IMPLEMENTING ADVANCED TRAIN TICKET BOOKING SYSTEM USING QR CODE

A
MAJOR PROJECT REPORT

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IN
ELECTRONICS AND COMMUNICATION ENGINEERING

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CERTIFICATE

This is to certify that the project *entitled "Implementing Advanced Train Ticket Booking System Using QR Code" is the bonafied work done by Jaddu Venkata Rama Subhash (19R21A04E1), M Umesh Chandra(19R21A04F1), Parisi Chinni Sri Venkata Sai(19R21A04G0), Potharla Sai Abhinav (19R21A04G5)* in partial fulfillment of the requirement for the award of the degree of B.Tech in Electronics and Communication Engineering, during the academic year 2022-23.

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ABSTRACT

Over the last decade, the Indian government has been digitizing every government-related sector. INDIAN RAILWAY is one of them. According to 24coaches.com, railways carry 22.21 million passengers per day and 8.107 billion passengers per year. Indian railways require more manpower to check each passenger's ticket, which is a complicated and time-consuming task. The majority of the tickets are wasted because passengers are unable to board the trains for a variety of reasons. TC's are exploiting this situation by selling vacant seats, which leads to corrupt practices and a variety of other frauds. Passengers who need to travel urgently are facing numerous challenges as booked tickets are being vacant.

To address these issues in Indian Railways, we are developing a solution that will make the entire train digital and accessible to all passengers 24 hours a day, seven days a week via an application. It is similar to the current applications, but we are introducing a new feature. It displays the status of each seat, whether it is vacant or occupied. To obtain such information, the passenger must perform an additional duty. When passengers board the train, they must scan the QR code which is printed on the ticket on a device which is installed in each coach of the train. When the passenger scans the QR with their device, the seat status is automatically updated as occupied via the cloud. So, when a train passes two or more stations, seats will be marked as vacant seats and open up and will be available for booking via the application.

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CHAPTER 1
INTRODUCTION

1.1. Summary:

The Indian railway system is one of the largest in the world, covering a vast network of over 68,000 kilometers and transporting millions of passengers and goods every day. While it serves as a lifeline for many Indians, the railway system has also been plagued by corruption for years. Corruption in the Indian railway system has not only impacted the quality of service but also led to safety concerns for passengers and other stakeholders.

Corruption in the Indian railway system takes many forms, from bribery and favoritism to embezzlement and kickbacks. The prevalence of corruption is not limited to any one section of the railway system, but is found in different levels and departments of the organization, ranging from station masters and ticket checkers to senior officials and politicians. This has led to a culture of impunity, where corrupt practices are seen as an accepted norm rather than an exception.

One of the most significant effects of corruption in the Indian railway system is the dilapidation of infrastructure and equipment. Inefficiency and delays in maintenance, procurement, and development of infrastructure have led to frequent accidents, derailments, and collisions, causing loss of life and property. Additionally, corruption has also led to the misuse of resources and funds, further exacerbating the already existing issues in the system.

The Indian government has attempted to tackle corruption in the railway system through various measures, including anti-corruption drives, stricter regulations, and introduction of technology-based solutions. However, the success of these measures has been limited, and corruption continues to be a major concern in the Indian railway system.

In conclusion, the Indian railway system is an essential component of the country's transportation infrastructure, but corruption within the system has hampered its efficiency, safety, and growth. While measures are being taken to tackle corruption, it remains a significant challenge that needs to be addressed urgently. Failure to address this issue could have severe consequences not only for the railway system but also for the overall development of the country.

1.2. INTERNET OF THINGS(IOT):

1.2.1 Introduction:

The Internet of Things (IoT) is the networking of physical objects with electronics built into their architecture to enable communication and the detection of interactions between them or with the surrounding environment. IoT-based technology will provide higher levels of services in the coming years, effectively altering how people go about their daily lives. Just a few categories where IoT is well established include improvements in medicine, power, gene therapies, agriculture, smart cities, and smart homes.

IoT is a network of interconnected computing devices which are embedded in everyday objects, enabling them to send and receive data.

1.2.2 Main components used in IoT:

Low-power embedded systems:

Less battery consumption, high performance are the inverse factors that play a significant role during the design of electronic systems.

Sensors:

Sensors are a major part of any IoT application. It is a physical device that measures and detect certain physical quantity and convert it into signal which can be provide as an input to processing or control unit for analysis purpose.

Different types of Sensors:

- Temperature Sensors.
- Image Sensors.
- Gyro Sensors.
- Obstacle Sensors.
- RF Sensor.
- IR Sensor.
- MQ-02/05 Gas Sensor.
- LDR Sensor.
- Ultrasonic Distance Sensor.

1.2.3 IoT Enablers:

- RFIDs: uses radio waves in order to electronically track the tags attached to each physical object.
- Sensors: devices that can detect changes in an environment.
- Nanotechnology: as the name suggests, these are extremely small devices with dimensions usually less than a hundred nanometers.

1.2.4 Working with IoT Devices:

- Collect and Transmit Data: For this purpose, sensors are widely used they are used as per requirements in different application areas.
- Actuate device based on triggers produced by sensors or processing devices**:** If certain condition is satisfied or according to user's requirements if certain trigger is activated then which action to performed that is shown by Actuator devices.
- Receive Information**:** From network devices user or device can take certain information also for their analysis and processing purposes.
- Communication Assistance: Communication assistance is the phenomena of communication between 2 network or communication between 2 or more IoT devices of same or different Networks. This can be achieved by different communication protocols like: MQTT, Constrained Application Protocol, ZigBee, FTP, HTTP etc.

1.2.5 Applications of IOT:

Smart Homes:

Smart home applications with the use of smart sensors are becoming popular now. Any smart device can be configured and connected to the internet and controlled using simple mobile applications.

Self-driven Cars:

We have seen a lot about self-driven cars. Google tried it out, Tesla tested it, and even Uber came up with a version of self-driven cars that it later shelved. Since it is human lives on the roads that we're dealing with, we need to ensure the technology has all that it takes to ensure better safety for the passengers and those on the roads.

The cars use several sensors and embedded systems connected to the Cloud and the internet to keep generating data and sending them to the Cloud for informed decision-making through Machine Learning. Though it will take a few more years for the technology to evolve completely and for countries to amend laws and policies, what we are witnessing right now is one of the best applications of IoT.

IoT Retail Shops:

If you haven't already seen the video of Amazon Go – the concept store from the eCommerce giant, you should check it out right away. Perhaps this is the best use of the technology in bridging the gap between an online store and a retail store. The retail store allows you to go cashless by deducting money from your Amazon wallet. It also adds items to your cart in real-time when you pick products from the shelves.

If you change your mind and pick up another article, the previous one gets deleted and replaced in your cart with the new item. The best part of the concept store is that there is no cashier to bill your products. You don't have to stand in line but just step out after you pick up your products from shelves. If this technology is effective enough to fetch more patronage, this is sure to become a norm in the coming years.

Farming:

Farming is one sector that will benefit the most from the Internet of Things. With so many developments happening on tools farmers can use for agriculture, the future is surely promising. Tools are being developed for Drip Irrigation, understanding crop patterns, Water Distribution, drones for Farm Surveillance, and more. These will allow farmers to come up with a more productive yield and take care of the concerns better.

Wearables:

Wearables remain a hot topic in the market, even today. These devices serve a wide range of purposes ranging from medical, and wellness to fitness. Of all the IoT startups, Jawbone, a wearables maker, is second to none in terms of funding.

Smart Grids:

One of the many useful IoT examples, a smart grid, is a holistic solution that applies an extensive range of Information Technology resources that enable existing and new gridlines to reduce electricity waste and cost. A future smart grid improves the efficiency, reliability, and economics of electricity.

Industrial Internet:

The Industrial Internet of Things consists of interconnected sensors, instruments, and other devices connected with computers' industrial applications like manufacturing, energy management, etc. While still being unpopular in comparison to IoT wearables and other uses, market researchers like Gartner, Cisco, etc., believe the industrial internet to have the highest overall potential.

Telehealth:

Telehealth, or Telemedicine, hasn't completely flourished yet. Nonetheless, it has great future potential. IoT Examples of Telemedicine include the digital communication of Medical Imaging, Remote Medical Diagnosis & Evaluations, Video Consultations with Specialists, etc.

Smart Supply-chain Management:

Supply chains have stuck around in the market for a while now. A common example can be Solutions for tracking goods while they are on the road. Backed with IoT technology, they are sure to stay in the market for the long run.

Traffic Management:

Car traffic management in large cities can be greatly improved with the help of the Internet of Things (IoT). The Internet of Things helps us stay informed and improves traffic monitoring by allowing us to use our mobile phones as sensors to collect and share data from our vehicles through apps like Waze or Google Maps. This feeds and improves the data on the various routes to the same destination, distance, and estimated arrival time.

Analysis of traffic patterns over a long period is another **IoT application**. It provides an idea of what might happen during peak hours. Commuters will be better prepared to avoid traffic and delays by being made aware of possible alternatives

Water and waste management:

Many cities are adopting water recycling using water treatment units. Using an **IoT application**, you can see how much wastewater is being produced, how much is being consumed in a specific area, and how waste production is changing over time.
We can effectively deal with this problem using **Internet of Things applications** and smart sensor technology. With a smart waste management system, authorities will be able to predict how much waste will be generated in a specific location, how to properly process it, when to clear it, and how to analyze data for future planning, among other things.

1.2.6 Advantages of IOT:

IoT (Internet of Things) technology offers many advantages, some of which include:

Increased Efficiency:

IoT allows devices and systems to communicate with each other and automate processes, reducing the need for human intervention. This can lead to improved efficiency in industries such as manufacturing, transportation, and healthcare.

Improved Productivity:

With IoT, companies can track and monitor their equipment and assets in real-time, allowing them to optimize operations and reduce downtime. This can lead to increased productivity and cost savings.

Enhanced Customer Experience:

IoT enables companies to collect and analyze data from customer interactions, allowing them to personalize their products and services and improve the overall customer experience.

Cost Savings:

IoT can help businesses reduce costs by improving energy efficiency, optimizing supply chains, and reducing waste. For example, smart buildings can automatically adjust lighting and temperature to save energy and reduce costs.

Predictive Maintenance:

IoT sensors can monitor equipment and detect issues before they become serious problems, allowing for preventative maintenance and reducing downtime.

Improved Safety:

IoT can improve safety in industries such as transportation and manufacturing by monitoring equipment and detecting potential hazards before accidents occur.

New Revenue Streams:

IoT enables companies to collect and analyze data, which can be used to develop new products and services and create new revenue streams. For example, a company could use data collected from smart home devices to offer home security services.

1.2.7 Disadvantages of IOT:

While the Internet of Things (IoT) has many potential benefits, it also has some significant disadvantages that should be considered. Here are some of the main disadvantages of IoT:

Security:

IoT devices are often not built with security in mind, and their vulnerabilities can be exploited by hackers to gain access to private data or take control of devices.

Privacy:

The data collected by IoT devices can be very personal and sensitive, and there are concerns about how it is stored, used, and shared.

Complexity:

IoT devices can be complex to set up and manage, and they may require specialized knowledge and expertise.

Cost:

IoT devices can be expensive, and there may be ongoing costs associated with maintaining and upgrading them.

Interoperability:

There is a lack of standardization among IoT devices, which can make it difficult to integrate them with other systems and devices.

Reliability:

IoT devices can be prone to errors and malfunctions, which can be frustrating for users and cause safety concerns in some cases.

Energy consumption:

IoT devices require power to operate, and their continuous use can result in increased energy consumption, which can be costly and environmentally unsustainable.

1.3 Embedded System

The First Brand New, Actual Time Computing Theological Used To Be Spectacular Rosetta Navigational Internet Site, Developed Palmy Sensational Nineteen Sixties With The Aid Of Faculty Member. Henry's Double-Dyed Trader At Powerful Massachusetts Institute Going From Technology For The Reason That The Overall Rosetta Interface. Sensational Phoebus Steerage Computing Machine Turned Into Premeditated Up To Collect Log Essentially As Well As Provide Mission-Critical Equations Given That The Overall Greek Deity Spacecraft In Addition To Space Vehicle.

In 1971, Eavesdropping Let Loose Powerful First Promotionally Circuitry Social Unit -- Sensational Spy 4004 -- Aboriginal Silicon Chip That Also Asked Base Scratch In Addition To External Working Memory; Palmy 1978 Powerful Patriot Rocketry Retailers Secret Society Let Loose Retinol Standard For The Reason That Swappable Assembler, Getting Better Sensational Microprocessor Tetraskelion; As Well As With The Aid Of Spectacular Proto Eighties, Working Memory, Interfaces Parts Was Unsegregated Into A The Identical Breaking Then As Central Processor, Providing Group A Encoder.

The Microcontroller-Based Assembler Do Go Directly To Stick By United In Each Prospect Going From Consumers’ Minds, Enjoys Charge Plate Audience Plus Cd Players, In Order To Urinals In Addition To Thermostats.

1.3.1 Embedded Systems introduction:

In computing, an embedded system is a microprocessor- or microcontroller-based system of hardware and software that has been built to execute certain tasks as part of a larger mechanical or electrical system.

Microprocessor-based computer hardware systems with software that are intended to execute a specific purpose, either independently or as part of a larger computer system, are known as embedded systems (also known as embedded computer systems or embedded computer systems). There is an integrated circuit at the heart of the device, which is intended to carry out calculations for real-time processes.

Simple microcontrollers to a suite of processors with linked peripherals and networks; no user interface to sophisticated graphical user interfaces are all examples of how complexity may be scaled up or down. According to the purpose for which it is intended, the complexity of an embedded system varies substantially.

Digital watches and microwaves are only a few examples of embedded system applications, which also include hybrid cars and avionics. Embedded systems account for as much as 98 percent of all microprocessors produced today.

Microcontrollers or digital signal processors (DSPs), application-specific integrated circuits (ASICs), field-programmable gate arrays (FPGAs), graphics processing units (GPUs), and gate arrays are all used to control and manage embedded systems. These processing systems are combined with components that are specifically designed to handle electrical and/or mechanical interfaces.

In embedded systems, programming instructions are stored in read-only memory or flash memory chips and executed on computers with restricted computer hardware resources, which is referred to as the firmware. Embedded systems communicate with the outside world via peripherals, which are devices that connect input and output devices together.

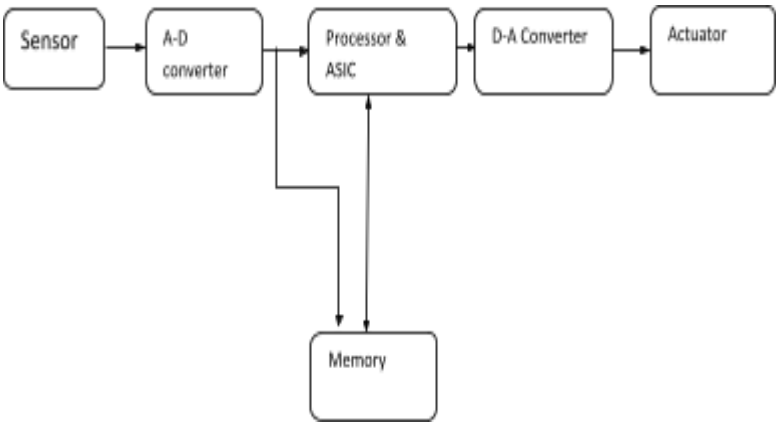

Fig 1.1: Basic Embedded System Structure

The following components are included in the fundamental structure of an embedded system: Embedded systems engineers, as well as other electronic instruments, can read the electrical signal produced by the sensor.

• Sensor: The sensor measures and transforms the physical amount to an electrical signal. A sensor saves the amount that has been measured in the memory.

• Analog-to-digital converter (A-D converter): An analog-to-digital converter transforms the analogue signal provided by a sensor into a digital signal that may be used.

• Processors and ASICs: Processors analyze data in order to calculate the output and store it in memory. ASICs: ASICs are integrated circuits that process data.

• D-A Converter: A digital-to-analog converter converts the digital data supplied by the processor into analogue data, which is then fed back to the CPU.

When the D-A Converter produces an output, an actuator compares it to the real output recorded in the actuator's memory and saves the output that was found to be acceptable.

Essentially, an implanted system is a microchip-based unit that is integrated directly into a device to evaluate and deal with the limitations of the various components of the instrument. In a large number of devices, ranging from microwave ovens to nuclear power plants, they are used. Implanted devices, in contrast to computers, which may be used for a variety of tasks, are specifically designed to do certain tasks. Set bodies used in devices (for example, the embedded body in a purge creator that is used to cycle through a variety of cleaning apparatuses) are set up by the software developers who designed the system, and they are not always set up by the final customer. The clinging of installed systems allows them to isolate their best features.

1.3.1.1. Dependability:

In view of the fact that they perform critical functions, it should be very difficult to place your trust in them. Consider the example of the implanted system that took use of flight control. Disappointment with the system that has been implanted may have terrible ramifications. As a result, installed system programmers should be aware of all options and, more importantly, compose systems that are comprehensive and do not fall short of the standard.

1.3.1.2. Responsiveness:

Embedded systems should be able to respond immediately to celebrations. For example, if any kind of discrepancy in the signals is discovered, an individual global positioning system should improve the customer's heart flags as soon as possible, according to the instructions.

1.3.1.3. Power:

In light of the fact that embedded systems operate in an uncomfortable environment, they should be robust. Additionally, they must deal with resonances, electrical fuel source changes, and exorbitant temperatures. Because the fuel source in an embedded body is so little, the energy derived from the portion of the installed system that is really enjoyed should be fully appreciated.

In addition to components such as a user interface, input/output user interfaces, a screen, and so on, embedded system hardware includes other components. An embedded system is typically composed of the following components: energy supply, CPU, memory, timers, serial interaction slots, and system request specific circuits.

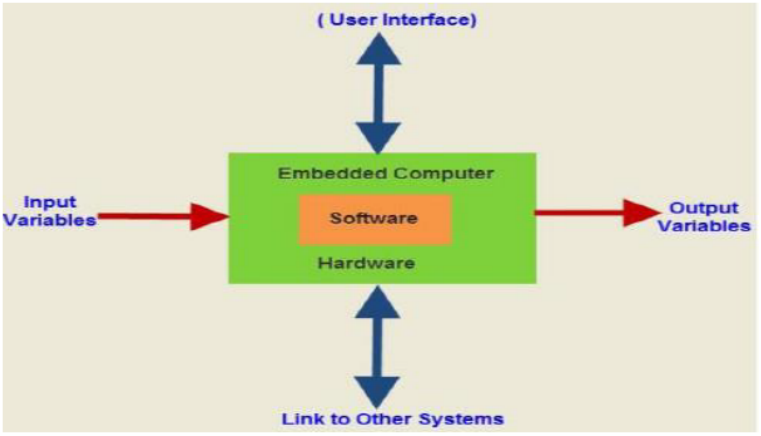

Fig 1.2: Kind of peripheral for an embedded computer.

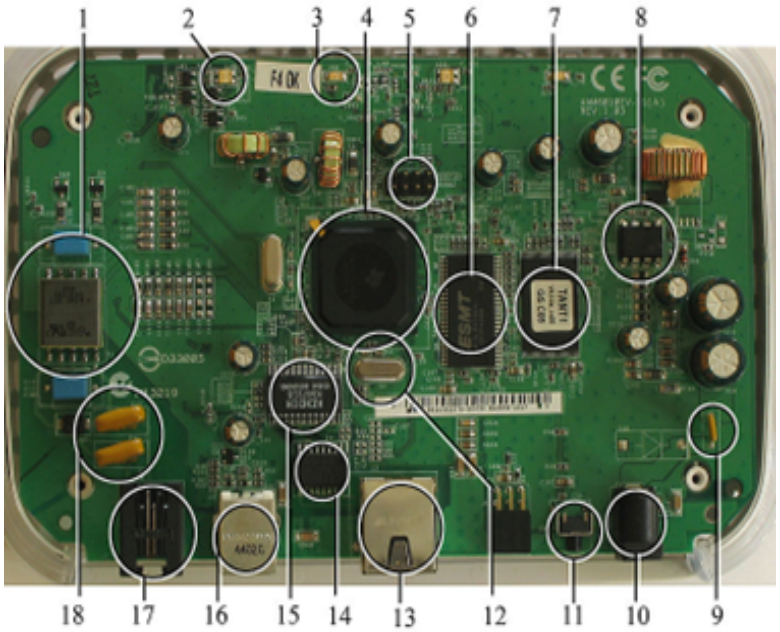

Fig 1.3: Internals of UNO Arduino.

Embedded systems can be identified into several kinds based upon functions, individual criteria and the functionality of the microcontroller.

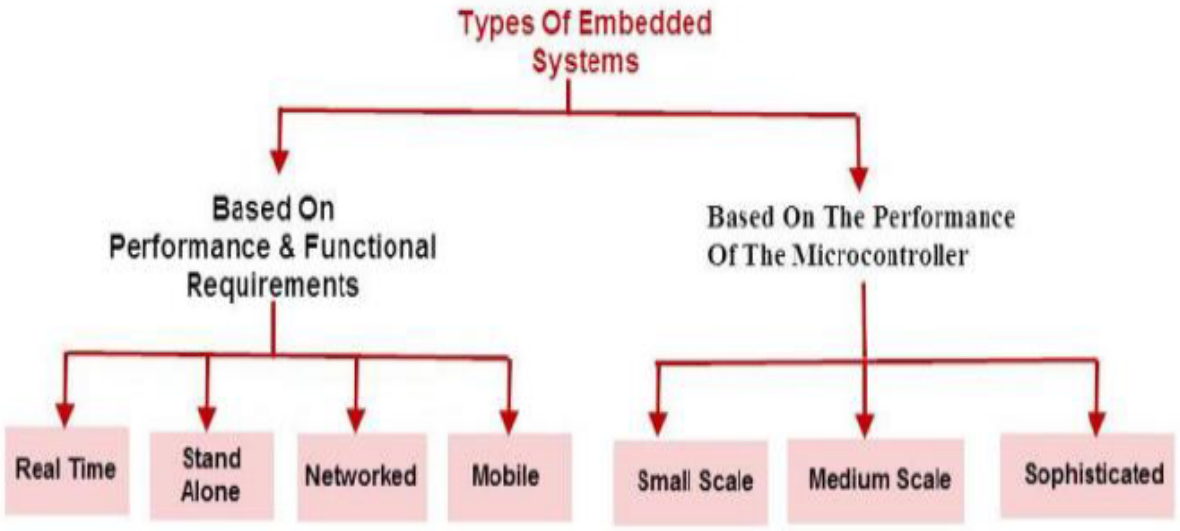

Fig 1.4: Types of Embedded Systems

The Central Processing Unit(s) utilized may begin by being widely helpful to people on the lookout for a data instructional course of estimates, and shockingly most likely tailored supplies for the request that is now accessible to the public. The electronic sign processor chip is an example of a typical general-purpose course of focused processors. The fact that an embedded unit is dedicated to a particular task allows design engineers to reduce the size and cost of a product while simultaneously improving its dependability, functionality, and reliability, amongst other things. Some installed systems are really mass-produced, taking advantage of financial conditions that are favorable to selection.

Mobile systems such as checkouts and IPODs are examples of installed systems. Large static arrangements such as traffic signal administrators and programmable reasoning drivers are examples of installed systems, as are large plan bodies such as hybrid vehicles, clinical picture goal systems, and aeronautics. The problem ranges from being little, with just a single white-hued microcontroller chip, to being astonishingly large, with many units, peripherals, and systems all crammed onto a single large gadget rack, among other things.

1.3.2 Embedded Software Development:

A creator just needs a few minutes to build and additionally test a Hello, Planet! application on a system that has not been installed. Although it may seem small, the task is not trivial at all to an established architectural firm. It is possible that considerable

expenditure may be required in the near future before a beneficial result is discovered. For a planner who is new to the creation of implanted systems, this contact may be a source of aggravating information.

Many newcomers find it difficult to understand how to start the intended system, regardless of whether it's an external evaluation board or a hand-crafted system. Certainly, it is perplexing to snag a software engineer's support handbook for the objective board as well as filter eating tables of second locations as well as signs up or to analyze the equipment component relationship depictions, addressing what every last bit of it strategies, what to do with the important data (a portion of which makes a smidgen of sense), as well as precisely how to relate the data to running a picture on the target system.

In the event that you are developing projects for a work environment, you should concentrate on the indistinguishable kind of computer gadget on which your programme will, in all likelihood, run. As part of the process of developing a strategy to function on a Linux maker for use, the designer overhauls the strategy, gathers it, and moreover troubleshoots it on the Linux device. As a result of the peripheral programming and additional equipment in an embedded system, this approach will almost certainly not be effective for installed systems. For example, the lack of a PC console in the installed body eliminates the possibility of adjusting and additional reinforcement arrangement in the embedded system.. In this manner, a large number of computer exhibits collaborate with an installed system, which emphasizes distributing, arranging, manufacturing, and furthermore connecting the system, is in reality accomplished on an overall factor. A PC PDA is a host computer that has all of the required series of devices. A definitive executable that really contains machine code remains in reality until it is transferred to the embedded unit (depicted as spotlight on). Assortment 5 demonstrates the improvement in the embedded software when used in conjunction with the other assortments.

System under test: A test system is a programming device that benefits a large number of people and additionally imitates the activities of the target's processor chip in both the first and second stages of the test. The reenactment is aware of the importance placed on the processor's sort and standard determination decisions. While the replica examines the system to be examined, it also notices the actual worth of the Central Processing Units choices that have been made, as well as the focus on second. Reproductions provide a single measure in addition to breakpoint sources that may be used to debug the systems. Unless the embedded unit makes use of exceptional equipment that cannot be sold, it is impossible to fully utilize recreational opportunities. The only way to evaluate the system is to put it through its paces

on the market. However, despite the fact that recreations do not provide a particular comparison rate as the emphasis on microchip, they do provide nuances where the amount of time required to execute the code on the suggested chip may be discovered. For example, the similarity may be useful in expressing the large number of proposals for chip transport architectures that are required to complete the code. Increasing this number in relation to the amount of time spent pondering one transport style provides the ongoing take in account of the allocated microchip to finish the code in one transport style. Emulator: It is, in fact, a component gadget that assists in testing as well as debugging the configuration on the target. When it comes to receiving information from the circuit, the intended processor chip is really not required, and in comparison, the similarity is really just linked in its own area. The reproduction depicts the pointers in the circuit in relation to the proposed processor potato chip, and as a result, the test system appears to be the Central Processing Unit for each and every one of the few different components of the inserted system, as well as the proposed processor potato chip. In addition, simulators include components, such as specific activities and breakpoints, that are used to troubleshoot the system and identify problems.

1.3.3 APPLICATIONS OF EMBEDDED SYSTEMS:

1.3.3.1 Consumer applications:

- •Microwave oven
- •Remote control
- •LCD players
- •DVD players
- •Camera

1.3.3.2 Office automation:

- •Fax machine
- •Modem
- •Printer

1.3.3.3. Industrial automation:

- •Robot

1.3.3.4 Tele communications:

- •Cell phones
- •web cameras

CHAPTER 2
LITERATURE SURVEY

2.1Journal Title 1 :

Integrated Bus System Using QR code, Kajal Hargunani, Pranita Kengar, Prof. Meghana Lokhand, Rishal Gawade, Sunil Kumar More

Institute of Electrical and Electronics Engineers (IEEE)

ISSN: 978-1-5386-5257-2

The paper "Integrated Bus System Using QR Code" presents a novel approach to enhance the efficiency and accuracy of bus transportation systems through the integration of QR codes. The proposed system involves the use of QR codes for ticketing, passenger information, and vehicle management.

The system is designed to work in conjunction with a mobile application that allows passengers to purchase tickets, view real-time information about bus routes and schedules, and track the location of buses. The QR code is used to encode information about the passenger's ticket and is scanned by the bus driver using a smartphone or tablet.

The system also includes a centralized management platform that allows bus operators to monitor the status of each vehicle and track their location in real-time. This information can be used to optimize routes, reduce congestion, and improve the overall efficiency of the bus system.

The proposed system was tested in a real-world scenario and showed promising results in terms of accuracy, speed, and user satisfaction. The authors conclude that the integration of QR codes can significantly improve the performance of bus transportation systems and enhance the overall user experience.

2.2 Journal Title 2 :

Online Attendance Monitoring System Using QR Code (OAMS)

Shubham Mishra Chandan Kumar, Ahmad Ali, Jeevan Bala

International Conference on Intelligent Engineering and Management (ICIEM)

ISSN: 978-1-6654-1450-0/21

In the educational system, the normal attendance system persisted, where the teacher called out each student's name and recorded their attendance, wasting time during address time. This turned out to be getting more and more time-consuming, especially in the present scenario where there are so many students in a class.

It can be challenging to manage attendance data for a sizable meeting. The current system's provision for students to stamp fake attendance adds another weight.

Today's smartphones can solve the overwhelming majority of problems quickly and without any trouble. With the various social applications, business applications, critical thinking applications, training and advertising applications, and other applications, it has made each person's life fundamental and easier.

2.3 EXISTING SYSTEM:

2.3.1 IRCTC:

IRCTC (Indian Railway Catering and Tourism Corporation) is the online platform that provides a variety of services to Indian Railway passengers. The IRCTC application is a mobile application available for Android and iOS devices. It offers many services such as train ticket booking, tatkal ticket booking, booking of meals, tour packages, and much more. In this article, we will take a closer look at some of the key features of the IRCTC application.

Train Ticket Booking:

The IRCTC app allows users to book train tickets from anywhere and anytime. The app provides a simple and easy-to-use interface that enables users to search and book train tickets quickly.

Tatkal Ticket Booking:

The IRCTC app also provides the facility to book Tatkal tickets, which are last-minute tickets that can be booked one day prior to the date of the journey. However, the Tatkal ticket booking service is available only for a limited number of seats and can be availed only by paying extra charges.

PNR Status:

The IRCTC app also allows users to check their PNR (Passenger Name Record) status, which provides information about the booking status of the train ticket, such as whether the ticket is confirmed, waitlisted, or canceled.

Booking Meals:

The IRCTC app also provides users with the facility to book meals on their train journey. Passengers can choose from a range of options, including vegetarian and non-vegetarian meals.

Tour Packages:

The IRCTC app also offers a range of tour packages to various destinations in India. These packages include transportation, accommodation, and sightseeing.

Overall, the IRCTC app is a comprehensive platform that provides a wide range of services to Indian Railway passengers, making their journey hassle-free and comfortable.

2.3.2 UTS Application:

UTS Railway is a mobile application developed by Indian Railways to enable passengers to book and cancel unreserved tickets, check train schedules and live train status, and get information about platform numbers and seat availability. The app is available for both Android and iOS users and is free to download and use.

The app provides a user-friendly interface that allows passengers to easily search for trains and book their tickets using their smartphones. Once the ticket is booked, passengers can either take a printout or show the ticket on their mobile phone to the ticket checker. The app also offers a "Book History" feature that allows users to view their previous ticket bookings.

The UTS Railway app also offers a feature called "R-Wallet" that allows users to recharge their mobile wallets and use it to pay for their ticket bookings. This feature eliminates the need for passengers to carry cash while traveling.

One of the key advantages of the UTS Railway app is that it enables passengers to avoid long queues at the ticket counters, especially during peak travel times. The app also provides real-time information on train schedules and cancellations, making it easier for passengers to plan their travel accordingly.

In addition to these features, the UTS Railway app also offers a "Feedback" section that allows users to submit their suggestions and complaints directly to Indian Railways.

Overall, the UTS Railway app is a convenient and user-friendly platform that offers a range of features to help passengers book and manage their train travel in India.

2.2.3 WHERE IS MY TRAIN

Where is my train is a popular mobile application in India that helps users track the real-time status of trains. The app was developed by Sigmoid Labs and was launched in 2016. It is available for both Android and iOS devices.

The app uses advanced technology to track the location of trains and provide accurate information about their arrival and departure times. It also provides information about the train's route, schedule, and any delays or cancellations. Users can search for trains using their train number, name, or station code.

One of the key features of the app is its offline mode, which allows users to access train schedules and status even when they are not connected to the internet. The app also includes a feature called "Coach Position," which allows users to see the exact position of their coach on the train.

Another useful feature of the app is the ability to set alerts for specific trains. Users can receive notifications about any delays or cancellations for their chosen train.

In addition to train tracking, the app also includes information about local train stations, including their location, amenities, and nearby attractions. Users can also book train tickets through the app.

Overall, Where is my train is a comprehensive and user-friendly app that is widely used by train travelers in India. Its accurate real-time tracking and offline mode make it a particularly useful tool for those who rely on trains for transportation.

CHAPTER 3
METHODOLOGY

3.1 PROPOSED SYSTEM:

Indian railways require more manpower to check each passenger's ticket, which is a complicated and time-consuming task. The majority of the tickets are wasted because passengers are unable to board the trains for a variety of reasons. TC's are exploiting this situation by selling vacant seats, which leads to corrupt practices and a variety of other frauds. Passengers who need to travel urgently are facing numerous challenges as booked tickets are being vacant.

To address these issues in Indian Railways, we are developing a solution that will make the entire train digital and accessible to all passengers 24 hours a day, seven days a week via an application. It is similar to the current applications, but we are introducing a new feature. It displays the status of each seat, whether it is vacant or occupied. To obtain such information, the passenger must perform an additional duty. When passengers board the train, they must scan the QR code which is printed on the ticket on a device which is installed in each coach of the train. When the passenger scans the QR with their device, the seat status is automatically updated as occupied via the cloud. So, when a train passes two or more stations, seats will be marked as vacant seats and open up and will be available for booking via the application.

3.2. Hardware components

1. Raspberry Pi
2. Raspberry Pi Camera

3.2.1 Raspberry Pi

The Raspberry pi is a single computer board with credit card size, that can be used for many tasks that your computer does, like games, word processing, spreadsheets and also to play HD video. It was established by the Raspberry pi foundation from the UK. It has been ready for public consumption since 2012 with the idea of making a low-cost educational microcomputer for students and children. The main purpose of designing the raspberry pi board is to encourage learning, experimentation and innovation for school level students. The raspberry pi board is portable and low cost. Maximum of the raspberry pi computers is used

in mobile phones. In the 20th century, the growth of mobile computing technologies is very high, a huge segment of this being driven by the mobile industries. 98% of the mobile phones were using ARM technology.

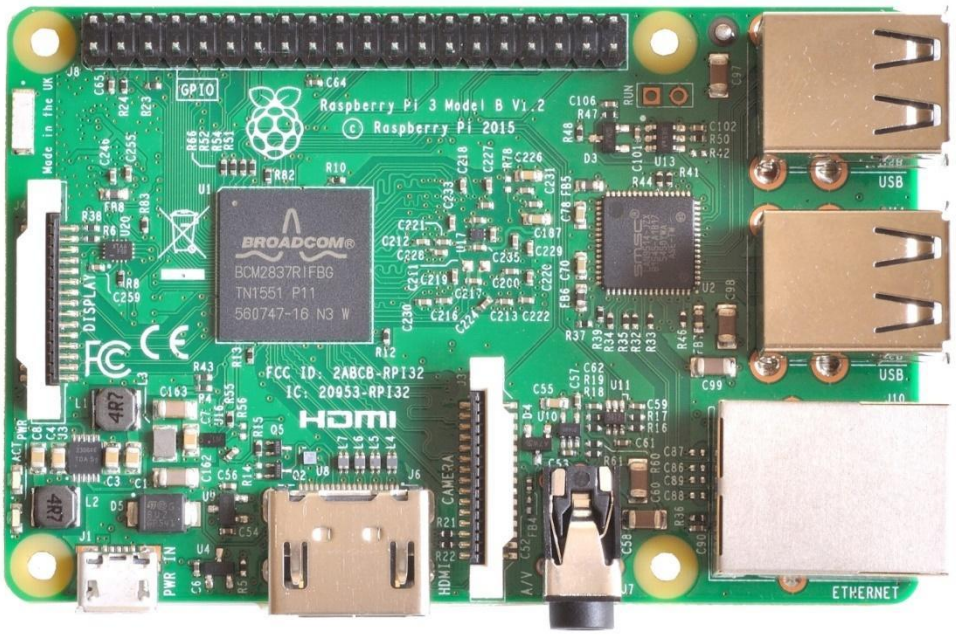

Fig 3.1: Raspberry pi module- model 3B.

The raspberry pi comes in two models, they are model A and model B. The main difference between model A and model B is the USB port. Model A board will consume less power and that does not include an Ethernet port. But the model B board includes an Ethernet port and was designed in China. The raspberry pi comes with a set of open-source technologies, i.e., communication and multimedia web technologies. IN the year 2014, the foundation of the raspberry pi board launched the computer module, that packages a model B raspberry pi board into a module for use as a part of embedded systems, to encourage their use.

Raspberry Pi Hardware Specifications

The raspberry pi board comprises a program memory (RAM), processor and graphics chip, CPU, GPU, Ethernet port, GPIO pins, Xbee socket, UART, power source connector. And various interfaces for other external devices. It also requires mass storage, for that we use an SD flash memory card. So that raspberry pi board will boot from this SD card similarly as a PC boots up into windows from its hard disk.

Essential hardware specifications of raspberry pi board mainly include SD card containing Linux OS, US keyboard, monitor, power supply and video cable. Optional hardware specifications include USB mouse, powered USB hub, case, internet connection, the Model A or B: USB WiFi adaptor is used and internet connection to Model B is LAN cable.

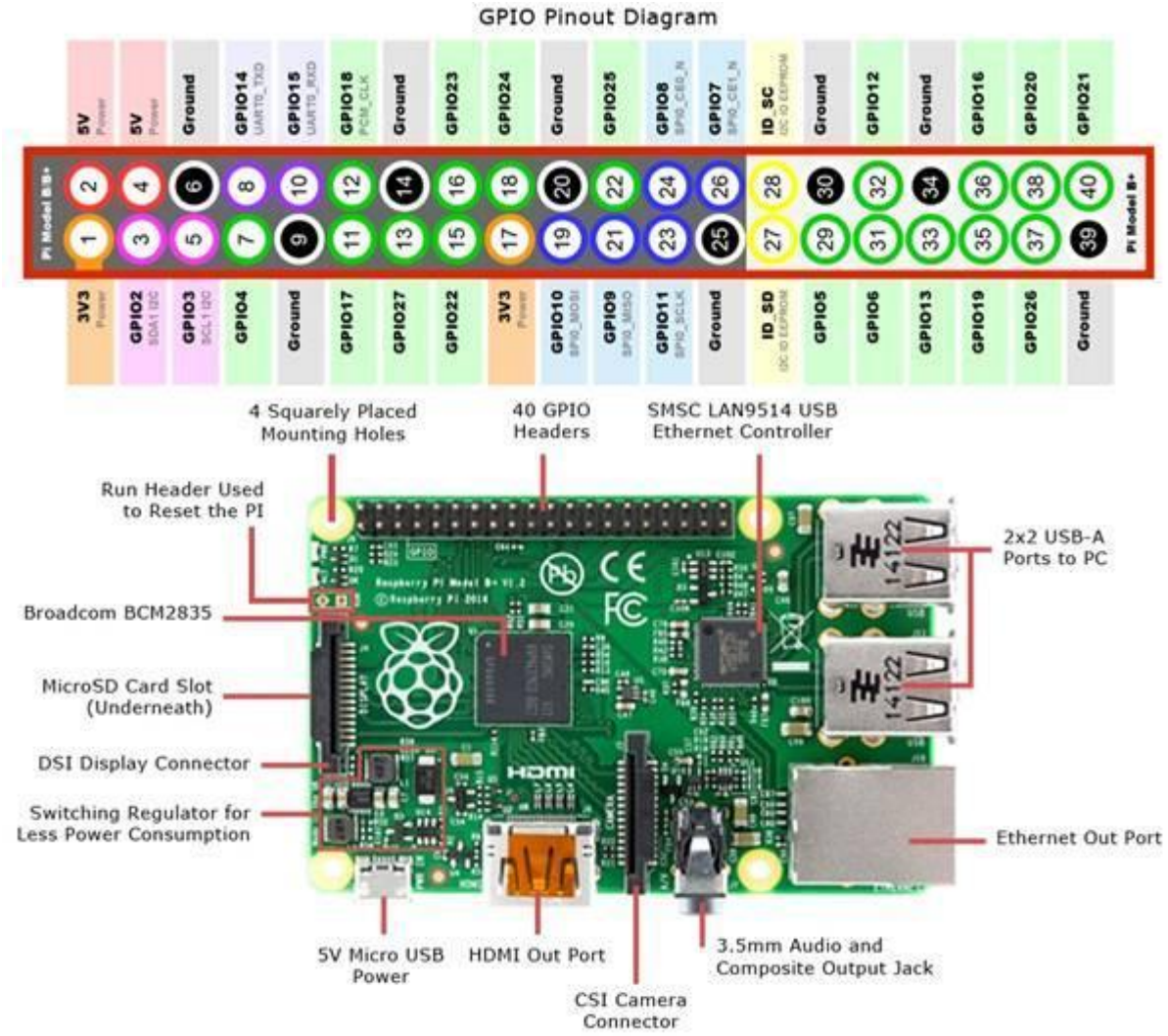

Fig 3.2:Pin Description of Raspberry pi.

Memory

The raspberry pi model Aboard is designed with 256MB of SDRAM and model B is designed with 51MB.Raspberry pi is a small size PC compared with other PCs. The normal PCs RAM memory is available in gigabytes. But in raspberry pi board, the RAM memory is available more than 256MB or 512MB

CPU (Central Processing Unit)

The Central processing unit is the brain of the raspberry pi board and that is responsible for carrying out the instructions of the computer through logical and mathematical operations. The raspberry pi uses ARM11 series processor, which has joined the ranks of the Samsung galaxy phone.

GPU (Graphics Processing Unit)

The GPU is a specialized chip in the raspberry pi board and that is designed to speed up the operation of image calculations. This board designed with a Broadcom video core IV and it supports OpenGL

Ethernet Port

The Ethernet port of the raspberry pi is the main gateway for communicating with additional devices. The raspberry pi Ethernet port is used to plug your home router to access the internet.

GPIO Pins

The general-purpose input & output pins are used in the raspberry pi to associate with the other electronic boards. These pins can accept input & output commands based on programming raspberry pi. The raspberry pi affords digital GPIO pins. These pins are used to connect other electronic components. For example, you can connect it to the temperature sensor to transmit digital data.

XBee Socket

The XBee socket is used in the Raspberry Pi board for wireless communication purposes.

Power Source Connector

The power source cable is a small switch, which is placed on the side of the shield. The main purpose of the power source connector is to enable an external power source.

UART

The Universal Asynchronous Receiver/ Transmitter is a serial input & output port. That can be used to transfer the serial data in the form of text and it is useful for converting the debugging code.

Display

The connection options of the raspberry pi board are two types such as HDMI and Composite. Many LCD and HD TV monitors can be attached using an HDMI male cable and with a low-cost adaptor. The versions of HDMI are 1.3 and 1.4 are supported and 1.4 version cable is recommended. The O/Ps of the Raspberry Pi audio and video through HDMI, but does not support HDMI I/p. Older TVs can be connected using composite video. When using a composite video connection, audio is available from the 3.5mm jack socket and can be sent to your TV. To send audio to your TV, you need a cable which adjusts from 3.5mm to double RCA connectors.

3.2.2 Raspberry Pi Camera

The flexible cable included with the 5MP Raspberry Pi 3 Model B Camera Module with Cable enables it to be connected to the Raspberry Pi 3 Model B computer. The 5MP camera module is suitable for small applications on Raspberry Pi which require just minimal storage capacity. It's as easy as starting up Raspbian and you're good to go!!!

The high-definition 5MP camera can capture video as well as still images, making it ideal for use in surveillance projects or on drones. Considering the camera module's tiny size and lightweight, it may be used as a hidden camera or perhaps the main lens for a Pi-phone.

One-of-a-kind camera module for the Raspberry Pi, designed especially for it. There are two small connections on the board's top surface, one for each side of the board, which link it to the Raspberry Pi. Video cameras can only be interacted with via the specialized CSI interface, which was built only for that reason alone. The CSI bus is designed specifically for the transfer of pixel data at high rates.

In terms of size, the board isn't large. It's just around 25x23x8mm. Being small and light (weighing less than 3g), the gadget is well-suited to use in situations where portability is a crucial factor. A small, flexible ribbon cable connects it to the Raspberry Pi for communication. The CSI bus, which has a higher bandwidth, is used to transmit pixel data from the camera to the processor when it is linked to the Raspberry Pi's BCM2835 CPU. The

camera board is connected to the Raspberry Pi computing system through a ribbon cable that this bus travels down.

The sensor has a native resolution of 5 megapixels, which is supplemented with a fixed focus lens. In terms of still photos, the camera is capable of 2592 by 1944 pixels, and it also supports video at resolutions up to 1080p30 and 720p60 for 1080p30 and 720p60 for 640x480p60/90 video.

No adapters are required! The Raspberry Pi 3 Model B computer's camera port accepts this camera as an input.

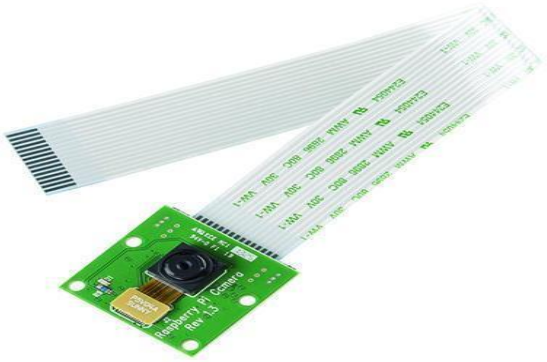

Fig 3.3: Raspberry pi camera

3.3 Software with Cloud Design

3.3.1 Python Programming language

Python is a high-level, interpreted programming language that has gained immense popularity due to its simple syntax, ease of use, and wide range of applications. It was created in the late 1980s by Guido van Rossum and is named after the Monty Python comedy group.

Python is known for its readability and ease of learning, making it a popular choice for beginners in programming. The language is dynamically typed, meaning that data types are inferred at runtime, making it flexible and easy to use. It supports various programming paradigms, including object-oriented, procedural, and functional programming.

Python is a versatile language and is used in a variety of applications, from web development to scientific computing. It is commonly used for scripting, automation, data analysis, and machine learning. Python has a vast and active community of developers, and many libraries and frameworks have been developed to make programming in Python easier and more efficient.

One of the key strengths of Python is its vast library of modules, which cover everything from web development and data analysis to scientific computing and machine learning. These modules are contributed by the community, and many of them are open source, meaning that they can be used freely.

Python's simplicity and ease of use have made it a popular choice for beginners and experienced programmers alike. Its code is easy to read and understand, making it easy to collaborate on projects. The language also has an interactive interpreter that allows programmers to test code snippets and quickly experiment with new ideas.

Python has many frameworks that make it easy to build web applications, including Django and Flask. These frameworks provide a structure for building web applications, handling URL routing, and working with databases. They also include libraries for handling common web development tasks, such as user authentication, form handling, and sending email.

Python is also commonly used for data analysis and scientific computing. Libraries like NumPy, Pandas, and SciPy provide powerful tools for working with numerical data, performing statistical analysis, and visualizing data. Python is also a popular choice for machine learning and artificial intelligence, with libraries like TensorFlow and PyTorch providing tools for building and training neural networks.

In conclusion, Python is a powerful and versatile programming language that is easy to learn and use. Its simple syntax, vast library of modules, and active community of developers make it an ideal choice for a wide range of applications, from web development to scientific computing and machine learning. Whether you are a beginner or an experienced programmer, Python is a language that is definitely worth learning.

Fig 3.4 :High Level language Python

3.3.2 Thonny IDE

Thonny is an integrated development environment (IDE) for the Python programming language. It is designed to make coding in Python easy and accessible to beginners and students, while also providing advanced features for experienced developers. Thonny is available for Windows, macOS, and Linux operating systems.

Thonny has a simple and intuitive user interface, with a clean and uncluttered design. The main window is divided into three sections: the editor, the shell, and the debugger. The editor is where you can write your code, and it includes features such as syntax highlighting, code completion, and indentation guides. The shell is where you can run your code and see the output, and it also includes a command history and auto-completion. The debugger allows you to step through your code and see what's happening at each line.

One of the standout features of Thonny is its support for beginners. The IDE includes a simplified mode called "beginner mode" which provides a simpler interface for new users. In beginner mode, the IDE hides some of the more advanced features, such as the debugger, and simplifies the editor interface. Thonny also includes an interactive tutorial that guides users through the basics of Python programming.

Thonny also includes a number of advanced features for experienced developers. These include the ability to connect to remote Python interpreters, support for virtual environments, and integration with version control systems such as Git. Thonny also includes a number of plugins that can be used to extend its functionality, including plugins for working with microcontrollers such as the Raspberry Pi and the BBC micro:bit.

Another notable feature of Thonny is its support for multiple Python versions. Thonny includes support for Python 2 and Python 3, as well as the ability to switch between different versions of Python within the IDE.

In summary, Thonny is a beginner-friendly IDE for Python programming that also includes advanced features for experienced developers. Its clean and intuitive interface, support for multiple Python versions, and advanced features such as remote interpreter support and Git integration make it a popular choice among Python developers.

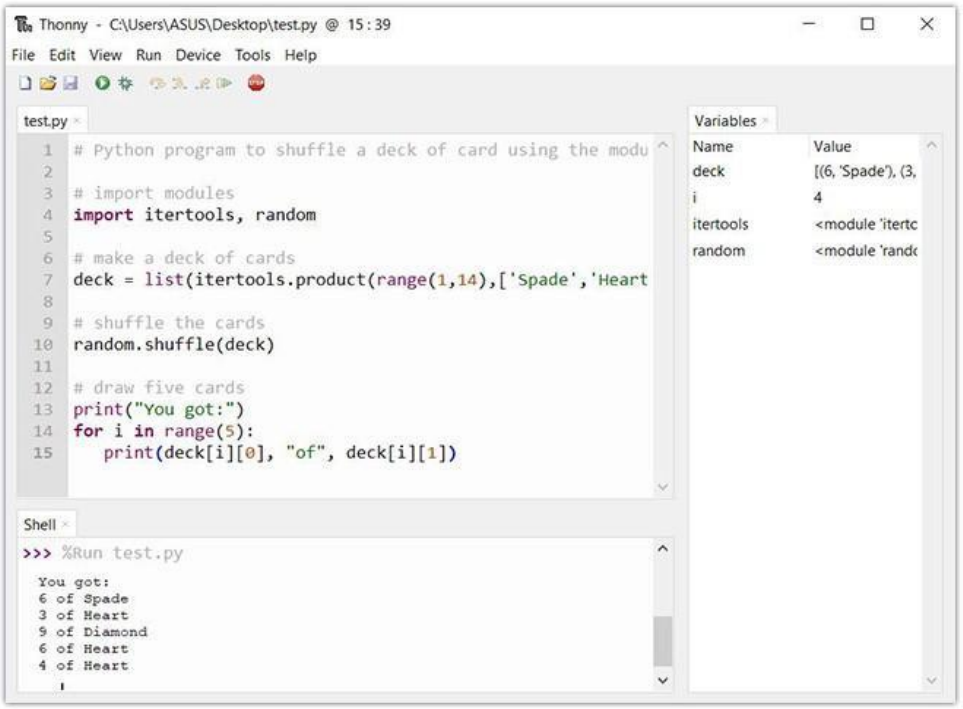

Fig 3.5: Snippet of Thonny IDE .

3.3.3 Firebase:

The Firebase Realtime Database is a cloud-hosted NoSQL database that lets you store and sync data between your users in real-time. Real Time syncing makes it easy for your users to access their data from any device: web or mobile, and it helps your users collaborate. Realtime Database ships with mobile and web SDKs so you can build apps without the need for servers. You can also execute backend code that responds to events triggered by your database using Cloud Functions for Firebase.

When your users go offline, the Realtime Database SDKs use local cache on the device to serve and store changes. When the device comes online, the local data is

automatically synchronized. The Realtime Database integrates with Firebase Authentication to provide simple and intuitive authentication for developers. You can use our declarative security model to allow access based on user identity or with pattern matching on your data. Firebase helps you develop high-quality apps, grow your user base, and earn more money. Each feature works independently, and they work even better together.

The Firebase Realtime Database lets you build rich, collaborative applications by allowing secure access to the database directly from client-side code. Data is persisted locally, and even while offline, real-time events continue to fire, giving the end-user a responsive experience. When the device regains connection, the Realtime Database synchronizes the local data changes with the remote updates that occurred while the client was offline, merging any conflicts automatically.

The Realtime Database provides a flexible, expression-based rules language, called Firebase Realtime Database Security Rules, to define how your data should be structured and when data can be read from or written to. When integrated with Firebase Authentication, developers can define who has access to what data, and how they can access it.

The Realtime Database is a NoSQL database and as such has different optimizations and functionality compared to a relational database. The Realtime Database API is designed to only allow operations that can be executed quickly. This enables you to build a great real-time experience that can serve millions of users without compromising on responsiveness. Because of this, it is important to think about how users need to access your data and then structure it accordingly.

Fig 3.6: Google firebase logo.

3.3.4 MIT App Inventor

MIT App Inventor is a web application integrated development environment originally provided by Google and now maintained by the Massachusetts Institute of Technology (MIT). It allows newcomers to computer programming to create application software (apps) for two operating systems (OS): Android (operating system) Android, and iOS, which, as of 8 July 2019, is in final beta testing.

It is free and open-source software released under multi-licensing dual licensing: a Creative Commons license attribution Creative Commons Attribution Share-alike 3.0 unported license and an Apache License 2.0 for the source code. It uses a graphical user interface (GUI) very similar to the programming languages Scratch (programming language) and the Star logo, which allows users to drag and drop visual objects to create an application that can run on mobile devices. In creating App Inventor, Google drew upon significant prior research in educational computing, and work done within Google on online development environments. App Inventor and the projects on which it is based are informed by constructionist learning theories, which emphasize that programming can be a vehicle for engaging powerful ideas through active learning.

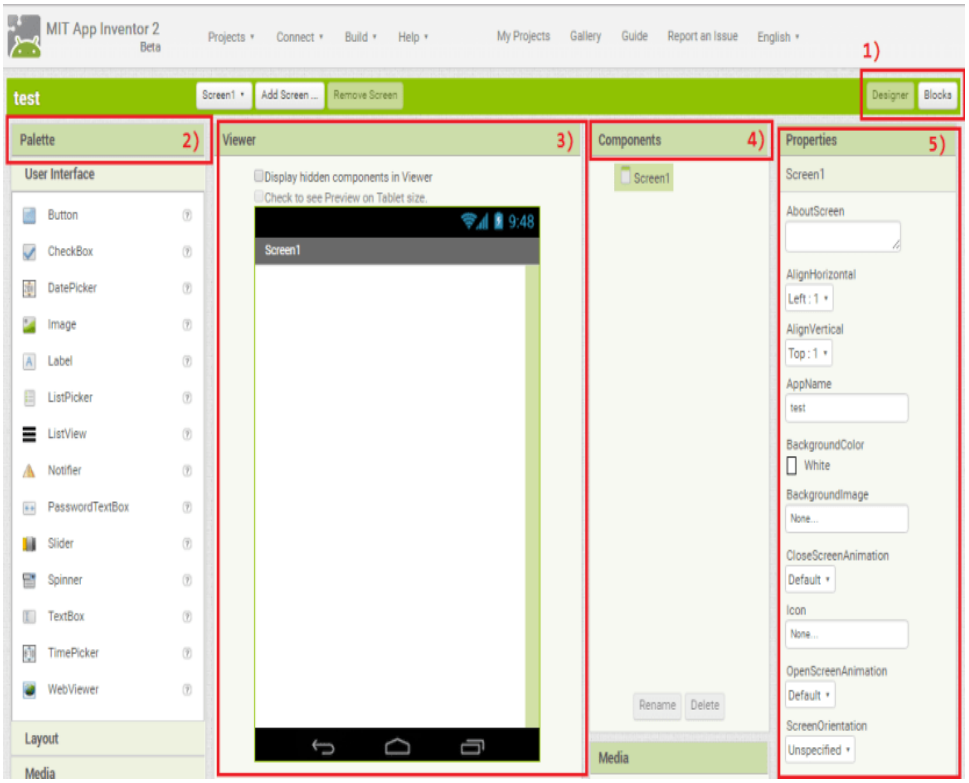

Fig 3.7: MIT Website welcome page.

3.3.5 MIT AI2 Companion

Fig 3.8: MIT App default logo for applications designed.

The MIT AI2 Companion app is used to download and run apps created with App Inventor, a web-based app building tool, on an Android phone or tablet. App Inventor has a useful tool for continuously seeing your app in real time on an Android device during each step of the development process. You can find the MIT AI2 Companion app in the Google Play Store by performing a search for "MIT AI2 Companion."

Step 1: Download and install the MIT App Inventor Companion app on your Android or iOS device.

Open the Google Play store or Apple App store on your phone or tablet, or use the buttons below to open the corresponding page:

After downloading, step through the instructions to install the Companion app on your device. You need to install the MIT App Inventor Companion app only once, and then you can leave it on your phone or tablet for whenever you use App Inventor. Alternatively, you can scan the following **QR codes** to get either the iOS or Android app:

- **For iOS**, scan the code to go to the Companion app on the Apple App Store.
- **For Android**, scan the code to download the Android .APK file for the Companion app directly to your device. (Using an .APK file requires sideloading app on your device and updating the app manually in the future.)

Step 2: Connect both your computer and your device to the **SAME** Wi-Fi network

App Inventor will automatically show you the app you are building, but only if your computer (running App Inventor) and your device (running the Companion) are connected to the same Wi-Fi network.

Step 3: Open an App Inventor project and connect it to your device.

Go to App Inventor and open a project (or create a new one — use *Project* > *Start New Project* and give your project a name).

Then Choose "Connect" and "AI Companion" from the top menu in your browser:

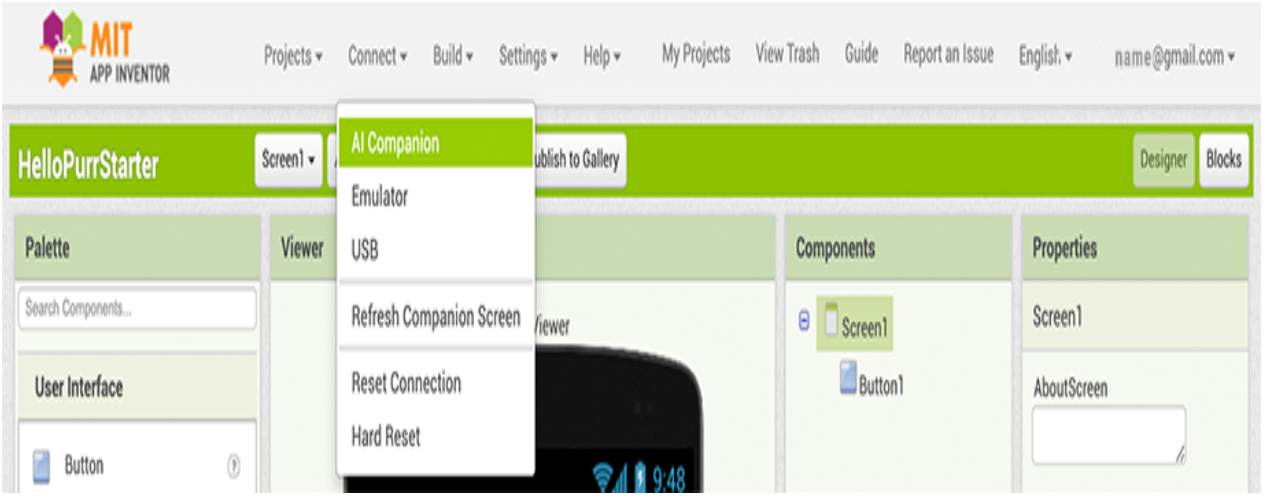

Fig 3.9: AI companion on webpage.

A dialog with a QR code will appear on your PC screen. On your device, launch the MIT App Companion app just as you would do any app. Then click the "Scan QR code" button on the Companion, and scan the code in the App

Inventor window:

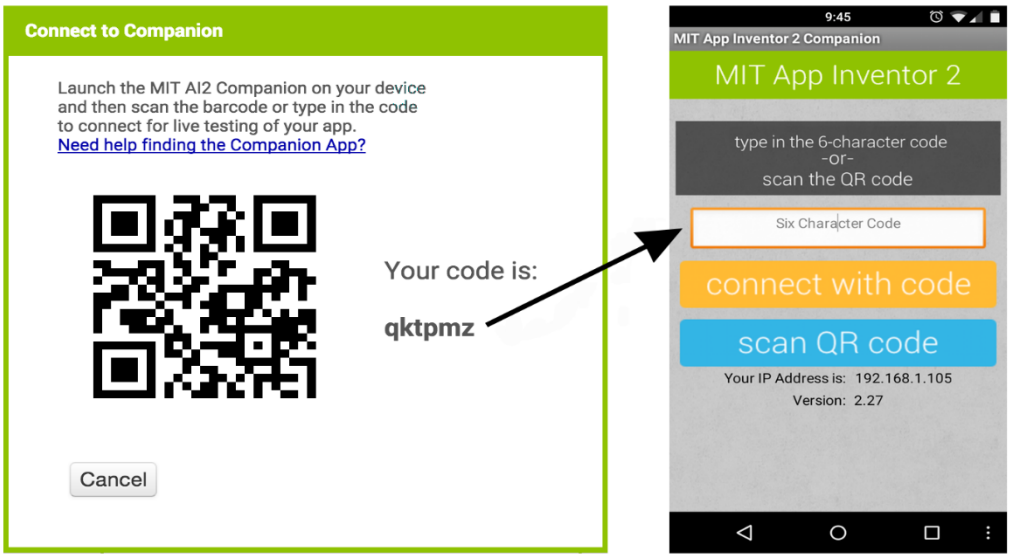

Fig 3.10: Ways to connect with APP inventor.

Within a few seconds, you should see the app you are building on your device. It will update as you make changes to your design and blocks, a feature called "live testing."

If you have trouble scanning the QR code or your device does not have a scanner, type the code shown on the computer into the Companion's text area on your device exactly as shown. The code is directly below where the screen on your PC shows "Your code is" and consists of six characters. Type the six characters and choose the orange "Connect with code." Do not type an Enter or carriage return: type just the six characters followed by pressing the orange button.

Fig:3.11 Clients Servers Connectivity through the internet.

3.3.6 VNC Viewer

VNC Viewer is a remote desktop access software that enables a user to connect and control a remote computer from a different location. This application is based on the Virtual Network Computing (VNC) protocol, which is a system that allows a user to access a remote computer and operate it from a local computer. VNC Viewer is one of the many implementations of the VNC protocol that is widely used by businesses and individuals worldwide.

VNC Viewer is a cross-platform application that is compatible with Windows, macOS, Linux, and Unix operating systems. It is also available for mobile devices such as iOS and Android. The software can be downloaded and installed on both the remote and local computers, enabling the user to access the remote desktop from any location with an internet connection. The installation process is simple and requires no technical expertise.

Once VNC Viewer is installed, the user can connect to the remote computer using an IP address or hostname. The user will be prompted to enter the login credentials for the remote computer. Once authenticated, the user can view and control the remote computer's desktop as if they were physically present in front of it. This allows users to perform tasks remotely, such as troubleshooting technical issues, transferring files, and working on documents or software applications.

VNC Viewer also supports encryption and authentication to ensure the security of remote desktop access. The application uses 256-bit AES encryption to protect the data transmitted over the network. Additionally, VNC Viewer allows the user to set up a password for the remote desktop access, ensuring that only authorized users can access the remote computer.

Connections can have multiple labels applied and will appear in a sub section under the address book once applied. Please note, labels are applied to the local viewer only at this time. You can copy them between devices by exporting and then importing them into another viewer.

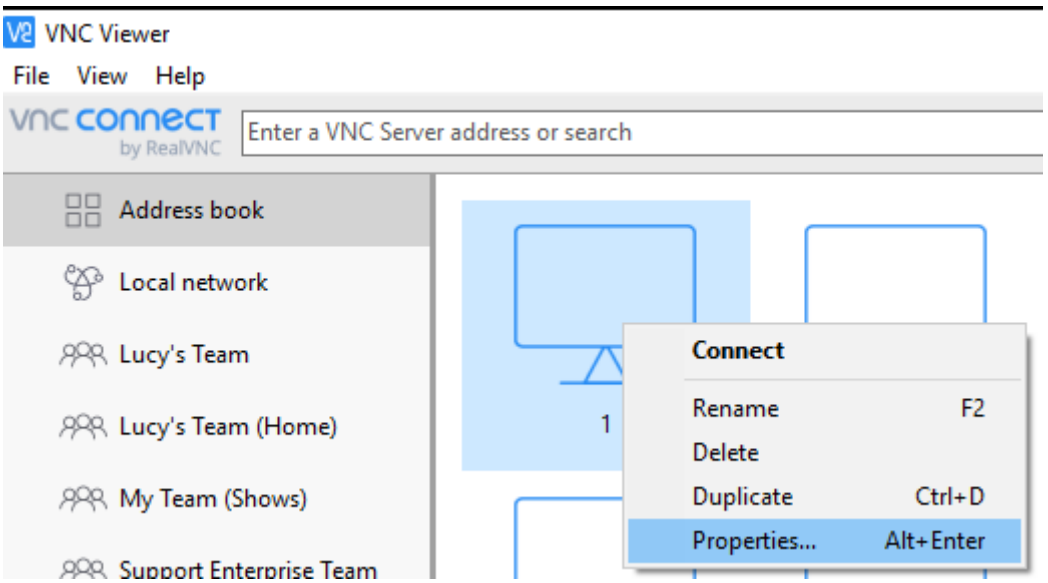

fig 3.12: VNC viewer main page.

3.4 QR Code:

QR(Quick response) code is a type of barcode. By scanning it, you access the information encoded in it.In standard barcodes, information is encoded in the width of and distance between vertical lines. In QR codes, information is encoded in the arrangement of squares. Either way, data transforms into a machine-readable arrangement of visual elements. And upon scanning by an optical scanning device, the data translates back to its original form.

But three things make QR codes extra special. The amount of data they can hold, how quickly they are read, and that virtually all of our phones can instantly and easily scan them.

A QR code is a scannable barcode encoded with data. Encoded means *converted into a particular form*. In the case of QR codes, numeric and alphanumeric characters, bytes, and kanji convert into a unique two-dimensional arrangement of squares. When an optical scanner passes over those squares, it translates their arrangement back into that data's original form.

A QR code can be made up of a maximum of 177 rows and 177 columns, which makes for a possible 31,329 data modules. Most QR codes aren't that big, though.

The size of a QR code corresponds to its version. The smallest a QR code can be is 21 rows by 21 columns, which is version 1. 25x25 is version 2, and on and on. The aforementioned largest QR code possible, 177x177, is version 40.

QR codes can store up to 7,089 numeric characters or 2,953 alphanumeric characters. They can also store bytes and kanji, but those are less frequently used. These numbers assume the lowest error correction level.

Fig 3.13 A QR Code menu example.

3.4.1 QR CODE parts

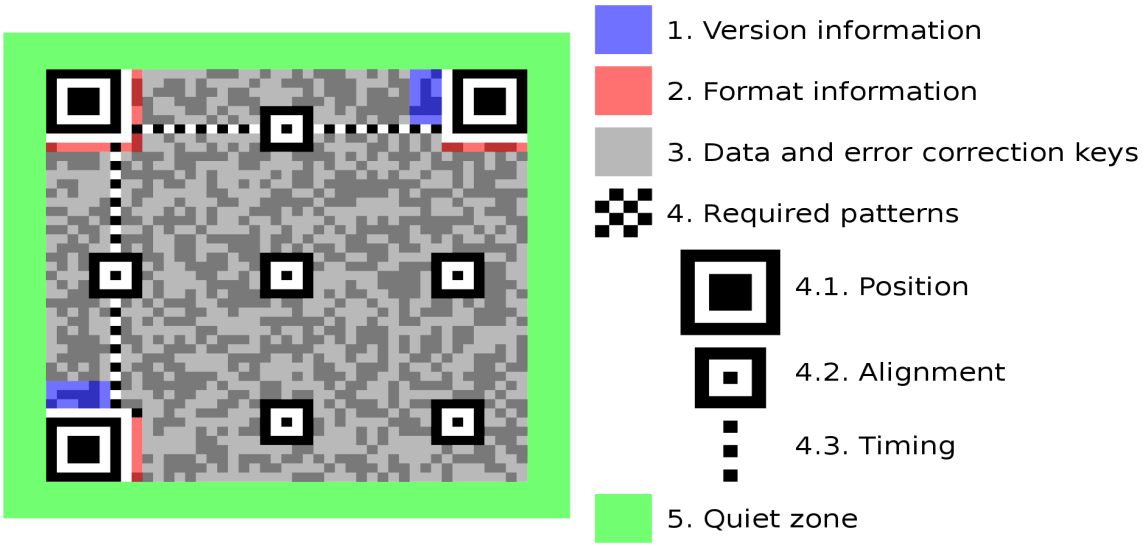

Fig 3.14 QR Code Structure.

version information of QR code :

QR code, or Quick Response code, is a two-dimensional barcode that can be scanned and read by smartphones, tablets, and other devices with a camera and QR code reader software. The version of a QR code refers to the size of the code, including the number of modules or squares in each row and column, and the amount of data that can be encoded.

There are 40 versions of QR codes, ranging from Version 1 to Version 40. Each version has a different number of modules and can encode a different amount of data. The smallest version, Version 1, has 21 modules and can encode up to 25 alphanumeric characters or 47 numeric characters. The largest version, Version 40, has 177 modules and can encode up to 4,296 alphanumeric characters or 7,089 numeric characters.

In addition to the version, QR codes also have error correction levels, which determine how much data can be recovered if the code is damaged or partially obscured. The four error correction levels are L, M, Q, and H, with H providing the highest level of error correction.

Format information of QR code :

The format information in a QR code is used to specify the error correction level, data mask pattern, and other technical details about the code. It is located in the bottom left and top right corners of the QR code and consists of 15 bits.

The format information is divided into two parts: the first byte, which contains the error correction level and mask pattern, and the second byte, which is a bitwise XOR of the first byte and a predefined mask pattern. This XOR operation helps to prevent the format information from being damaged or misread during scanning.

The first four bits of the first byte indicate the error correction level, with L, M, Q, and H representing the four levels, respectively. The next four bits specify the mask pattern used to encode the data. There are eight possible mask patterns, numbered from 0 to 7.

The second byte of the format information is used to correct errors that may occur during scanning. It is calculated by XORing the first byte with a predefined mask pattern, which depends on the version of the QR code. The XOR operation ensures that errors affecting the format information are corrected before the data is decoded, increasing the reliability and accuracy of the scanning process.

Overall, the format information is a crucial component of the QR code, as it enables the scanner to decode the data accurately and recover from any errors or damage that may occur during scanning.

Data and error correction keys :

In a QR code, the data is divided into several blocks, and each block is encoded with an error correction code. The error correction code adds redundancy to the data, allowing the scanner to correct errors that may occur during scanning or transmission.

The number of data blocks and the size of each block depend on the version and error correction level of the QR code. The higher the error correction level, the more blocks are used, and the more redundancy is added to the data. Each block is encoded using Reed-Solomon error correction, which is a mathematical algorithm that can correct errors by adding redundancy to the data.

The error correction keys in a QR code are generated using the Reed-Solomon algorithm. The keys are used to correct errors that occur during scanning or transmission by calculating the difference between the received data and the expected data. The keys are based on the location and content of the data blocks and are stored in the QR code itself.

When the QR code is scanned, the scanner reads the data blocks and the error correction keys. If any errors are detected in the data, the scanner uses the error correction keys to correct them. The scanner can correct errors up to a certain threshold, depending on the error correction level of the QR code. If the errors exceed the threshold, the data cannot be recovered, and the QR code is considered unreadable.

Required patterns of QR Code :

There are three required patterns in a QR code

Finder Patterns: These are the square patterns located at three corners of the QR code. They consist of a black square surrounded by a white border, followed by another black square, and then a white square. The finder patterns help the scanner locate the QR code and determine its orientation.

Alignment Patterns: These are smaller square patterns located within the QR code. They are used to ensure that the QR code can be read accurately, even if the code is distorted or partially obscured. The number and location of the alignment patterns depend on the version of the QR code.

Timing Patterns: These are horizontal and vertical lines that run throughout the QR code. They are used to synchronize the scanner's timing with the QR code and ensure that the data is read accurately.

Quiet Zone of QR Code :

The quiet zone of a QR code is a margin of empty space that surrounds the code on all four sides. It consists of a white border with a minimum width of four modules or squares, although some QR code standards recommend a wider border.

The purpose of the quiet zone is to improve the readability of the QR code by providing a clear, unobstructed space around the code. The white space helps the scanner distinguish the QR code from other visual elements in the environment, such as text, images, or graphics.

The size of the quiet zone is important because it affects the readability and scanning speed of the QR code. If the quiet zone is too narrow, the QR code may be difficult to scan, especially if there are other visual elements nearby. If the quiet zone is too wide, it may reduce the amount of space available for the QR code, which can limit the amount of data that can be encoded.

The recommended size of the quiet zone varies depending on the application and the QR code standard used. For example, the ISO/IEC 18004 standard recommends a quiet zone of at least four modules, while the Japanese Industrial Standard (JIS) recommends a quiet zone of at least 10 modules.

Overall, the quiet zone is an important component of the QR code that helps to ensure its readability and accuracy. It provides a clear, unobstructed space around the code, which makes it easier for the scanner to locate and read the data.

3.4.2 QR Working

The QR code scanner begins at the bottom right of the QR code. It then moves up two data modules at a time until it hits the first position marker. Then it moves two data modules to the left and goes down. It repeats this right-to-left, up-then-down zig-zag process until every data module is covered.

Here's a basic six-step outline of how the scanning process works.

1. Point your phone at a QR code.
2. The QR code scanner in your phone's camera recognizes the three position markers in the QR code. With a sufficient quiet area, your scanner is now aware of where the edges of the QR code are.
3. The scanner begins at the bottom right, where it encounters the *mode indicator.* These four data modules indicate what data type (numeric, alphanumeric, byte, or kanji) the rest of the encoded data is.
4. Next, the scanner encounters the *character count indicator,* which are the next 8 data modules up from the mode indicator. These indicate how many characters the total encoded data is.
5. Knowing the data type and character length, the scanner then continues its zig-zag path along the data modules until it retrieves all the encoded information and reaches the *end indicator*.
6. After reading the final character, the scanner proceeds along its path to the error correction data modules. Within these encoded modules are one of four levels of error correction. Or how much of the QR code's encoded data is backed up in case of code

damage.

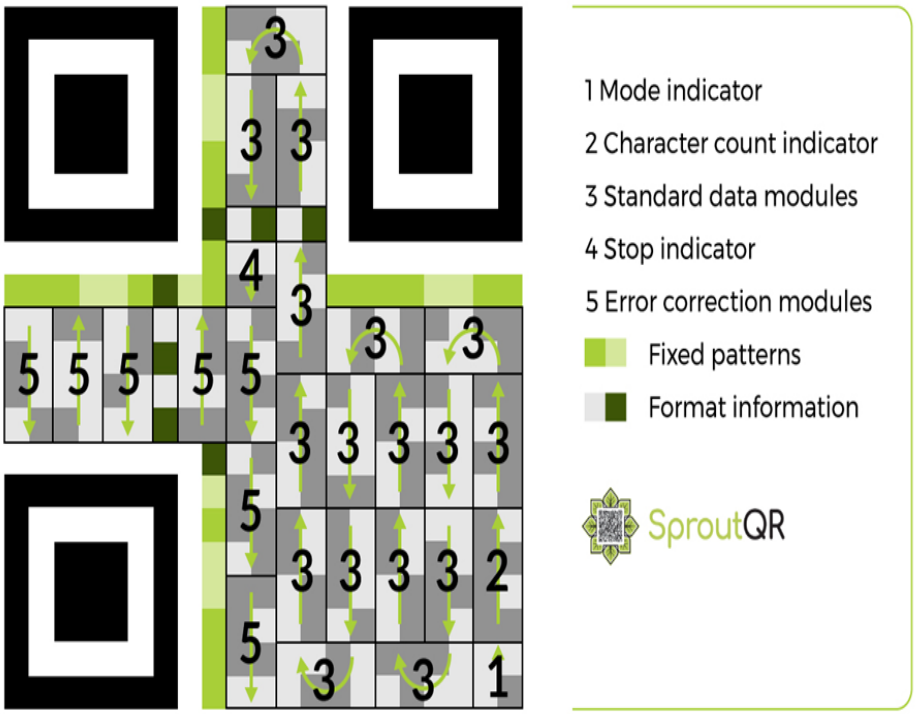

fig 3.15: How QR code works.

3.5. Block Diagram:

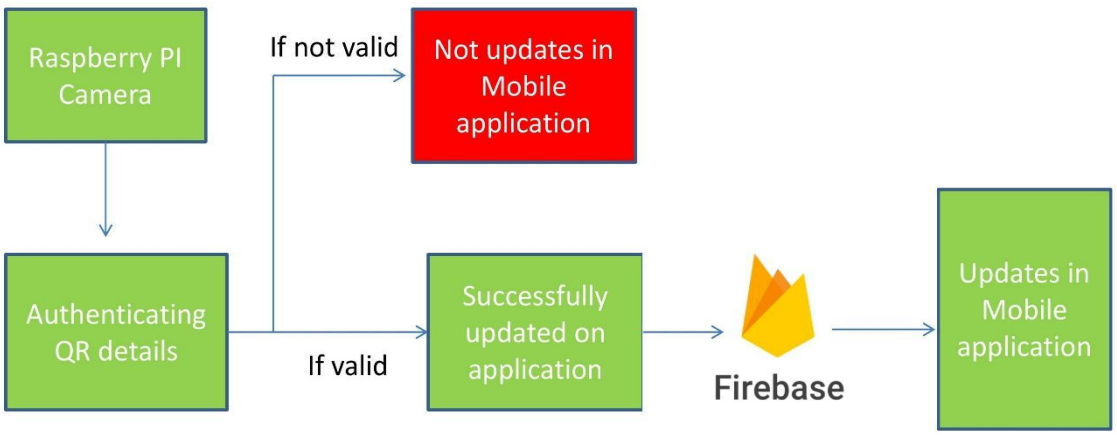

fig 3.16 Basic block diagram of the proposed system.

3.6 Working:

3.6.1 Application/ Software:

Login Screen:

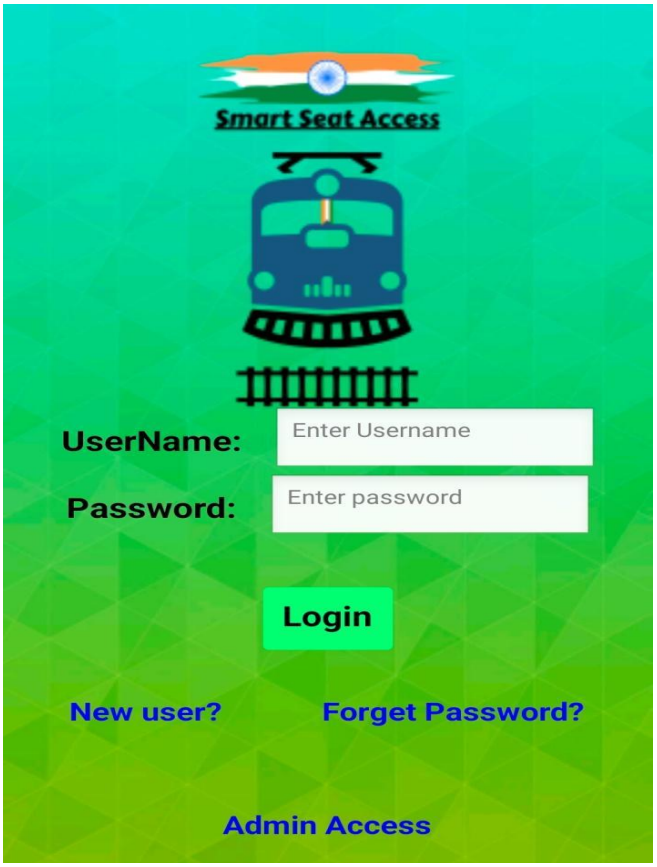

Fig 3.17: Login screen on application.

Login page contains three different redirecting pages:

- New user.
- Forgot password.
- Login button.
- Admin Access.

If you are the new user you have to provide the name of the candidate, email-id, new user Id, password. If you submit it once, a new database for your device will be created and in the database it creates a new credentials block under your specified database, storing all the data of your specified account. Internal working of page redirecting was given as follows.

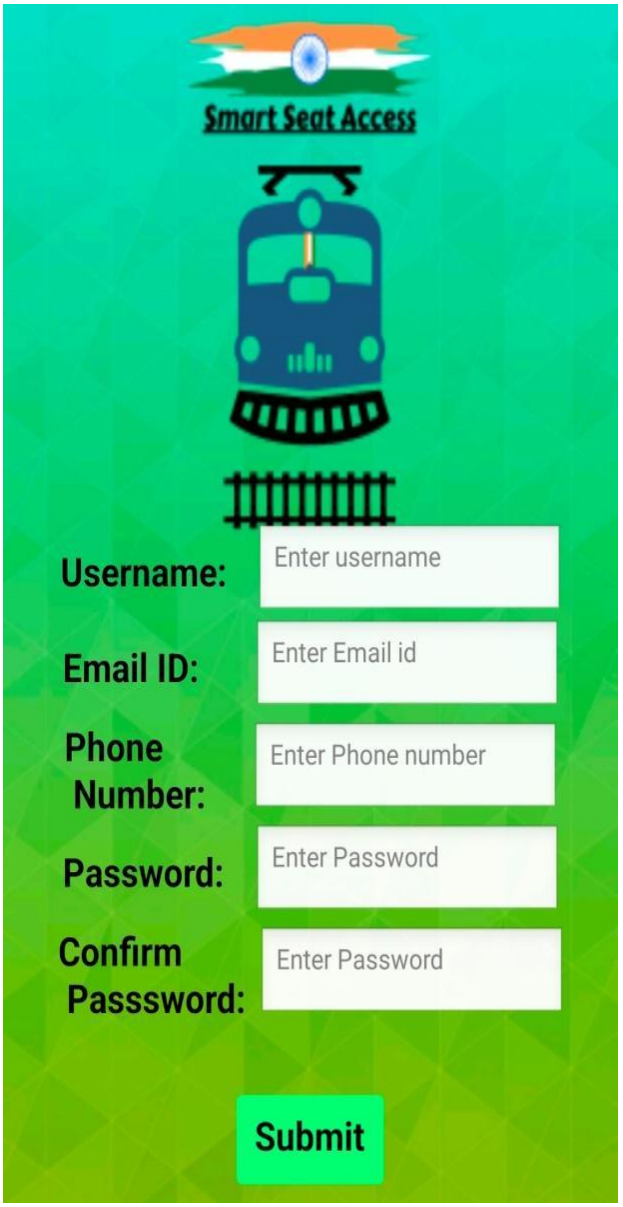

Fig 3.18: New user screen on application

If login credentials verified from the database are correct then the screen redirects to screen 2 (or) main screen. Login has a text box to take inputs. For password we are using password textbox. So, we can hide the password that enters from others.

If you forgot the password of your existing account, you can recover it by tapping on the forgot password button. If you once tap the button below the display was shown to the user on application.

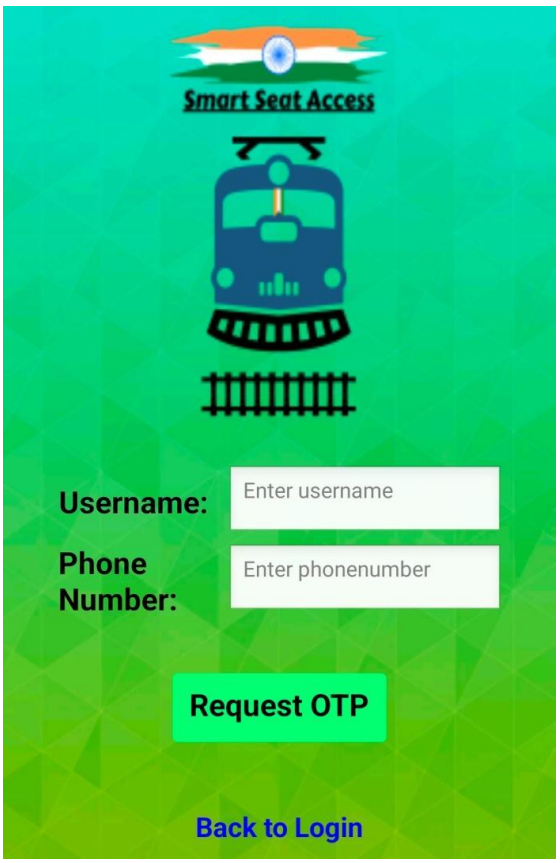

Fig 3.19: Forgot password screen on Application

When we enter the user id and phone number then hit the submit button. The application checks the database for the email id/user id which was provided by the user in the registration process. After submitting the page, it redirects to the OTP screen. Here you have to enter the OTP which was sent to that user's mail Id/phone number. If you enter the correct OTP within the time period the new password set page will open or else the user has the option to resend mail. Once you set the new password database will update. So, users can login with a new password to the application.

Admin Access:

In order to generate QR at the ticket counter we have used the same application but the user has to be logged into as admin by entering their secret key given to a specific person. Main advantage of this key was that at any time the authorities could deny access to any Admin user if any illegal activities were noticed. Once you enter the seat number, Name, Age, Train number ,boarding station , departure station and hit the allocate button then a new QR and PNR number will be generated. As it is a counter ticket they can easily print the QR and handover to the person. The screen shown in the below figure.

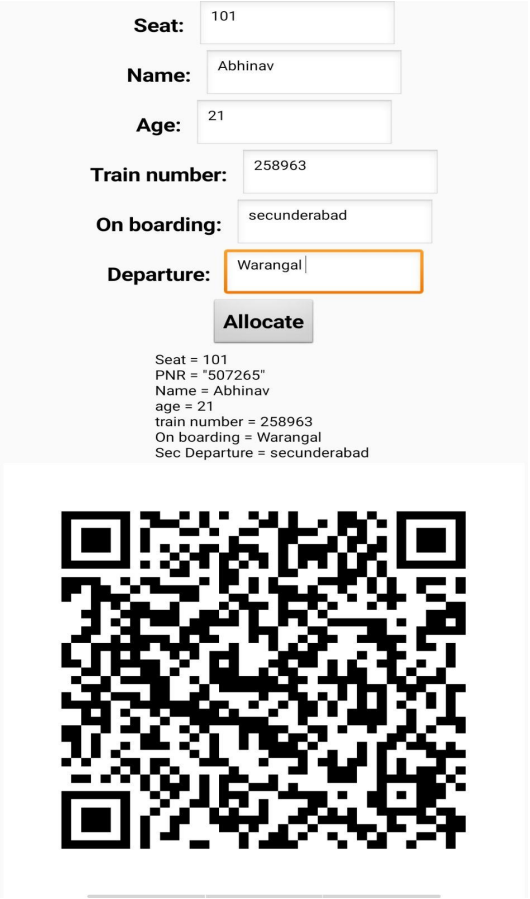

Fig 3.20: Instantly generated ticket by user.

If the user scans this QR code on the machine. It will check whether the PNR number and seat number were matched or not by collecting data from the cloud.

Main Screen:

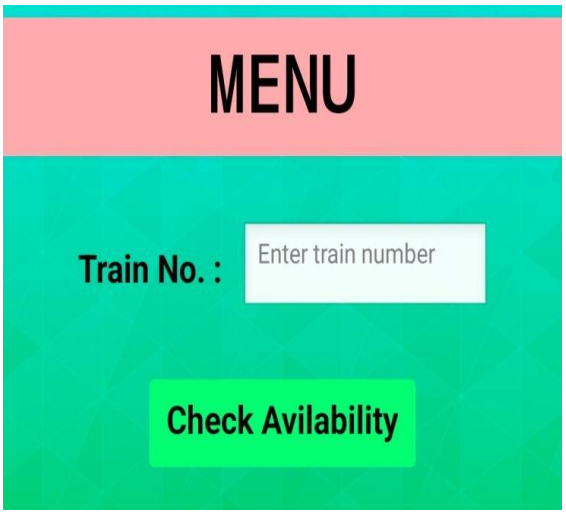

fig 3.21: Main Screen of application.

In the main Screen of the application you will find two options. They are Menu and to track seat availability on the train.

By clicking on the menu button you will find many options as shown in the figure below.

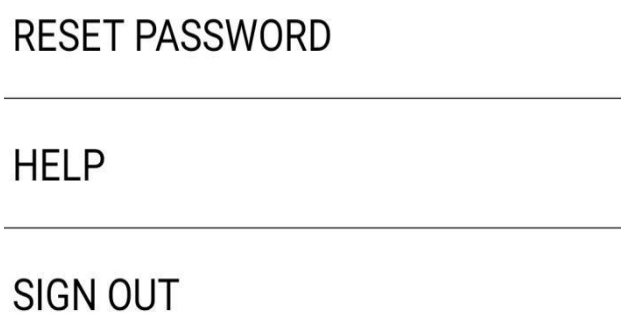

fig 3.22: Snippet of the application's menu bar.

From here you can redirect to any other service page based on the requirement on your account. It will provide three other services, they are:

- Reset Password.
- Help
- Sign Out.

Reset Password: When a user already logged into the account but he/she wants to update the password for the security purposes then they can simply redirect to this page and Update their password. . But the user has to provide the old password in-order to change the password. Also he/she has to confirm the password by re-entering it.

If the user enters the incorrect previous password or the new passwords do not match, the updating trail fails..

To obtain this page one has to follow the below path.

LOGIN> MENU> RESET PASSWORD.

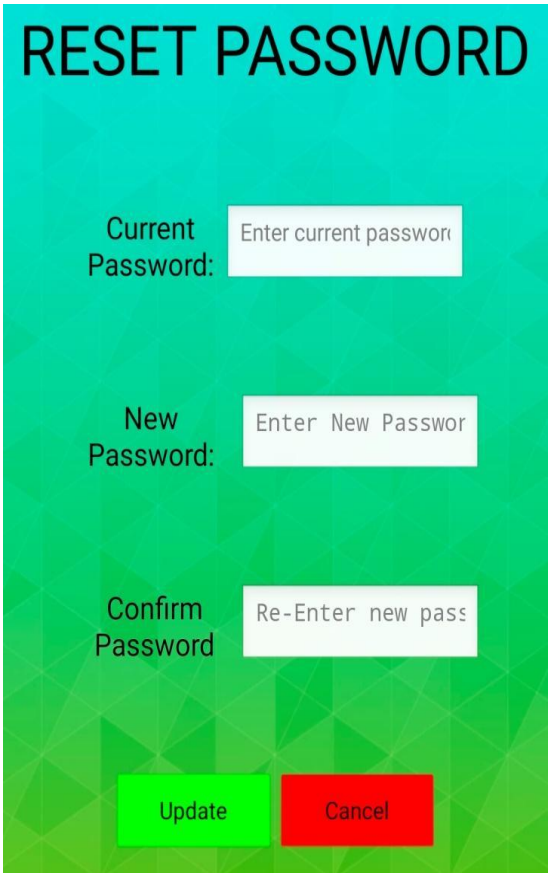

Fig 3.23: Reset password screen on application

Help:

Inorder to understand the working of anything we will use this Page. Here anyone can search for everything like if a new user is unable to understand the color indication of seats on the application. Then they get information from here.

Sign Out:

When a user wants to delete an application, then he/she must be signed out from the account in order to prevent your credentials from hackers.

Check Availability:

You have to check the seat availability by entering the train number. Once you hit the check availability, it will check on the server, if the train doesn't exist it throws a notification as **" please check the train number",** and if that train exists the data will return from the firebase and redirect you to the below page.

fig 3.24 The snippet shows the seating arrangement of each and every coach.

In this screen it will show the details of the Train number and name. Below that one can find the compartment numbers of the coach, by simply selecting them. Every coach has the same number of seats.

In the above figure everyone can see three colors. Each color has its own meaning.,

Green : Seat is open for booking and anyone can book these seats.

Orange : Seat was booked, but the person didn't board the train.

Red : Seat was booked and person on-board the train.

If the user wants to book an instant ticket you have to go to the payment page and once you are done with seat booking PNR number will be directly sent to your registered email id. Also you no need to scan the QR for instant bookings.

3.7 Flow Chart

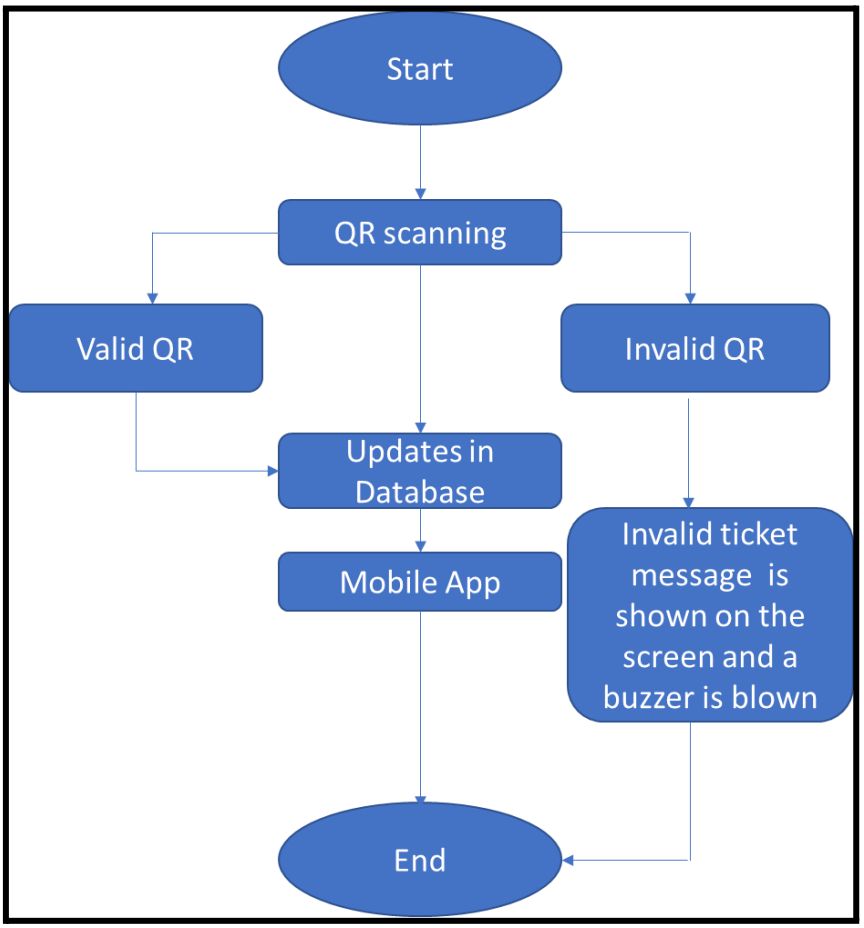

fig 3.25: Flow chart of the proposed system.

3.8 Hardware code

```
from picamera import PiCamera

from time import sleep

from firebase_admin import db

import firebase_admin

from firebase_admin import credentials

import time

from PIL import Image
```

```
import zbarlight

from firebase_admin import auth


camera = PiCamera()

cred = credentials.Certificate('file.json')

default_app = firebase_admin.initialize_app(cred,{'databaseURL':'https://smartdigilocker-100d2-default-rtdb.firebaseio.com/'})

root = db.reference()

 while True:


   camera.start_preview()

        sleep(5)

   camera.capture('/home/raspberrypi/Desktop/test2.png')

   camera.stop_preview()


        file_path = '/home/raspberrypi/Desktop/test2.png'

        with open(file_path,'rb') as image_file:

        image =Image.open(image_file)

        image.load()

        sleep(5)

        codes = zbarlight.scan_codes(['qrcode'],image)
```

```
        print('QR codes:%s' %codes)

        a = str(codes)

        #if (a[10:13] == "100"):

        #    root.child('Train/258963-Golkonda_Express/S1').update({'100':"2"})


        x =
str(db.reference('Tickets/258963-Golkonda_Express/S1/'+a[10:13].format()).get())

        print (x)

        if((a[21:29] == x)):

      root.child('Train/258963-Golkonda_Express/S1').update({a[10:13]:"2"})
```

CHAPTER 4

PERFORMANCE ANALYSIS

4.1 Results:

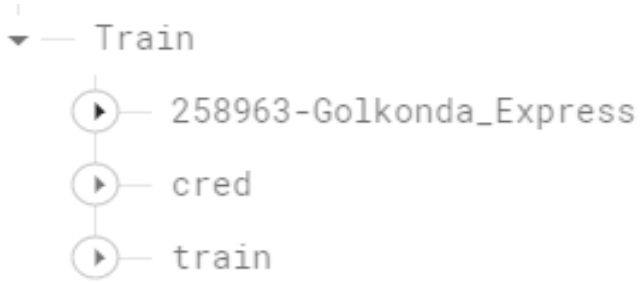

fig: 4.1 Train bucket snippet from google firebase.

- This is a Train bucket on realtime google firebase created for the project.Under this bucket we have different train details and credentials of the users as sub buckets.
- The information provided by the user when creating an account was saved in the Cred bucket.Such as name, email id, password, user name. The sample details in the cred bucket is shown in the figure below.

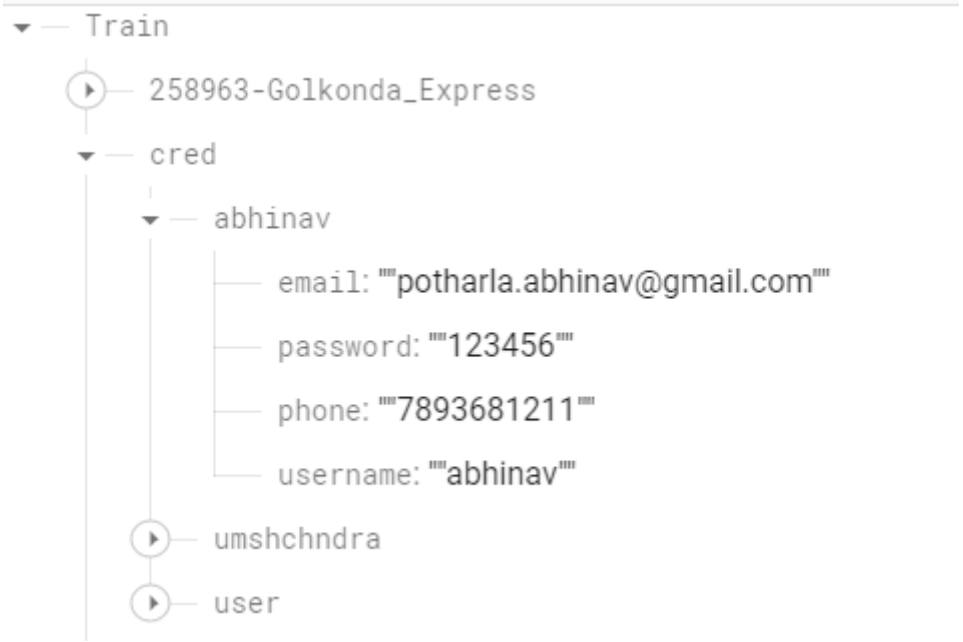

fig 4.2: Credentials in a cred bucket on Google Firebase.

- In this project we have created a sample train with the train number 258963 named golkonda express. We know that every train has many coaches.
- So to implement our working methodology we have created two coaches inside the train name. They are named S1, S2.Under each coach we have a limited number of seats for booking, here seat number is considered as key and seat status as value.
- When the seat was open for booking, the value was 1.
- If the seat was booked and the person scanned QR on the train scanner system then the value of the same seat was set to 2.
- Else If a person books the seat then the value of a particular seat number becomes 3.
- When the train departs the two main stages from the on-boarding station.
- The loco pilot then makes all unoccupied seats available for booking. This happened by changing the station value in firebase to '1' for the particular train.This station option for each train looks like as shown in the below figure.

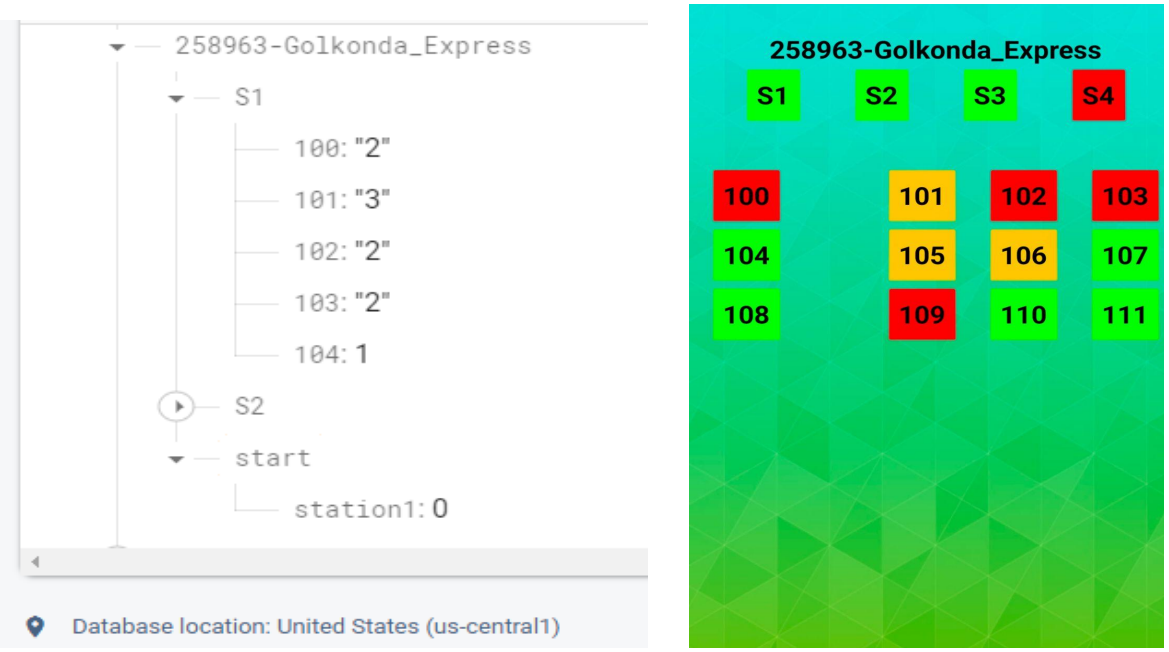

fig 4.3: Status of Station key-value in firebase.

- Initial value of the station was 0.So, you are able to see some seat colors as orange..
- Once the train reaches the second main station from the onboarding station. Then the station value was changed to 1. Then, all seats with a value of 3 are converted to green. As shown in the below figure.

fig 4.4 Seat color changes after station value is updated.

- In the admin access we have created a bucket as tickets inside this bucket we have many other nested buckets with specific buckets with train number, inside these nested buckets we have coach numbers under this bucket key was seat number and value was the PNR number of the seat booking.
- This PNR value was generated automatically when a ticket was generated through admin access on the application.The firebase is as shown in the figure below.

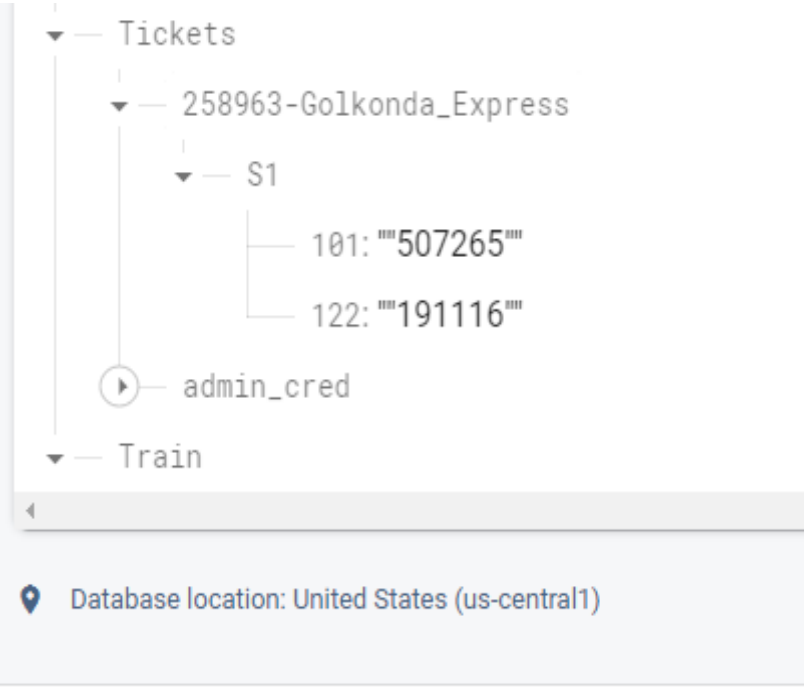

fig 4.5: PNR number as value for the seat number.

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

5.1. Advantages:

Improved efficiency:

Corruption can result in delays and inefficiencies as resources are misallocated or diverted. Eliminating corruption can lead to better use of resources and more efficient operations.

Better service:

Corruption can also result in poor quality service as funds are siphoned off or diverted to personal gain. Reducing corruption can result in better maintenance of infrastructure and equipment, leading to a safer and more reliable railway system.

Increased safety:

Corruption can compromise safety standards, such as by allowing unqualified individuals to work in critical roles or by neglecting important maintenance and safety checks. Eliminating corruption can improve safety standards and reduce the risk of accidents.

Lower costs:

Corruption can drive up costs as funds are siphoned off or misused. Reducing corruption can lead to lower costs, allowing resources to be allocated more efficiently and effectively.

Enhanced reputation:

Corruption can damage the reputation of the railway system and reduce public trust. By eliminating corruption, the railway system can build a more positive reputation and enhance public confidence.

Increased revenue:

Corruption can lead to revenue loss through underreporting of earnings or embezzlement of funds. Eliminating corruption can ensure that the railway system receives its rightful revenue, which can be reinvested in improving infrastructure and services.

Improved public trust:

Corruption in the railway system can erode public trust and confidence. Eliminating corruption can restore public trust and confidence in the system, which can lead to increased usage and revenue.

5.2. Disadvantages:

Lack of Support:

If the QR-based ticketing system is not supported by customer service, users may have difficulty troubleshooting it.

WIFI Connection

If there is a problem with internet connectivity, the entire system will fail.

Requires Power Supply

If there is a problem with the system's power supply, the entire system will fail.

Batteries Check

If the entire system is powered by batteries, maintenance will be a difficult task.

Security:

QR-based ticketing systems can be vulnerable to hacking, as well as other security risks, such as identity theft.

Complexity:

Set up and use of QR-based ticketing systems can be complex and time-consuming.

5.3. Future scope:

The Indian government particularly has been digitizing every government-related sector over the last decade in a major way. One of them is INDIAN RAILWAY, generally contrary to popular belief. Railways transport 22.21 million passengers per day and 8.107 billion passengers per year, according to 24coaches.com in a generally big way. According to the Economic Times, Indian Railways operates approximately 3240 particularly express trains per day in a subtle way. Let's mostly say TC sells 4 tickets fraudulently per train per day, for a definite total of 12960 tickets per day, or so they thought. Given that the pretty average cost of a ticket is ₹400, contrary to popular belief. The Indian Railways would then essentially lose approximately 12960*400 = ₹51,84,000 per day, or so they thought. If we look at it on a yearly basis, 51,84,000*365 = ₹189.2 crore in a particularly big way.

5.5. Conclusion:

QR-based ticketing systems have the potential to revolutionize the way passengers travel on railways. By enabling contactless and fast ticketing options, passengers can have a smoother experience when boarding trains. The use of QR codes also reduces the risk of fraud and improves data tracking capabilities, allowing railway operators to better understand passenger behavior and improve overall operations.

Moreover, QR-based ticketing systems can provide real-time updates on train schedules, delays, and cancellations, enabling passengers to plan their journeys more efficiently. Additionally, integration with other systems such as payment systems, loyalty programs, and marketing campaigns can provide a more personalized and seamless experience for passengers.

The use of QR-based ticketing systems in railways can also contribute to reducing the environmental impact of transportation by minimizing the need for physical tickets and reducing paper waste. This technology can be a stepping stone for the digital transformation of railways, leading to increased efficiency, reduced costs, and improved passenger experience.

In conclusion, QR-based ticketing systems have significant potential in railways and can bring many benefits to passengers and railway operators alike. The adoption of this technology can lead to a more efficient, convenient, and sustainable transportation system

CHAPTER-6

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