

NB-IOT based smart car parking system

¹M.Praveen, ²V.Harini

¹Asst Professor ²U.G.Student,

Department of Electronics and Communication Engineering,

Saveetha Engineering College, Chennai.

praveen@saveetha.ac.in¹, harinivelu0109@gmail.com².

Abstract— The main purpose of this paper is to propose a design of an smart car parking system based on NB-IoT commanded by an software application that instructs the number of cars to be parked on assigned parking lot by automating the parking and unparking of the car with the help of features of a website or application. In recent times, the concept of smart city and artificial intelligence has drastically increased great popularity. With the dawn of Internet of things the implementation of smart city is made practically achievable. Continual experiments are made in the field of IoT in order to improve the reliability of urban infrastructure, NB-IoT was developed by 3GPP standard. the use of different modern techniques such as artificial intelligence, argued reality, wireless sensor based, GPS based, vehicle communication based by using either Arduino or raspberry pi board can reduce parking issues practically. But the term smart car parking aims at low cost, wide area coverage, low power consumption, high connectivity. And all these features are provided by NB-IoT.

Keywords—NB-IoT, QR code, android application.

I. INTRODUCTION

Now-a-days the number of vehicles in many cities is rapidly occupying the availability of parking spots in public places. Today Parking has become a alarming issue in almost all urban countries. This problem can be resolved by implementing smart parking wherever possible. Smart parking helps each and every individual or car drivers to available parking spots, making the maximum use of available parking space efficiently, reduce administrative costs, and also the traffic congestion. However, the existing smart parking systems still possess a number of connectivity and integrity issues while coming into real-time existence. Moreover, Street parking spot information cannot be updated periodically and also transmitted to the managing platform. Existing street parking use magnetic detectors which is for only short-range wireless technology that to sometimes prove to be inefficient in progress. This requires the addition of routing gateways, which is the key reason which makes street parking practically hard to hard to implement and maintain on large-scale of smart parking. Moreover, some isolated parking area in rural areas cannot be made receivable to a specific urban parking management platform. As a result of which, the available slot cannot be made to share information to the central server and the roll out of few implementations such as urban parking guidance and parking space sharing are thereby made more affected. For these reasons NB-IoT is enabled.

II. SHORTCOMINGS IN THE EXISTING SYSTEM

An overview of some existing systems show that

the level of automation in them is less only to features like vehicle identity number plate extraction, processing of image based in case of multilevel parking in metropolitan cities. This system aims to reduce the level of human dependability by fully-automating the process of car parking. This in turn will be useful in reducing the traffic congestion and time consumption in searching for empty parking slots manually driving through various parking areas.

The existing methods contain only human monitored systems, by allocating parking slots for the vehicles. This process will be time consuming in busy days as there will more vehicles searching for a parking slot. This will create more difficulties for the customers as well the parking management labors. People with important duties are affected due to this. This can be solved by smart parking systems.

III. ARCHITECTURE OF THE SYSTEM

NB-IoT is the best choice for communications of the Smart Parking Systems in this rapid developing environment. The NB-IoT vehicle detectors have relatively less power consumption compared to all other existing designs and have a stable span of four to five years. NB-IoT sub stations provide more deeper network coverage and the signals are sufficient enough to penetrate through and cover even a underground parking lot. Different from short-range wireless technologies, such as RF technology or ZigBee, NB-IoT Smart Parking Solution uses global server networks and proves to be beneficial to customer.

Reliable network construction: Wireless vehicle detectors and other parking gadgets are connected to a master server provided by servers. These devices transmit and receive live parking informations to the cloud platform in only one hop per message packet.

Reliable maintenance: Unlike short-range wireless technologies, the Narrowband-IoT Smart Parking Solution does not require any gateways or acknowledgement. Network coverage is optimized by servers, which helps to improve implementation and maintenance costs. High reliability NB-IoT is a high quality, high performance, and secure technology, which works on licensed spectrum standardized by 3GPP and is made to lower collisions from other surrounding devices.

The NB-IoT Smart Parking Solution collects parking data such as availability and time of parking and transmits this information to management

Service providers. This improves data size to be generated corresponding to scheduled parking and reduces economic losses. Individuals or drivers can be able to obtain the real-

timelive parking space information. For example, when only few parking spots are available, drivers can be diverted directly to the next vacant parking lot nearby. This eases traffic congestion for drivers in searching for potential spots. Furthermore, self-help payment saves manpower interference to parking supervision.

IV. OVERVIEW OF NB-IOT

NB-IoT Technology is the most innovative solutions among communication devices as it provides various benefits as shown in figure 1. This transmission technology operates in 3GPP standard.

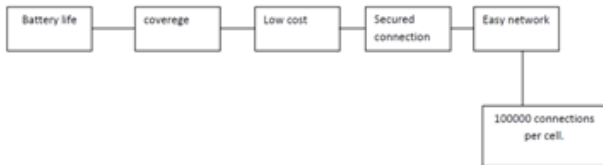


Figure 1. Merits of NB-IOT.

V. PROCESS OF BOOKING

AFTER OPENING THE PARKING MOBILE APPLICATION, THESE STEPS ARE PERFORMED

The user must register by clicking “not yet Register? click here”

Fill the details like Username, email ID and password asked by the application.

If you are a already registered, enter your registered email ID and password and click login.

Now enter the time and check for the availability of the slots.

Select the desired slot and click book.

Now a parking Slot is booked.

VI. HIGHLIGHTS

Highlights of the proposed system

Display the available and unavailable parking slots.

The available slots are highlighted in green color.

The unavailable slots are highlighted in red color.

The timer starts as soon as the user parks the vehicle

When the timer exceeds, a notification is sent to the user.

Once the vehicle has been taken out of the slot, the user cannot re-enter the slot.

VII. HARDWARE DETAILS OF SMART PARKING

A. Sensor

The sensor, once positioned and calibrated, allows to detect the vehicle's presence in the parking.

The technology tracks the earth's magnetic field by the presence of a calibrated iron mass of an object such as vehicle. The status is then transmitted by radio, i.e. by a communication network, to the central server. From the central server, the process starts by combining data with any payment transaction and make them available to all.

B. parking meter/app:

Firstly, enter the car lot number.

The tariff will be displayed on the monitor.

It is made possible to pay with credit or debit card or via net banking.

Take the payment receipt or message from the parking meter. It's possible to extend the parking stop period.

C. For app:

After downloading the app from App store it is possible to make registrations as new user for the very first time. When the registration is complete the App and its features can be configured according to the user's needs:

Cities to use in;

Cards to virtualize;

Connected cards for payments.

Once configuration is done, it is possible to park in the pre allotted slot and pay with the parking lot number either via online or manually.

The Smart Parking App provides real-time data transmission and detailed mapping of the desired zonal area with signaling, through “PINs” that are Varied in colour, the streets where free parking places are available.

C. Central Server:

It constantly communicates with all system peripherals. It should have a maximum security **network**. It instantly communicates with the system variables and updates in real time.

D. Buzzer:

A Buzzer is a device usually electronically used in automobiles, household appliances such as a microwave oven, or game shows. It commonly consists of a number of sensors connected to a central server that determines which button was turned on or a preset time has lapsed, and sends a warning in the form of a continuous buzzing alarm or interrupted beeping sound.

VIII. BLOCK DIAGRAM DEVELOPED BY LORAWAN

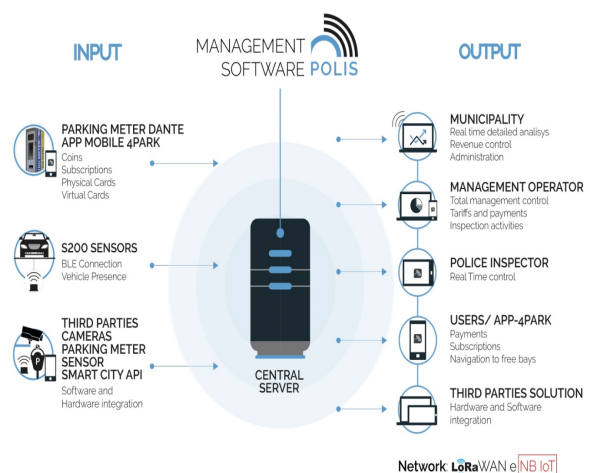


Figure 2. Software developed by Lorawan.

IX. WORKING TECHNIQUE

The powerful processing tool that analyzes summarizes making it available to all Public Administration, parking management companies, controller of parking activities, end users.

The software is one of the main parts of smart parking because it can practically analyze and also manage all input live data entering in the system in real time. Figure 2 depicts the management software developed in Madrid in Huawei laboratories.

Information are available on any of the terminal devices like PC, smartphone, tablet) and they can be distributed and customised for every specific user or admin.

Every information is saved, about car lot availability and about the activities of the system.

A. Advanced Analysis System:

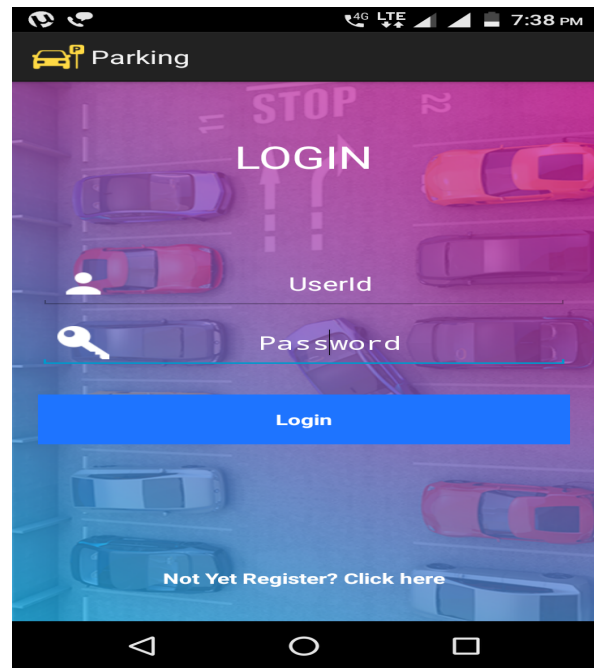
POLIS management software provides parking information, violation protocols, and revenues, continuously in real time. From the terminal is possible to get information about the cash management and other activities Specific alert or security can be created for the maintenance department, notified on smartphone or other terminals.

B. Verification:

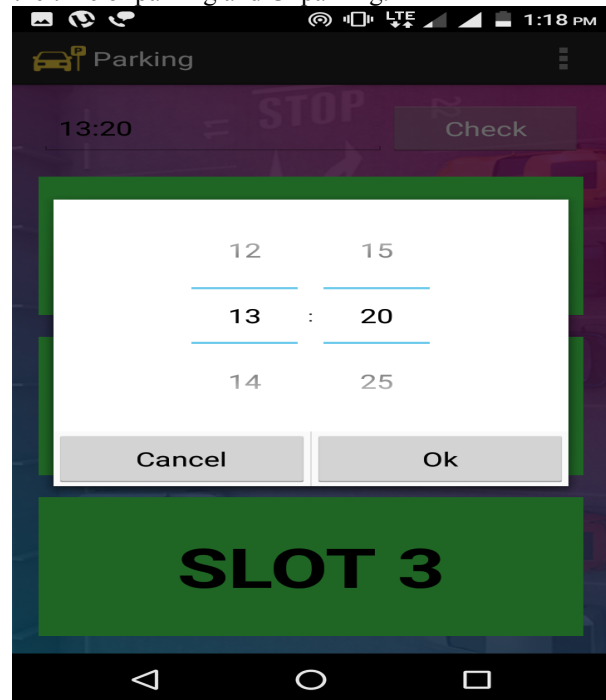
Smart Parking Systems allows to show the controller the way towards the vehicle in case of violation. It is possible to find an ideal way to make the activities as efficient as possible.

X. AND CURRENT PROGRESSES OF IMPLEMENTING WITH RASPBERRY PI AND QR CODE GENERATION

The application proceeds with the registration of details of the user by login or signing up with required detail. Login the parking app by entering the Username And Password if already registered. If new user register by providingName, Phone number, Residential address and Email id.

**Figure 3.** Login page.

Give the timing details for slot booking to Ensure in case of pre booking and to avoid Time delay at the time of parking and Unparking.

**Figure 4.** Parking Time details.

Book the desired slot by selecting it, and clicking book. You can give cancel to select some other different slot.

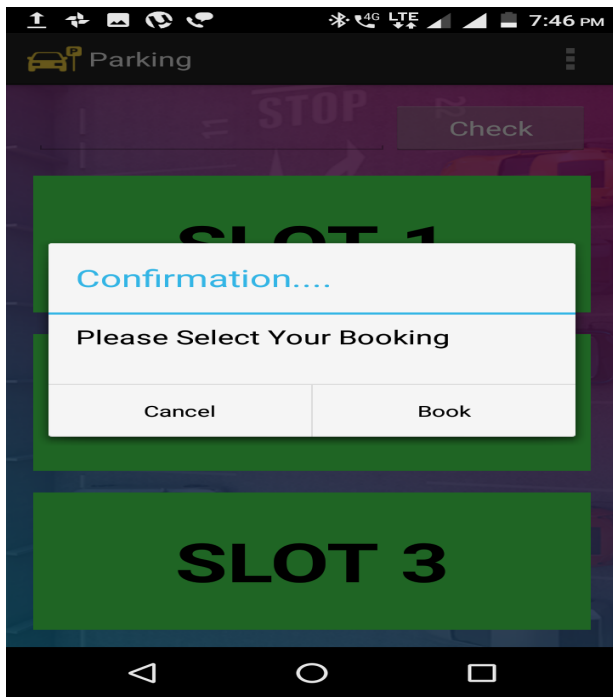


Figure 5. Confirmation page.

The slot 1 is booked. Booked slot is indicated With red color and unbooked available slots are indicated with green color for other users to book the slot .



Figure 6. Booking of desired slot.

Now, the QR code is obtained. This QR code is Used to enter the parking area by scanning this Generated QR code at the entrance.

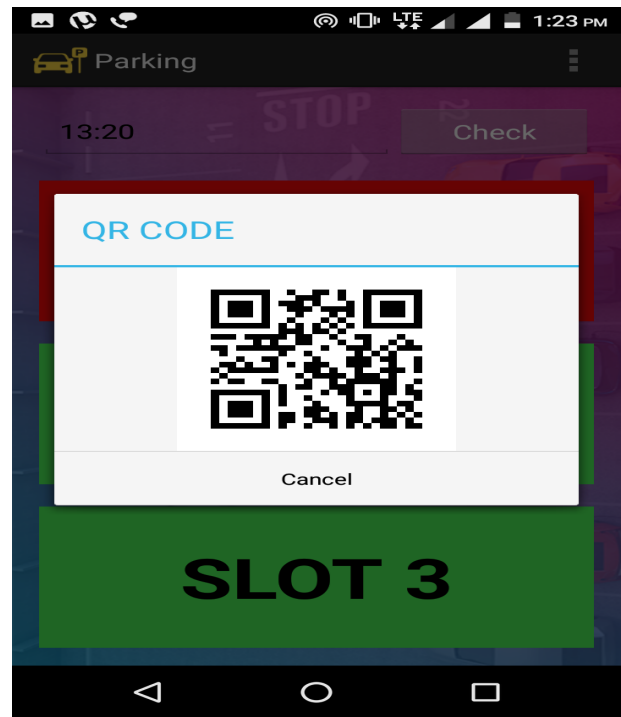


Figure 7. QR code generation.

The QR code is scanned.This QR code consists User details like name, nameplate details etc.

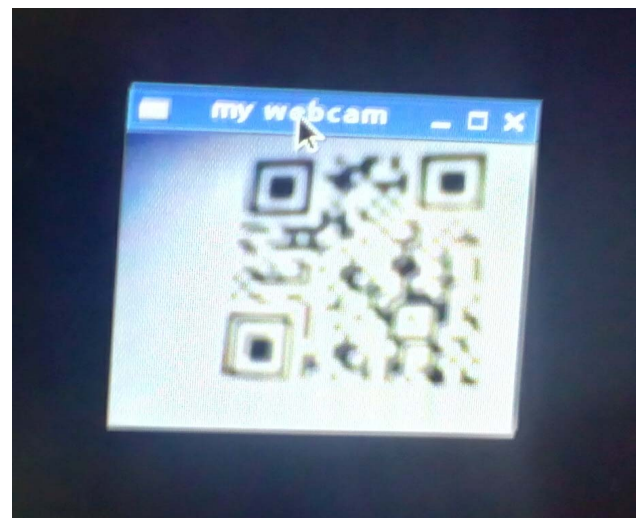


Figure 8. Scanning of QR code.

After scanning, the QR code is matched and the gate is opened. Timer starts for the user.

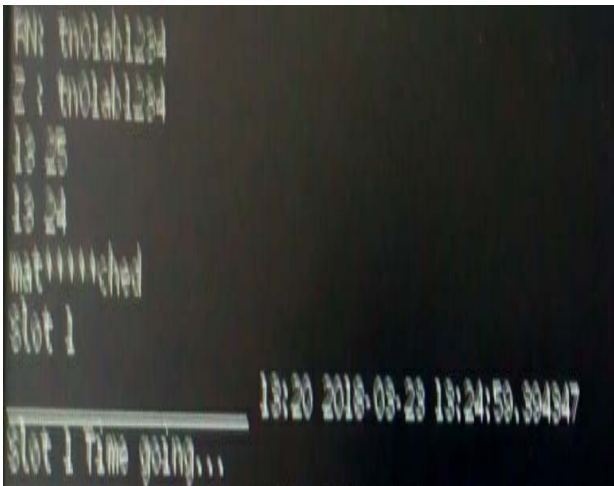


Figure 9. Coding section.

When the time exceeds, the timer stops and a notification is sent to the user.

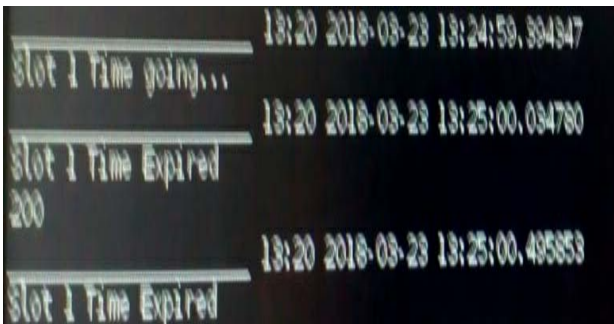


Figure 10. Program of slot booking.

XI. CONCLUSION

Thus, by using this smart system, parking issues can be eliminated without much effort.

The drawback of this system is that only one parking area is considered at a time. So in future, we can implement multiple parking areas within the app. For example, one can have many choices in choosing between malls. It can also be made to find the parking slots available in their location using GPS. Thus these updates can be in future to make this system more reliable in future. This system can be adopted in various malls and complexes so that they solve their customers parking difficulties.

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