indications are controlled by PLC passing the signals TLRED, TLYEL, TLGRE to the pins Y5, Y6 and Y7. Therefore the PLC is the master control of the entire hardware logic.

There are many different patterns by which **IoT idea** can be delivered:-

One of the ideas used in our project is "MVC Pattern" for end user interaction. It stands for MODEL VIEW CONTROLLER where the programming is done in three different ways that is modal in SQL Developer, controller in WEB DEVELOPER, view in UI/UX DESIGNER. The base language used here is **PHP** (Hypertext Preprocessor) is a widely-used open source general-purpose scripting language that is especially suited for web development. It is an eco-friendly language (i.e. the programming codes are easily understandable to the user). The main aim of using the MVC Pattern is communication between the user, android app and database is very easy.

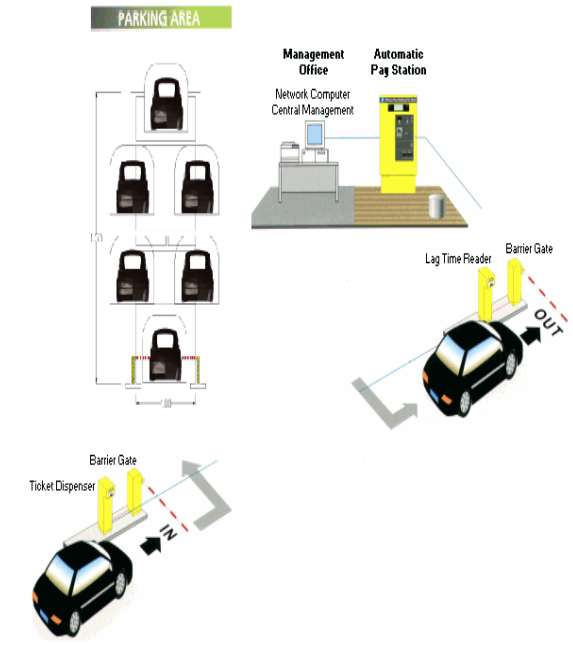

Fig. 4: *Schematic view of overall parking system*

Even though the construction of the mechanical setup is easy, it is necessary to understand the mechanical drawing which is designed below. It involves chain, bearings, slots, sprocket arrangements. Acrylic Sheets are used for this mechanical construction.

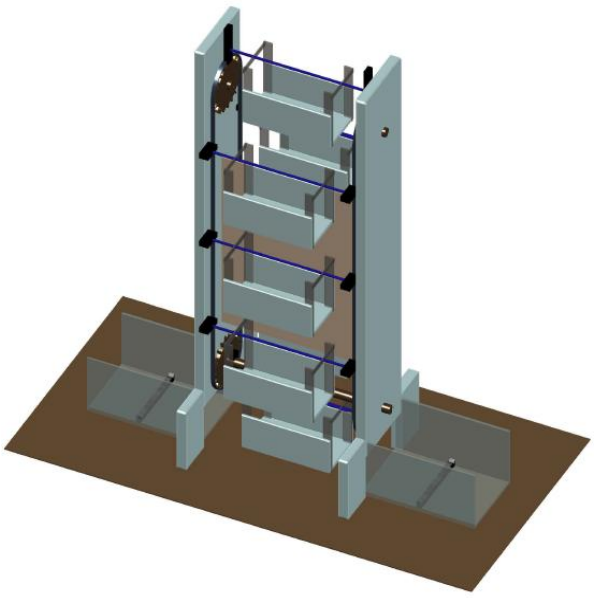

Fig. 3: *3D Isometric view*

III. Hardware Specification

Programmable Logic Controller: Programmable Logic Controller is a controlling device used in the field of Automation [2][3]. Programming in PLC is as simple as compared to any other programming devices like microcontrollers, microprocessors etc. Error can easily detected with the help of fault indicators present in all brands of PLC. Mitsubishi FX-5U-32MT/ES series uses GX Developer (MELSEC) software to develop the ladder logic.

Human Machine Interface: The main purpose of HMI is to control the entire operation manually especially in case of any technical failure. Advancement of Internet of things in HMI technology allows user to

have remote interaction with machines in industries [4]. It has high memory capacity and faster monitoring of speeds. Mitsubishi GS2107 series uses GT Works2 software to develop various operating and monitoring screens.

RFID: Recent developments in RFID and NFC technologies help manufacturer to find out ways of replacing traditional object identification such as bar code with RFID tags. These RFID tags are passive and cheaper tags that enable object tracking a reality [5]. Each card has its own uniqueness in identification of objects, people or animals. The main applications of RFID involve Real Time Location System, Logistics and supply chain visibility, Material Management.

ULN 2803 module: An ULN2803A is a Darlington transistor array and it has a rated high output voltage and collector current of 50V and 50mA. Each Darlington pair has 2.7kilo ohm series base resistor for direct operation with TTL or 5V CMOS devices. It is used as an intermediate chip for communication between sensors and IoT to PLC.

Servo motor: A servo motor is termed as a rotary or linear actuator that controls angular position precisely. A motor is coupled to a sensor, in order to acquire an exact position feedback. Servo motor is used along with servo drive to perform closed loop operation. In the car parking system the servo motor is responsible for the rotary motion of the entire mechanical setup. It is mainly used for positioning the appropriate slots according to the user's request. The encoder feedback gives the information about the current slot to the servo drive. The servo drive compares the current slot with the requested slot which is informed by the PLC. Then the servo drive instructs the motor to bring down the requested slot by providing appropriate pulses. Thus necessary torque and speed is obtained by tuning various parameters.

IV. Result

The Internet of Things (IoT) concept implemented in rotary car parking system is highly advantageous as it provides a reliable and secured parking system. Nearly 6-24 cars can be parked in a rotary manner with a less space consumption of very few m^2. A new method of digitization in parking systems plays a vital role in digital world. Open space can be saved enormously through this system, which can be used for planting trees or for other eco-friendly projects. Thus ensuring a greener environment.

V. Conclusion And Future Enhancement

In this process the space required is minimal and is less expensive in comparison with other automated parking systems. This system does not require a parking attendant and is extremely time efficient. The operator can manually troubleshoot the parking system with the help of HMI screen in case of any technical failure. This reduces the complexity of the system.

Automated car parking through dedicated Web Apps has got a huge potential in our country as many smart city projects are coming up in our nation and a huge investment has already been lined up. The Web App can be further developed into an user friendly Android App in near future.

References

[1]. Chandni Patel, Monalisa Swami, Priya Saxena, Sejal Shah,Rotary Automated Car Parking System,International Journal of Engineering Science and innovative Technology(IJESIT),Vol. 4, Issue 2,March 2015.
[2]. Petruzella, Frank D. (2010)- 'Programmable logic Controllers'- Tata McGraw Hill Education.
[3]. Daniel Kandray,Programmable Automation Technologies, Industrial Press, 2010 ISBN 978 - 0- 83113346- 7, Chapter 8 Introduction to Programmable Logic Controllers.
[4]. Harpreet Singh Saini,R D Daruwala,Computing Communication Control and Automation (ICCUBEA), International Conference, 10.1109/ICCUBEA .2016.7860151.
[5]. V.Ravi,R.Aparna,Security in RFID based Smart retail system Computing for sustainable global development,ISBN 978-9-3805 - 4421-2,31 Oct 2016.

IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) is UGC approved Journal with Sl. No. 4198, Journal no. 45125.

C.Mahalakshmi "Intelligent Secured Garage for Smart Buildings ." IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE), vol. 13, no. 1, 2018, pp. 18-22