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| **M S RAMAIAH INSTITUTE OF TECHNOLOGY**  **(Autonomous Institute Affiliated to VTU)**  **Department of Information Science and Engineering** |
| Image result for msrit logo  August-Dec 2017 |
| A Project Report on |
| **“SMART PARKING SYSTEM USING RFID TECHNOLOGY”** |
| *Submitted in partial fulfillment of the CIE for the subject*  **Project preliminary Report(IS715)**  **By**  **SACHIN POOJERI – 1MS14IS090**  **SHUBHAM PAWAR – 1MS15IS418**  **MD ABDUL AHAD CHANDA – 1MS14IS061**  **SACHEEN ISHWAR ADAVINAVAR – 1MS14IS089**  *Under the guidance of*  **Mohan Kumar S.**  Assistant Professor Department of ISE,  MSRIT  **TABLE OF CONTENTS**   1. Acknowledgement 2. Abstract 3. Introduction 4. Components of RFID Technology 5. General Structure and Design of the System 6. System Design 7. System Analysis 8. Conclusion 9. References   **Acknowledgment**  First of all, I thank the Almighty God for helping me complete this Report. I would also like to express my sincere gratitude to Head of the Department of Information Science and Engineering Prof**. Vijay Kumar B.P**, Assistant Prof. **Mohan Kumar S.** for providing all the help, motivation and encouragement from beginning till the end. I am Also hugely indebted to my friends and other teachers for all their help and support.  **SACHIN POOJERI**  **SHUBHAM PAWAR**  **MD ABDUL AHAD CHANDA**  **SACHEEN ISHWAR ADAVINAVAR**  **Abstract**  There has been a considerable amount of reduction in transaction costs and decrease in stock shortage with the use of Radio Frequency Identification (RFID) technology in automation. Most of the RFID networks include a wide range of automation technologies. These technologies are RFID readers, RFID writers, RFID barcode scanners, RFID smart sensors and RFID controllers. In this study, a solution has been provided for the problems encountered in parking-lot management systems via RFID technology. RFID readers, RFID labels, computers, barriers and software are used as for the main components of the RFID technology. The software has been handled for the management, controlling, transaction reporting and operation tasks for parking lots located on various parts of the city. Check-ins and check-outs of the parking-lots will be under control with RFID readers, labels and barriers. Personnel costs will be reduced considerably using this technology. It will be possible to see unmanned, secure, automized parking-lots functioning with RFID technology in the future. Check-ins and check-outs will be handled in a fast manner without having to stop the cars so that traffic jam problem will be avoided during these processes. Drivers will not have to stop at the circulation points and parking tickets will be out of usage during check-ins and check-outs. It will be avoided ticket-jamming problems for the ticket processing machines as well. Vehicle owners will not have to make any payments at each check-out thus a faster traffic flow will be possible. Since there won't be any waiting during check-ins and check-outs the formation of emission gas as a result of such waiting will be avoided. An atomized income tracking system, a car tracking system for charging and a central parking-car tracking system have been developed and utilized. Instead of cars' parking on streets, a more modern and a fast operating parking-lot system have been developed.  **INTRODUCTION**  Radio Frequency Identification (RFID is a technology that helps to identify the animate or the inanimate through radio waves. RFID is one of the most fundamental technologies enabling wireless data transmission. However, RFID is not a single, simple technology. It consists of tags, readers, computer networks, and systems including middleware, databases, and so forth. There has been a considerable amount of reduction in transaction costs and decrease in stock shortage with the use of RFID technology in automation. Most of the RFID networks include a wide range of automation technologies. These technologies are RFID readers, RFID writers, RFID barcode scanners, RFID smart sensors and RFID controllers. The use of RFID technology is expanding rapidly in numerous applications such as logistics, supply chain management, transportation, healthcare and aviation. Due to the variety of the current applications, typical RFID systems use application specific hardware and proprietary protocols (Tung and Jones 2008).The integration of business systems with factory floor automation is a challenge with many aspects to consider. However, one bright spot is clearly visible: RFID information technology, which helps bridge the gap. RFID is enabling companies to see further into the supply chain than ever before, providing more accurate real-time information and improvements in process efficiency.  **COMPONENTS OF RFID TECHNOLOGY**  **RFID technology is roughly composed of RFID tag and RFID tag reader.**  An RFID tag is composed of chip, power source and antenna. RFID reader/writer and application software can be added to them. The IC chip in the tag is used for data storage and logical operations, whereas the coiled antenna is used for communication between readers (Philips Semiconductor Technology). The tag is divided into active tag and passive tag according to the supply of electronic power.  RFID reader or transceiver is a device that sends RF signal to the tag and receives the information from the tag, and then sends this information to the back office application. The reader may read data from the tag and write data to the  data from the tag and write data to the tag. In general, reader is composed of a RF module, a control unit and a coupling to interrogate electronic tag.  **How does RFID system work?**  **C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\FKIEXP21\rfidlabel2[1].jpg C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\SS960RYQ\ExpressPay-PayPass-PayWave.svg[1].png C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\SS960RYQ\ExpressPay-PayPass-PayWave.svg[1].png C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\SS960RYQ\Wireless_tower.svg[1].png**  **RFID Tag RF Power RFID Antenna**  **C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\SS960RYQ\1375966995[1].png C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\GI9A752E\Alien-Reader-267x300[1].jpg**  **Database RFID Reader**    **C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\GI9A752E\AJ-Computer[1].pngDigital Signal**  **PC**    **RFID Work Scheme**  **GENERAL STRUCTURE AND DESIGN OF THE SYSTEM**  **C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\FKIEXP21\rfidlabel2[1].jpg C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\GI9A752E\Alien-Reader-267x300[1].jpg C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\GI9A752E\barrier-gate[1].jpg C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\FKIEXP21\hp-pavilion-pc[1].jpg**  **TAG READER BARRIER PC**  **C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\FKIEXP21\Data_server[1].png C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\D8ZNEDOO\world-wide-web[1].png C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\FKIEXP21\rfidlabel2[1].jpg C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\GI9A752E\Alien-Reader-267x300[1].jpgC:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\GI9A752E\barrier-gate[1].jpgC:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\FKIEXP21\hp-pavilion-pc[1].jpg**  **Database Server Internet TAG READER BARRIER PC**  **C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\FKIEXP21\rfidlabel2[1].jpg C:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\GI9A752E\Alien-Reader-267x300[1].jpgC:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\GI9A752E\barrier-gate[1].jpgC:\Users\hp\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\FKIEXP21\hp-pavilion-pc[1].jpg**  **TAG READER BARRIER PC**  In this study, controlling of three parking-lot check-ins and check-outs has been achieved by using a central database system. The parking-lots are located on various parts of the city  The primary motive of choosing parking lots located on various locations is to show that this project has a city-wide working scale. The only physical connection with one lot to another is the intranet  The objective of the client software is to monitor and control RFID readers and barriers automatically. The vehicle data processed by RFID readers is transferred to the central server.  Thus the server and client computers are in a synchronized state at all times.  The primary motive of choosing parking lots located on various locations is to show that this project has a city-wide working scale. The only physical connection with one lot to another is the intranet. Phone lines have been utilized for internet connection with four DSL modems to connect three parking lots and a central office. The server containing database management system with current databases has been assigned static IPs at the central office. The same static IP assignment has been done to other three parking lots with DSL modems. The server software which is Windows based and developed by dot net framework 2.0, has been installed on each computer at the parking lots. The objective of the client software is to monitor and control RFID readers and barriers automatically. The vehicle data processed by RFID readers is transferred to the central server. Thus the server and client computers are in a synchronized state at all times. While using hardware for the central management of the parking lots, software to control the hardware has been used as well. RFID readers, RFID antennas, RFID labels, Hubs (RJ45 to serial converters), cars, automatic barriers with RJ45 serial port connection, DSL modems, Cat5e Ethernet cables and laptop computers have been utilized for hardware requirements. To store and manage the vehicle tracking data, a database management system has been used as software requirements. A visual programming language (Microsoft C# 2005) has been used for operating the parking-lots and to reach the collected data.  **Tentative RFID reader technical specifications**   |  |  | | --- | --- | | Frequency range (adjustable) | 865 … 868 MHz | | Transmit power (adjustable in steps of 100 mW) | 0.1 W to 2 W ERP | | Tag read range (with 2x2 antennas, mounted opposite each other) | 10 m(max.) | | Tag read range (with 2 antennas, mounted side by side) | 5 m(max.) | | Number of antennas(configurable) | 2 to 4 | | Impedance(nominal) | 50 Ω | | Standards | EPC Gen 1, EPC Gen 2, ISO-18000-6B, Mixed Mode Operation | | Number of tags read per second | 50 read actions/s | | Data transmission rate for reading (EPC Gen 2) | 160 Kbyte/s at 3 m | | Interfaces | 1 port:RS232 1 port :RS422 1 port: Ethernet RJ45 Digital in/out:3x24 V DC, each 0.5 A | | Communications protocol | RS232, RS422, 802.3af Power over Ethernet | | Antenna Type | Circular polarized | | Temperature range | -25 … +75 0C | | Dimensions L x B x H (in mm) | 320 x 145 x 102 |   **Tentative RFID label technical specifications**   |  |  | | --- | --- | | Frequency range (adjustable) | 865 … 868 MHz | | EPC Code | 96 bits | | Protocol | As per ISO 18000-6B | | Typical read/write distance | 0 … 4 m | | Type of mounting | Adhesive on one side (self-adhesive labels) | | Antenna size | 20 x 88 mm | | Antenna material | Copper | | Operating temperature | -20 … +70 0C | | Dimensions | 101 x 152 mm (4" x 6") | | Material | Paper |   **SYSTEM DESIGN**  **working.png**The system starts working as soon as RFID labels are acquired from RFID centers. Label selling centers are located on certain areas of the city which vehicle owners could easily reach. Upon the purchase of RFID labels, a lot of information concerning the vehicle is recorded to Vehicle Information table of RFIDDATA database. In that way, every one of RFID-enabled vehicles will easily be identified and their check-ins and check-outs to the determined parking lots will be monitored. In this project the RFID labels were distributed by the central server office. When an RFID-labeled vehicle attempts to check-in to a parking-lot, the system queries if the vehicle is registered to the database or not. If it is a registered vehicle and it has not checked out of an unauthorized RFID-enabled parking-lot, the system will allow its entrance. Upon the entrance, the vehicles identification information, entrance date and time and current parking-lot title are recorded in the Vehicle Circulation Info table of the database. The check-in information carries great importance since it will be compared to the check-out information of the vehicle. If a vehicle has made an unauthorized check-out of a parking-lot, the vehicle will not be able to check-in to any of the RFID-enabled parking-lots.  The only solution for the vehicle to check-in is for the owner to pay the fine to the fine office. Upon receiving the approval, the barrier lifts up and initiates the check-in process (Fig. 3).  Is the vehicle registered?  Did the vehicle check -in?  Store check-in info   * Open the gate * Close the gate   Register the vehicle info to the Database  Do not open the gate  Database  Check-in Point  Read Vehicle ID  Read vehicle info |
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**Accessing vehicle information panel through the web interface.**

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When a vehicle drives into the exit area of the parking-lot to check-out, its identification information is queried on the database. If the vehicle is registered to the system and it has not made an unauthorized entry to the parking-lot the check-out process is initiated. The vehicle's check-out date and time is taken into consideration. The check-out date and time total are subtracted from check-in date and time total. The calculated time is converted into minutes thus the elapsed time in the parking-lot is determined. Upon the check-out, the check-in information of a vehicle is found and updated with check-out information. The check-out information means check-out date, time, the elapsed parking time, and the total fee. Moreover, the total fee of the elapsed parking time is updated with the previous related info on the database. If the vehicle has made an unauthorized entry to the parking lot the system does not allow its check-out. In that case, a fine should be paid to check-out again. The check-out process is initiated by lifting off barrier.

Check out Point

Read Vehicle ID

Is the vehicle registered?

Do not open the gate

Read vehicle info

Update check-out info

Did the vehicle check -in?

Database

* Open the gate
* Close the gate

The system starts working as soon as RFID labels are acquired from RFID centers. Label selling centers are located on certain areas of the city which vehicle owners could easily reach. Upon the purchase of RFID labels, a lot of information concerning the vehicle is recorded to Vehicle Information table of RFIDDATA database. In that way, every one of RFID-enabled vehicles will easily be identified and their check-ins and check-outs to the determined parking lots will be monitored. In this project the RFID labels were distributed by the central server office. When an RFID-labeled vehicle attempts to check-in to a parking-lot , the system queries if the vehicle is registered to the database or not. If it is a registered vehicle and it has not checked out of an unauthorized RFID-enabled parking-lot, the system will allow its entrance. Upon the entrance, the vehicles identification information, entrance date and time and current parking-lot title are recorded in the Vehicle Circulation Info table of the database. The check-in information carries great importance since it will be compared to the check-out information of the vehicle. If a vehicle has made an unauthorized check-out of a parking-lot, the vehicle will not be able to check-in to any of the RFID-enabled parking-lots. The only solution for the vehicle to check-in is for the owner to pay the fine to the fine office. Upon receiving the approval, the barrier lifts up and initiates the check-in process

**SYSTEM ANALYSIS**

According to a report, Smart Parking could result in 2,20,000 gallons of fuels saving till 2030 and approx. 3,00,000 gallons of fuels saved by 2050 , if implemented successfully .

U.S. Smart parking system market revenue by parking site,2013-2024

**Need and benefits analysis of smart parking**

• Accurately predict and sense spot/vehicle occupancy in real-time.

• Guides residents and visitors to available parking.

• Optimize Parking Space Usage

• Simplifies the parking experience and adds value for parking stakeholders, such as drivers and merchants

• Help traffic in the city flow more freely leveraging RFID technology.

• Enables intelligent decisions using data, including real–time status applications and historical analytics reports

• Smart Parking plays a major role in creating better urban environment by reducing the emission of CO2 and other pollutants

• Smart Parking enables better and real time monitoring and managing of available parking space, resulting in significant revenue generation

• Provides tools to optimize workforce management

**Challenges and major pain points:**

The major challenge in Parking Systems is of system integration due to wide variety of hardware and software platforms involved and hence possess a great threat or concern to the system scalability. The technology platform supporting P&E , PARC and PUCRS systems comprises of a myriad of hardware sensors, dynamic messaging systems and traffic control devices, wireless and wire line telecommunications systems, computer clients and servers and hardware drivers and application interfaces. Enabling all these devices from thousands of different vendors to communicate and tying them together into one platform is the greatest challenge in reducing the cost and complexity of smart parking. The varieties of infrastructure hardware and software systems that need to be integrated is enormous and add to it the conventional older hardware making investment in Smart Parking solution highly risky and fragmented. Another major pain point comes from the electronic payment vendors. These payment processors provide permit based electronic payment, typically for a convenience fee. The key to many of these hosted solutions is scalability, the ability of the transaction processor to support over wide geographical, market and service areas, with minimal cost.

**Indian Specific Ecosystem Challenges**

* Absence of a robust billing platform leading to possible revenue leakages
* Interoperability between devices/lack of standards.
* Although other countries have solutions deployed, Smart parking does not really provide much solution to two wheelers as yet in India.
* Various Security issues and threats to the installed on-site parking meter.
* The RFID enabled Parking System shall support mechanisms to correlate charging data/records from different RFID Application Service Providers.
* The RFID enabled Parking System shall support triggering M2M Devices to report on-demand information regarding collected data from other M2M Devices
* Smart parking providers will need to establish reliable application programming interfaces (APIs) that enable service partners to provide consumers with access to smart parking services on-line through a variety of channels, including the web, mobile phone apps, connected personal navigation devices and car telematics services

**Testing process for the RFID-controlled parking lot**

Two vehicles will be used for the testing process. An RFID label would be plastered on the windshields of each car. Testing process began right after saving identification information of the cars to the system.

During the testing stage of the parking lot system the following criteria should be taken into consideration:

A single vehicle's check-in and check-out processes were completed. Identification of the vehicle during check-ins and check-outs would be achieved at the distance of 2 to 4 m from the barrier. Then the barrier would be automatically activated for the passage of the car in or out of the parking lot.

Simultaneous check-in and check-outs would be performed. The system could control two barriers at the same time.

One of the vehicles will make an unauthorized entry to the parking lot. Upon its check-out stage, the barrier will not open. Only after the vehicle's fine has been paid up then the gate was open for the check-out.

Upon a regular check-in procedure, when the barrier would be still open, another vehicle following right after it did also makes a successful authorized check-in. The barrier continued working smoothly.

**CONCLUSIONS**

The major enablers or drivers for smart parking essentially are the problems of urban livability, transportation mobility and environment sustainability. Primarily Smart Parking technology is about enhancing the productivity levels and the service levels in operations. Some of the underlying benefits could be lowering operating costs, while building value for customer to drive occupancy, revenues and facility value. We have evolved from traditional servicing channels like toll-booth and parking attendants to incorporate automated pay stations, meters and gates. Parking is a $ 25 billion dollar industry which has seen minimalistic innovations and implementations. The majority of investments has always been in creating energy-efficient hybrid and electric vehicles, which in-turn still doesn’t solve the problem of global gridlock causing the same burden on urban gridlock. Finally, in the long run, smart parking can actually transform the very makeup of our urban landscapes, making them more amenable to people rather than cars. Street to Vehicle communication would be pivotal and crucial along with the Vehicle to Vehicle communication as the success and market readiness of Autonomous vehicle ecosystem lies in collecting and interpreting the data at the Street Level.

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