Automated Gateway using Raspberry Pi 3

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***Abstract*: The technological advancements are creating a painless and undemanding environment for people to work in. The necessity of using this technology in our daily routine is should be made worthwhile. Therefore, a system is introduced where people can avoid queuing up for tickets and directly board the metro, without wasting their time. This system uses an application that converts the provided information into QR code that is scanned by the camera, extracting the data and subsequently checking for errors. If the data is correct, the gate interfaced with it will open and as soon as the person passes the gate would automatically close. In case the data is incorrect the person would not be allowed to pass through. The whole system is a combination of hardware and software mechanisms.**

***Keywords*: Cloud database, Metro, Mobile Application, Python, QR code, Raspberry Pi.**

1. Introduction

With evolving technology bringing in exorbitant developments every passing day, life is becoming more and more effortless. With the power of technology today, we can acquire everything we need, in just a few clicks. For a hassle-free journey across the city, people prefer using the metro. But they still face inconvenience, predominantly due to the manual ticketing method. The process of buying tokens at the billing counter wastes a lot of time on a daily basis. Regular passengers also might forget their travel cards while using the metro. So as a solution to this inconvenience, an android application can be used comprising of all the necessary functionalities. Subsequently, people won't dawdle for ticket booking nor will there be any chance of losing it. The passenger's travel information will be requested through the application. It will lead to a payment gateway where the passenger can pay using a debit/credit card, e-wallets or net banking. After a successful transaction, a QR code will be generated with all the travel information stored in it.

Quick Response(QR) code is a machine readable code that can encode around 4000 characters. The information stored in the QR code would be saved in the main database via the cloud for validation purposes. A QR code scanner will read this QR code and accordingly take action for opening and closing of gates. This solution would create a whole new facile method of ticketing and solving passengers' day to day issues.

2. Literature survey

Mobile ticketing exists for traveling in railways, buses, and metros. The system is gradually moving towards mobile ticketing for metros as well.

In 2018, the paper entitled with "Automatic ticket printing and ticket checking system for ship service using QR code" introduces a system to automate ticketing and ticket checking by enabling the passenger to enter their details. A printer would then, print the ticket and the ticket would be checked using a camera. An IR sensor was used to count the number of passengers entering the ship.

In 2017, the paper entitled "Android App for local railway ticketing using GPS and QR code" introduces a system to book local train tickets using a mobile application. At the destination, a ticket checker would scan the QR code using a mobile application and the attributes would be validated using a database stored on cloud.

In 2014, the paper entitled "Smartphone Application for railway ticket reservation and validation using mobile network" introduces a system to book railway ticket using a mobile application. The ticket checker would have a mobile application with details of all passengers and a unique ID associated with each passenger.

3. Proposed system

The current method of metro ticketing is manual and time-consuming. The principle motive of this project is to develop an android application which will serve as a medium for the passengers to book metro ticket with utmost ease. It will majorly eradicate the hectic problem of standing in queues for short distance traveling.

The proposed system has two sections:
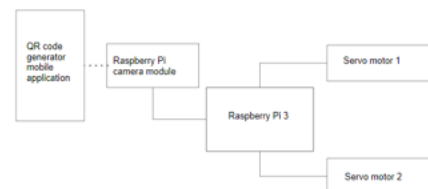- Ticket Generation
- Ticket Checking

Fig. 1. Block diagram

A. Ticket Generation

In this application, the user has to create his account and fill-in his basic details like name, e-mail address, and phone

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610

number. After the user has created his account, he will be directed to the booking page. It will ask for the source, destination, and the number of passengers. Then, the payment process will be initiated. The user can pay using either debit/credit card or e-wallets. After a successful transaction, a QR code will be generated encoded with the travel details. This generated QR code is just for one-time use. The travel details will be stored in the booking database for security purpose.

B. Ticket Checking

The ticket would be checked using a system comprising of Raspberry Pi 3 and a camera module. The camera module is interfaced with Raspberry Pi, scans the QR code and extracts passenger details i.e. source, destination, and the number of passengers. The Raspberry Pi checks whether the extracted source and destination are valid. If invalid, the passenger would be unable to enter the metro station. Servo motor is interfaced with Raspberry Pi to implement the entry or corresponding exit system. The gates would open or close based on the number of passengers.

4. Hardware requirements

A. Raspberry Pi 3

Raspberry Pi is an ARM-based credit sized computer that could be plugged into a computer monitor or TV, keyboard, and mouse to operate. It works on Raspbian operating system and has a quad-core cortex A-53 processor. It has a set of 40 GPIO pins. The available clock speed is 1.2GHz. It has four USB ports and wireless connectivity can be enabled using Bluetooth and Wi-Fi. It can be programmed using Python. An Ethernet port is provided for connecting to the Internet.

B. Raspberry Pi camera module v2

The Raspberry Pi camera module v2 is a high quality 8 megapixels camera. It is capable of 3280x2464 pixels static images and also supports 1080p30, 720p60 and 640x480p60/90 video. It is interfaced to the Raspberry Pi at its CSI camera port.

C. Servo motor SG90

A servo motor consists of a motor, a potentiometer, gear assembly, and a controlling circuit. It works on PWM principle, the angle of rotation is controlled by the duration of the pulse applied at its control pin. It can rotate 180 degrees. The operating speed is 0.1s/60 degree. The voltage range is 4.8-6V

5. Software and Operating System Requirement

A. Android Studio

The mobile application is developed using Android Studio

version 3.2. This platform uses Java programming language to design the application. Various libraries can be included as per requirement.

B. Raspbian OS

The raspberry pi uses Raspbian/Debian or any other operating system based on Linux kernel. It requires an SD card for booting the operating system.

C. Python 3 IDLE

The programming language used to design the system is Python 3 using Python 3 IDLE. The libraries time, PiCamera, GPIO, qrtools of Python 3 are included to implement the system.

6. Conclusion

This project is basically classified into two parts: software implementation and hardware implementation. The software implementation includes creating a mobile application using Android Studio. This application includes various libraries, predominantly ZXing which generates a QR code with the provided data. The final code for the project is programmed in Python.

The hardware implementation includes the interfacing of the camera module and servo motor. The camera module is connected at the CSI port and servo motor is connected to GPIO pin. The camera module clicks a picture of the QR code and extracts source, destination, and the number of passengers. Depending on the number of passengers, the stepper motor rotates a specified number of times.

The proposed system is time-efficient and customer friendly. Minimal cost and labour would be required in the implementation of the system. Also, this project is very well suited according to the Indian market.

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