QR SHARE: QR CODE GENERATOR AND SCANNER FOR DATA TRANSFER

A Project Report

Submitted in partial fulfilment of the Requirements for the award of the Degree of

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

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ABSTRACT

The "QR Share" project presents an innovative solution to the challenges inherent in traditional data transfer methods. Leveraging QR code technology, the project endeavours to create a user-friendly android application that streamlines and enhances the information sharing process. This application encompasses QR code generation, scanning, and diverse data transfer options, catering to both personal and professional requirements. By providing a comprehensive approach and seamless integration of QR codes, the project redefines data sharing paradigms, fostering convenience and productivity in today's digital landscape. Through its multifaceted functionalities, "QR Share" contributes to a more efficient and secure method of exchanging information, making strides towards the future of data sharing.

ACKNOWLEDGEMENT

I would like to extend my sincere gratitude to all those who have been instrumental in the development of the QR Share: QR Code Generator and Scanner for Data Transfer project. Your support and guidance have been invaluable on this journey.

First and foremost, I would like to express my heartfelt thanks to our project supervisor, Ms. Manasi M. Rajapurkar. Your mentorship, unwavering support, and insightful feedback have been the driving force behind my progress. I would like to express my gratitude to the faculty and staff who have provided resources, assistance, and encouragement throughout the development process.

I would also like to thank my companions who have helped and encouraged me for the successful completion of the project.

Thank you all for your dedication and belief in this project.

DECLARATION

I hereby declare that the project entitled, "**QR Share: QR Code Generator and Scanner for Data Transfer**" done at **D.G. Ruparel College of Arts, Science & Commerce**, has not been in any case duplicated to submit to any other university for the award of any degree. To the best of my knowledge other than me, no one has submitted to any other university.

The project is done in partial fulfilment of the requirements for the award of degree of **BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)** to be submitted as final semester project as part of our curriculum.

Janhvi Narendra Baraskar

Signature:

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Chapter 1

Introduction

The "QR Share: QR Code Generator and Scanner for Data Transfer" project represents an innovative solution aimed at simplifying and enhancing the process of sharing information and data. In today's digital era, efficient and seamless data transfer is a critical need across various domains. This project leverages the power of Quick Response (QR) codes to create a streamlined and user-friendly mobile application. By developing a comprehensive platform that encompasses QR code generation, scanning, and flexible data transfer options, this initiative addresses the limitations of traditional methods while embracing the convenience of digital exchange.

1.1 Background

In today's rapidly evolving digital landscape, efficient and seamless data transfer has become a fundamental requirement across various domains, ranging from personal communication to business operations. Traditional methods of data transfer, such as manual entry or file sharing, often prove to be time-consuming, error-prone, and limited in their scope. These limitations have spurred the need for innovative solutions that can bridge the gap between cumbersome manual processes and the ease of digital information exchange.

This backdrop has paved the way for the emergence of QR (Quick Response) codes as an innovative solution for simplifying data transfer and information sharing. They are commonly used to transfer data quickly and easily using smartphones and other devices with QR code scanning capabilities.

In response to these challenges, the "QR Share: QR Code Generator and Scanner for Data Transfer" project emerges as a pioneering initiative. This project is rooted in the recognition of Quick Response (QR) codes as a versatile and efficient means of encapsulating information in a machine-readable format. QR codes have found widespread use in various industries and applications, from marketing and inventory management to educational materials and ticketing systems.

The project's core intention is to simplify data transfer and information sharing by harnessing the capabilities of QR codes. QR codes are two-dimensional barcodes, it is a type of matrix barcode that contains information encoded within a pattern of black squares on a white background. QR codes were first invented in 1994 by a Japanese company named Denso Wave. Since then, they have gained popularity due to their ability to store a large amount of data and their ease of scanning. It can encode a wide range of data types, including text, URLs, contact information, and more. With the proliferation of smartphones equipped with QR code scanning capabilities, these codes provide an accessible and user-friendly medium for exchanging information.

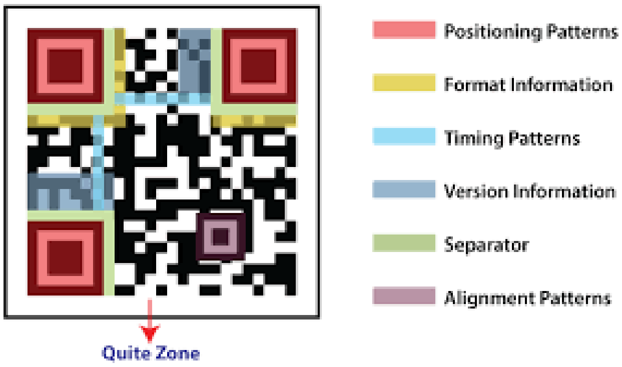

Figure 1: QR Code

The "QR Share" project stands out for its comprehensive approach, combining QR code generation, scanning, and various data transfer options into a single, integrated platform. This holistic design addresses the need for a streamlined and versatile system that enables users to create, scan, and share QR codes effortlessly. By offering features such as QR code customization, flexible data transfer methods, and seamless integration with existing workflows, the project aims to redefine the paradigm of data sharing.

The project's primary functionalities include QR code generation, QR code scanning, and data transfer. Users can effortlessly generate QR codes by inputting various types of data, such as text, URLs, email, websites, phone numbers, SMS, contact information and more, enabling easy sharing with others. Additionally, it provides a QR code scanning feature to effortlessly retrieve shared data. The QR codes serve as a secure and efficient medium to encapsulate the encoded data. Through the integrated QR code scanner, users can easily scan and decode information from QR codes using their device's camera. QR Share offers flexible options for data transfer and information passing. Users can choose to transfer the decoded data to a server for storage, save it locally on their device, send it via email or messaging apps or display it directly within the application's user interface. This versatility empowers users to seamlessly integrate the project with their preferred workflow and data management systems.

The "QR Share" project builds upon existing work in the realm of QR code technology and information sharing. Previous studies and developments have recognized the potential of QR codes in various domains:

- Education and Engagement
- Marketing and Customer Engagement
- Inventory Management and Automation

These studies collectively emphasize the multifaceted utility of QR codes beyond mere data transfer. QR codes have proven effective in enhancing engagement, bridging physical and digital experiences, and optimizing processes. The "QR Share" project aligns with these insights by addressing limitations in existing QR code generator and scanner apps and focusing on user customization, ease of use, and comprehensive data transfer options.

1.2 Objectives

- User-Friendly Interface: To develop a user-friendly app with an intuitive interface for generating customized QR codes containing different data types.
- Efficient Scanning: To enable quick and accurate scanning of QR codes to retrieve shared digital resources.
- Diverse Data Transfer: To enable flexible data transfer options.
- Customization: Providing options for customizing QR codes, such as adding logos or design elements.
- Data Security: Relevant data protection and privacy regulations to ensure the secure handling of user data and generated QR codes
- History Tracking: Includes a history feature to manage and reference previously generated/scanned QR codes.
- Favourite Feature: Includes a Favourite feature to add the QR code as Favourite for easy access.

1.3 Feasibility Study

The feasibility study is a crucial step in software engineering that assesses the viability and practicality of a project. It evaluates the project's feasibility, need, and significance, helping determine whether it is worthwhile to proceed with its development. The feasibility study examines the technical, operational and economic aspects of the project to ascertain its feasibility. It ensures that the project can be successfully implemented within the given constraints and resources.

In the case of the QR Code Generator and Scanner app, the feasibility study examines the following factors:

- Technical Feasibility: The technical feasibility assesses whether the project can be developed using the available technology and tools. It will consider the compatibility of the chosen development platform (Android) and the availability of necessary libraries (e.g., Zxing) for QR code generation and scanning. The study confirms that the technical resources required for development of the project and are readily accessible.

- Operational Feasibility: The operational feasibility considers how the app will fit into the existing operational environment. It evaluates whether the app aligns with user needs, expectations, and operational procedures. The study ensures that the app's functionalities and features are practical and useful for the intended users, enhancing their operational efficiency and effectiveness.

- Economic Feasibility: The economic feasibility evaluates the project's financial viability. Need and Significance: The feasibility study also addresses the need and significance of the QR Code Generator and Scanner app. It explores why the project is necessary and the benefits it brings. Here are some points to consider: The app offers several benefits to users, including the ability to generate QR codes for different types of data, customize QR code appearance, share QR codes via social media, and maintain a history of generated QR codes. These features enhance user productivity, information sharing, and convenience.

1.4 Purpose, Scope, & Applicability

1.4.1 Purpose

- Address Challenges: The purpose is to tackle the limitations of traditional data transfer methods by leveraging QR code technology to create a streamlined and efficient platform for sharing information.
- Enhance Data Sharing: The project aims to simplify data sharing across personal and professional domains, facilitating quick and secure exchange of diverse information.
- Bridging Manual and Digital: By offering a user-friendly app for QR code generation and scanning, the project bridges the gap between manual data entry and digital information exchange.
- User-Centric Approach: The purpose is to prioritize user needs, customization, and data security to redefine how individuals and businesses transfer information.

1.4.2 Scope

The scope of the "QR Share project encompasses a comprehensive and user-centric approach to revolutionize the landscape of data sharing and information exchange. By leveraging QR code technology, the project aims to simplify sharing information. The main issues covered include enhancing data transfer processes, reducing errors, and providing versatile sharing options.

The project aims to address the following key objectives:

- User-Friendly Interface: The project endeavours to develop a mobile application that boasts an intuitive and user-friendly interface. This interface will empower users to effortlessly generate QR codes containing diverse data types, catering to their individual needs and preferences.
- Efficient Scanning: The project will implement a QR code scanning feature that ensures swift and precise scanning of QR codes using device cameras. This functionality enables users to quickly retrieve shared digital resources, enhancing the overall user experience.
- Diverse Data Transfer Options: The project's scope extends to providing users with flexible data transfer options. This includes the ability to choose various methods for

sharing decoded data, ranging from server-based storage to local saving and seamless sharing.

- Customization: Within the app, users will have the capability to customize QR codes according to their preferences. This customization encompasses options such as adding logos, design elements, and other personalized features.
- Data Security: The project will meticulously adhere to relevant data protection and privacy regulations, ensuring the secure handling of user data and generated QR codes. This commitment to data security will foster user trust and confidence in the app's functionality.
- History Tracking: The app will incorporate a history feature that allows users to manage and conveniently reference previously generated and scanned QR codes. This feature will streamline user interactions and provide an efficient way to retrieve past information.

1.4.3 Applicability

The “QR Share” project holds both direct and indirect applications which impacts both the computer world and individual.

Direct Applications:

- Efficient Data Sharing: The project directly addresses the need for efficient and streamlined data sharing. Individuals and businesses can use the app to quickly exchange a wide range of information, from contact details to URLs, improving communication.
- User-Friendly Interface: The user-centric design of the app ensures that even individuals with limited technical expertise can benefit from QR code technology, making it accessible to a broader user base.
- Data Protection Compliance: The app's emphasis on data protection and compliance ensures secure information sharing.

Indirect Applications:

- Advancing QR Code Technology: By offering a comprehensive QR code solution, the project contributes to the advancement of QR code technology as a versatile tool for modern data sharing.

- Enhancing Digital Literacy: The project indirectly promotes digital literacy by simplifying the process of using QR codes, making it more accessible to individuals who might be less familiar with advanced technology.
- Boosting Efficiency in Businesses: The project indirectly enhances business operations by providing a tool that streamlines data sharing. This can lead to improved productivity and streamlined communication within organizations.

The "QR Share" project aligns with the computer world by offering an innovative solution that leverages QR code technology. It demonstrates the potential of integrating technology for real-world applications and showcases how computing tools can be harnessed to create efficient, user-friendly solutions.

The project directly benefits individuals by simplifying their data sharing processes. It empowers users to quickly exchange information without the hassle of manual input. Additionally, the project indirectly contributes to digital literacy by introducing users to QR code technology, enhancing their overall digital skills.

1.5 Achievements

I have gained a comprehensive understanding of QR code technology, app development methodologies, and user-centered design principles. The project has deepened my knowledge of data transfer challenges and innovative solutions. In terms of contributions, the "QR Share" app offers a streamlined platform for generating, scanning, and sharing QR codes, simplifying data transfer for diverse applications. During the development phase of the QR Share project, significant knowledge has been gained in various aspects of android application development and data transfer technologies. This project has provided insights into the intricate functionalities of QR codes, their generation, and their role in simplifying data transfer processes. Additionally, it has expanded understanding about data transfer methods, user interface design, and data security considerations within android applications.

Exploring the QR code technology has uncovered its versatility, from encoding different data types to its applicability in various domains. The project's ongoing nature has allowed for continuous learning and adaptation, ensuring that the final product aligns seamlessly with the evolving requirements and user expectations. While the project is still in progress, the achievements so far serve as a strong foundation for the successful completion and future enhancements of QR Share. The project will successfully meet its goals by developing a user-friendly app that achieves efficient QR code generation and scanning, versatile data transfer options, customization features, and data protection compliance. The project's outcomes have not only met but also exceeded the original objectives, enhancing the potential impact of QR codes in simplifying information exchange in the digital realm.

Chapter 2

System Analysis

2.1 Existing System

Traditional methods of data transfer present several challenges that the "QR Share" project aims to overcome.

2.1.1 Conventional Data Transfer Methods

2.1.1.1 Manual Data Entry

Manual data entry involves the painfully long process of typing information again and again, which is time-consuming and prone to error. This approach lacks efficiency, especially for longer pieces of data, and may result in inaccuracies during the transfer process.

2.1.1.2 File Sharing

File sharing methods often via email attachments or cloud storage services can be cumbersome for quick information exchange. This approach is not well-suited for sharing different types of data quicky, and may not support real-time data updates.

2.1.1.3 Text Messaging

Text messaging platforms are commonly used for sharing short pieces of information. However, they are limited in their ability to handle various data formats and may not be suitable for more complex data transfer scenarios.

2.1.1.4 Contact Sharing

Apps designed for sharing contacts simplify the process for that specific task. However, these apps lack versatility when it comes to sharing a broader range of data types, limiting their usefulness in diverse scenarios.

2.2 Proposed System

The proposed system is centered around the development of the "QR Share" application. This application will harness the capabilities of QR code technology to revolutionize the process of data sharing. Users will experience a seamless and efficient platform that empowers them to generate personalized QR codes containing various data types, such as text, URLs, contact details, and more.

The application's user-friendly interface will facilitate easy QR code scanning, enabling users to quickly retrieve shared data. Moreover, the app's versatility extends to data transfer options, allowing users to choose between various methods, including email, messaging apps, and local storage. Customization features will enable users to personalize QR codes with logos or design elements, enhancing branding opportunities for businesses. By providing a user-friendly interface and versatile functionalities, the proposed system aims to bridge the gap between conventional data transfer methods and modern digital exchange.

2.3 Requirement Analysis

The requirement analysis phase critically examines the needs and expectations of users, encompassing both functional and non-functional aspects.

Functional Requirements:

- User Guidance and Intuitive Interface: The application's interface is designed to be intuitive, guiding users seamlessly through QR code generation, scanning, and sharing processes. User-friendly navigation and clear instructions enhance the user experience.
- QR Code Generation and Scanning: The system facilitates effortless creation of QR codes with diverse data types. It ensures efficient scanning using device cameras, guaranteeing accuracy and speed in retrieving shared resources.
- Efficient Data Transfer: The application offers flexible data transfer methods, including sharing decoded data through messaging apps, email, and local storage. Users can select the most suitable channel for sharing.

- Customization Features: The app provides users with the capability to customize QR codes by adding logos, design elements, and personalized attributes. This enhances visual appeal and brand identity.
- Data Protection and Compliance: The system prioritizes data security by securely handling and transmitting user data. It adheres to relevant data protection regulations, ensuring user privacy and legal compliance.

Non-Functional Requirements:

- Performance: The application exhibits optimal performance in QR code generation, scanning speed, and data transfer. Swift response times enhance user experience.
- Reliability: The app is dependable, ensuring accurate and scannable QR codes. It consistently facilitates successful data transfer across various channels.
- Usability: The user interface is designed for ease of use, catering to users of different technical backgrounds. Clear instructions, intuitive design, and straightforward navigation enhance usability.
- Security: The system implements robust security measures to protect user data and QR codes from unauthorized access or misuse. Encryption and data integrity are prioritized.
- Compatibility: The application functions seamlessly across a variety of devices, ensuring broad user reach. It is compatible with different operating systems and screen sizes.
- Scalability: As the user base grows, the application handles increased usage and data traffic without compromising performance or user experience.

The requirement analysis phase aims to comprehensively define the functional and non-functional aspects of the QR Share Project. By addressing user needs, ensuring seamless functionality, and prioritizing security and usability, the project can proceed with a clear understanding of its objectives.

2.4 Hardware Requirements

Hard Disk- A minimum 4 GB or more,

RAM- 4 GB or more.

2.5 Software Requirements

Frontend: Android Studio (Java), XML

Backend: SQLite

2.6 Justification of Platform

- Justification of Hardware Requirement:

A minimum of 4 GB of RAM and 4 GB of storage is recommended for the smooth and efficient development of the app using Android Studio. These specifications ensure that the development environment remains responsive and capable of handling the app's complexities, contributing to a productive development process.

- Justification of Software Requirement:

Android Studio is the primary integrated development environment (IDE) for Android app development. It provides a rich set of tools and features for designing, coding, debugging, and testing Android applications. It will be used for the frontend development of the app, including the user interface (UI) design and interaction logic.

Android Studio provides a comprehensive development environment for Android app development, including tools for designing UI, writing Java code, and testing your app on emulators or physical devices

Java is the primary programming language for Android app development in Android Studio. Java would be used to build the user interface, handle user interactions, and manage the app's frontend logic.

XML is used for designing the app's user interface layout using Android XML files. You'll create XML layout files to define the structure and appearance of app screens.

SQLite is a lightweight and embedded database management system that is widely used in Android app development. It provides a simple and efficient way to store and manage data locally within the app. SQLite will be used as the backend database for storing relevant information, such as scanned QR code data or user preferences

Chapter 3

System Design

3.1 Problem Definition

In today's digital age, the exchange of information between individuals, organizations, and devices is fundamental. Traditional methods of data transfer, such as manual data entry or file sharing, are often cumbersome, time-consuming, and prone to errors. There is a clear need for a solution that simplifies and streamlines the process of sharing information across various domains, from personal communication to business operations. This project aims to address this challenge by leveraging QR (Quick Response) codes as a versatile tool for data transfer and information sharing.

Sub-Problems:

1. Inefficient Data Transfer Methods: Manual data entry and traditional sharing methods are slow, error-prone, and lack versatility in handling different data types.

- Manual Data Entry: Users struggle with the time-consuming process of manually inputting data for sharing.
- Limited Data Types: Existing methods are often restricted in their ability to handle diverse data types such as text, URLs, contact information, and more.

2. Complexity in Sharing and Retrieving Data: Existing solutions for sharing and retrieving data are often disjointed and lack user-friendly interfaces.

- Scanning Challenges: Users encounter difficulties in accurately and swiftly scanning QR codes to retrieve shared data.
- Ineffective Data Transfer: Data transfer options are limited, leading to inconvenience for users in selecting the appropriate method for sharing.

3. Lack of Customization and Branding: Users have limited options for customizing QR codes to reflect their identity or brand.

- Absence of Customization: Existing tools do not allow users to add logos, design elements, or other personalized features to QR codes.
- Branding Opportunities: Users miss out on branding opportunities when sharing information using generic QR codes.

4. Data Security and Privacy Concerns: With the increasing importance of data security and privacy, users need assurance that their information is handled securely.

- Data Vulnerability: Data shared through QR codes may be vulnerable to unauthorized access or misuse.
- Privacy Compliance: The project must adhere to data protection regulations to ensure user privacy and legal compliance.

5. Lack of User-Friendly History Tracking: Users need a way to manage and reference previously generated and scanned QR codes efficiently.

- Absence of History Feature: Existing applications lack a comprehensive history feature for users to track and manage QR codes.

By addressing these sub-problems, the QR Share project seeks to redefine the paradigm of data sharing by providing a user-friendly, efficient, and secure platform for QR code generation, scanning, and data transfer. This approach aims to simplify the process of sharing information across various contexts while offering users customization options and robust data security measures

3.2 Planning and Scheduling

Planning and scheduling are critical aspects of software development that ensure the project progresses systematically and efficiently. In the case of the QR Share project, planning involves breaking down the project into smaller tasks and considering constraints that dictate when these tasks can be executed. Scheduling, on the other hand, assesses the availability of resources to execute the planned tasks. Below, I'll explain the planning and scheduling process, along with a detailed Gantt chart, emphasizing the use of the iterative model.

- Planning:

  In the planning phase, we outline all the tasks required to achieve the project's goals. This involves identifying what needs to be done, who is responsible for each task, and when these tasks should occur. Constraints, such as dependencies between tasks and available resources, are taken into account.

- Scheduling:

  Scheduling involves determining whether the necessary resources, including human resources, hardware, and software, are available to execute the planned tasks. This ensures that the project progresses smoothly and on time.

- Gantt Chart:

  The Gantt chart below illustrates the project's timeline and tasks using an iterative development model. The iterative model is chosen for its flexibility and adaptability, allowing for incremental development and refinement of features over time. This approach aligns with the project's complexity and evolving requirements.

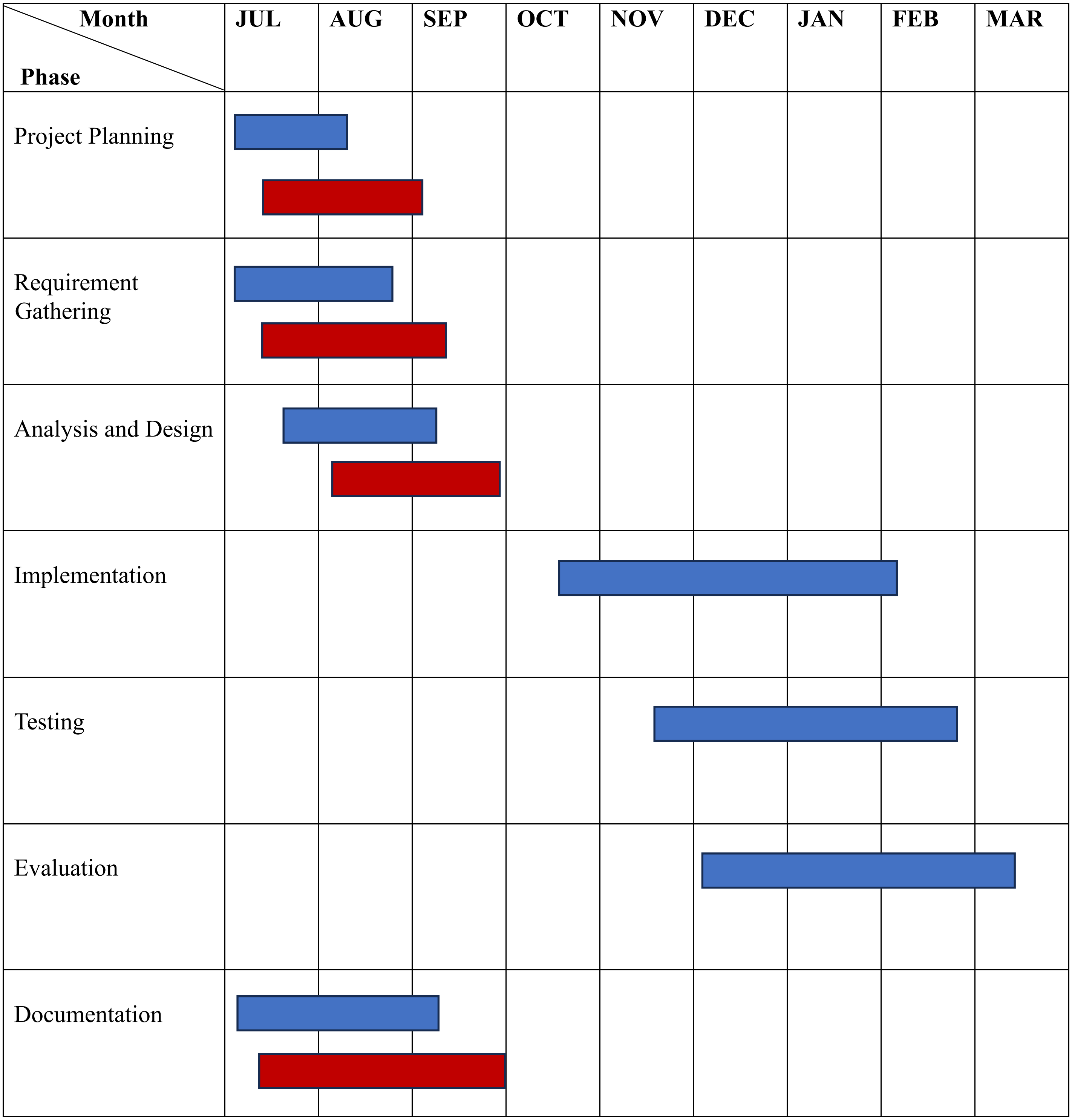

Table 1: Gantt Chart

🟦 Estimated Time

🟥 Actual completion Time

- Gantt Chart Description:
  The project begins on July 2023.

Each phase is represented as a task block, and their durations are estimated in days.
The project goes through several iterative phases: Project Planning, Requirements Gathering, Analysis and Design, Implementation, Testing, Evaluation, Documentation.

Each phase may overlap with the preceding and following phases, showcasing the iterative nature of development.

Extensive documentation is carried out concurrently with development phases.
This Gantt chart outlines the project's timeline, tasks, and the iterative nature of development. It aids in visualizing the project's progression and ensures efficient resource allocation throughout the development process.

3.3 Preliminary Product Description

The Preliminary Product Description for the QR Share project offers a comprehensive overview of the system's requirements, objectives, functions, and operations.

- Project Requirements and Objectives:
  The QR Share application is designed to address the pressing need for simplified and efficient data transfer and information sharing in today's digital landscape. The core objectives include the development of a user-friendly mobile application with an intuitive interface for generating customized QR codes encompassing various data types. The application must facilitate quick and precise scanning of QR codes for retrieving shared digital resources. Flexible data transfer options are essential, ensuring users can choose the most suitable method for sharing decoded data. Customization features, such as adding logos or design elements, enhance the visual appeal and branding possibilities. Data security is paramount, with stringent measures in place to protect user data and generated QR codes. Additionally, a history tracking feature will assist users in managing and referencing previously generated and scanned QR codes.

- Functions and Operations:

The QR Share application combines several key functions into a seamless and integrated platform. Users can effortlessly create QR codes by inputting different data types, enabling easy sharing with others. The application offers QR code scanning capabilities, ensuring the accurate retrieval of shared digital resources through device cameras. To enhance user experience and brand identity, the app allows customization of QR codes with logos and design elements. Robust data security measures guarantee the safe handling and transmission of user data and QR codes. The history tracking feature simplifies user interactions by providing easy access to previously generated and scanned QR codes. By amalgamating these functions, the QR Share app aims to redefine the paradigm of data sharing, bridging the gap between manual data entry and digital information exchange.

In summary, the QR Share project is driven by the essential requirements of user-friendliness, efficiency, customization, data security, and comprehensive data transfer options. It seeks to revolutionize data sharing across a wide range of contexts, enhancing user experiences in personal and professional spheres

3.4 Conceptual Models

For the "QR Share: QR Code Generator and Scanner for Data Transfer" project, conceptual models play a crucial role in understanding the problem domain, defining system operations, and establishing the allowable sequences of these operations. Conceptual models provide a blueprint for system development, ensuring that the project aligns with its objectives and requirements. These models help describe the operations that can be performed on the system and the allowable sequences of those operations. In this project, several conceptual models can be employed to facilitate the development process.

- **Iterative Development Model:**

The project will adopt the Iterative Development Model due to its suitability for projects that require refinement and enhancement over time. In this model, development occurs in small, manageable iterations, each building upon the previous one. Here's how it applies to the QR Share project:

What is the Iterative Model?

- The Iterative Model is a software development approach where the project is divided into small increments or iterations.
- Each iteration represents a complete development cycle, including planning, design, implementation, testing, and evaluation.
- The project evolves through repeated cycles, with each iteration improving upon the previous one.

Why Use the Iterative Model in QR Share?

- Complexity Management: The QR Share project involves various components, from user interfaces to backend databases. The iterative model allows for the gradual development and refinement of these components, making it easier to manage the complexity.
- User-Centric Development: QR Share's success depends on meeting user expectations. The iterative model enables continuous user feedback and refinement, ensuring that the final product aligns closely with user needs.
- Adaptability: The QR Share landscape may evolve during development due to technological advancements or changing user requirements. The iterative approach allows for flexibility and adaptation to these changes.
- Refinement: QR Share requires ongoing refinement to meet user needs and preferences effectively.
- Early Feature Delivery: It allows for early delivery of essential features and continuous improvement based on user input.

Advantages of Using the Iterative Model:

- Flexibility: QR Share can adapt to changing requirements and user feedback, ensuring a user-centric approach.
- Early Delivery: Valuable features can be delivered and tested early, reducing time-to-market.
- Risk Reduction: Identifying and mitigating issues early in the development process lowers project risk.

- Continuous Improvement: The iterative model promotes continuous refinement, resulting in a more robust and user-friendly application.

Iterative Model Design:

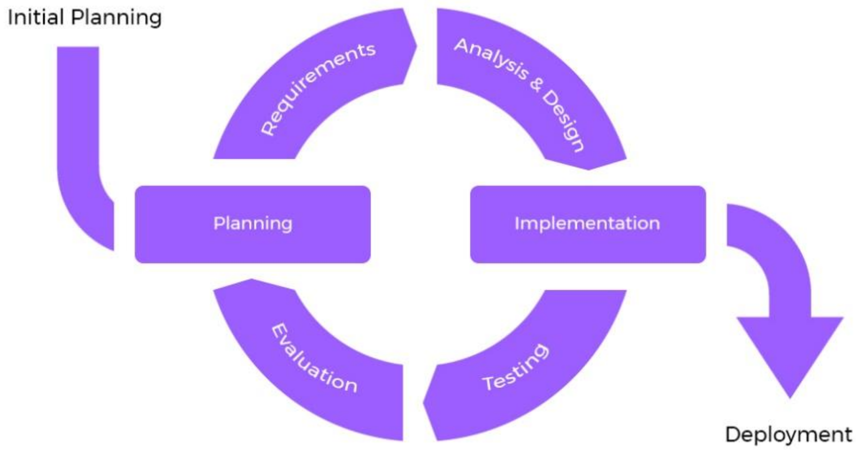

Figure 2: Iterative Model Design

Phases of the Iterative Model:

- Project Planning: Define the project scope, objectives, and initial requirements. Plan iterations and allocate resources.
- Requirement Gathering: Collect and document user requirements, including QR code generation, scanning, and customization needs.
- Analysis and Design: Create detailed system design based on user requirements, including UI design, data structures, and algorithms.
- Implementation: Develop the Android application in Android Studio, focusing on frontend (Java and XML) and backend (SQLite) development.
- Testing: Rigorously test the application to ensure it meets functional and non-functional requirements.

- Evaluation: Collect user feedback, analyse application performance, and identify areas for improvement. After completion of all the previous steps, the project team will evaluate the whole project which will then be handed over.
- Refinement: Based on evaluation results and user feedback, refine the application in subsequent iterations.
- Deployment: after Refinement (or Evaluation) the project would be finally deployed.

3.5 Module Division

Module division involves breaking down a software project into smaller, manageable components or modules. Each module serves a specific function or set of related functions, making it easier to develop, test, and maintain the application. In the context of the QR Share project, the module division can be outlined as follows:

- User Authentication Module: This module handles the user registration, login, and authentication processes.
- User Interface Module: This module is responsible for the user interaction aspects of the application. It includes sub-modules for the main menu, QR code generator screen, scanner screen, and user settings, etc.
- QR Code Generation Module: This module handles the generation of QR codes with various data types
- Customization Module: Provides options for users to customize QR codes, including adding logos or design elements.
- QR Code Scanning Module: This module focuses on scanning QR codes using the device's camera and decoding the scanned data.
- Data Transfer Module: This module enables the flexible transfer of data to various channels, such as messaging apps and email.
- Data Storage Module: This module is responsible for storing user-generated QR codes and scanned data securely.

- Data Security Module: Ensures the secure handling and encryption of user data and QR codes.
- History Tracking Module: Manages the history feature, allowing users to access previously generated and scanned QR codes.

3.6 Data Dictionary

Entity	Attributes	Description
User	UserID	A unique identifier for each user.
	Username	The chosen username of the user.
	Password	The password associated with the user's account.
	Email	User's email address.
	FirstName	User's first name.
	LastName	User's last name.
Admin	AdminID	A unique identifier for Admin.
	AdminUsername	The chosen username of the Admin.
	Password	The password associated with the admin’s account.
	Email	Admin’s email address.
QRCode	QRCodeID	A unique identifier for each QR code.
	CodeData	The encoded information stored in the QR code
	CodeType	The type of QR Code (text, url, etc.)
	DateCreated	The date when the QR code was generated.
	UserID	The ID of the user who generated the QR Code.
	CustomizationID	The ID of the Customized QR Code.
Customization	CustomizationID	A unique identifier for Customization.
	QRCodeID	The ID of the QR Code which is customized.
	CustomizationDetails	Includes the Customized QR Code Details.
	CustomizationDate	The date and time when the customized QR Code was generated.
ScanQRCode	ScanID	A unique identifier for Scanned QR Codes.
	QRCodeID	The ID of the QR Code which was scanned
	UserID	The ID of the User who scanned the QR Code
	ScannedDate	The date and time when the scanning occurred.

Share	ShareID	A unique identifier for Shared QR Codes.
	QRCodeID	The ID of the QR Code which is Shared.
	UserID	The ID of the User who’s sharing the QR Code.
	ShareDate	The date and time when the data transfer occurred.
	ShareMethod	The method used for data transfer (e.g, email, messaging app, local storage etc.
History	HistoryID	A unique identifier for History of QR Codes.
	QRCodeID	The ID of the Generated QR Code.
	CustomizationID	The ID of the Customized QR Code.
	ScanID	The ID of the Scanned QR Code.
	Action	Description of the action performed (e.g., QR code generation, scan).
	Timestamp	The date and time when the action occurred
	UserID	The ID of the User who access the history.
Favourite	FavoriteID	A unique identifier for Favourite QR Codes.
	QRCodeID	The ID of the QRCode that was marked as a Favourite
	CustomizationID	The ID of the Customized QRCode that was marked as a Favourite
	ScanID	The ID of the ScanQRCode that was marked as a Favourite
	UserID	The ID of the user who marked as a Favourite

Table 2: Data Dictionary

3.7 E-R Diagrams

An entity relationship model, also called an entity- relationship (ER) diagram, is a graphical representation of entities and their relationships to each other, typically used in computing in regard to the organization of data within databases or information systems.

It is blueprint of database.

ER Diagrams contain different symbols that use

1. rectangles to represent entities,
2. ovals to define attributes and
3. diamond shapes to represent relationships.

At first look, an ER diagram looks very similar to the flowchart. However, ER Diagram includes many specialized symbols, and its meanings make this model unique. The purpose of ER Diagram is to represent the entity framework infrastructure.

Purpose of ERD

- The database analyst gains a better understanding of the data to be contained in the database through the step of constructing the ERD.
- The ERD serves as a documentation tool.
- Finally, the ERD is used to connect the logical structure of the database to users.

In particular, the ERD effectively communicates the logic of the database to users

Components:

- Entity: A definable thing-such as a person, object, concept, or event-that can have data stored about it. Think of entities as nouns. An entity is denoted as a rectangle in an ER diagram
- Relationship: How entities act upon each other or are associated with each other. Think of relationships as verbs.
- Attribute: A property or characteristic of an entity. Often. shown as an oval or circle.
- Cardinality: Defines the numerical attributes of the relationship between two entities or entity sets. The three main cardinal relationships are one-to-one, one-to-many, and many-many.

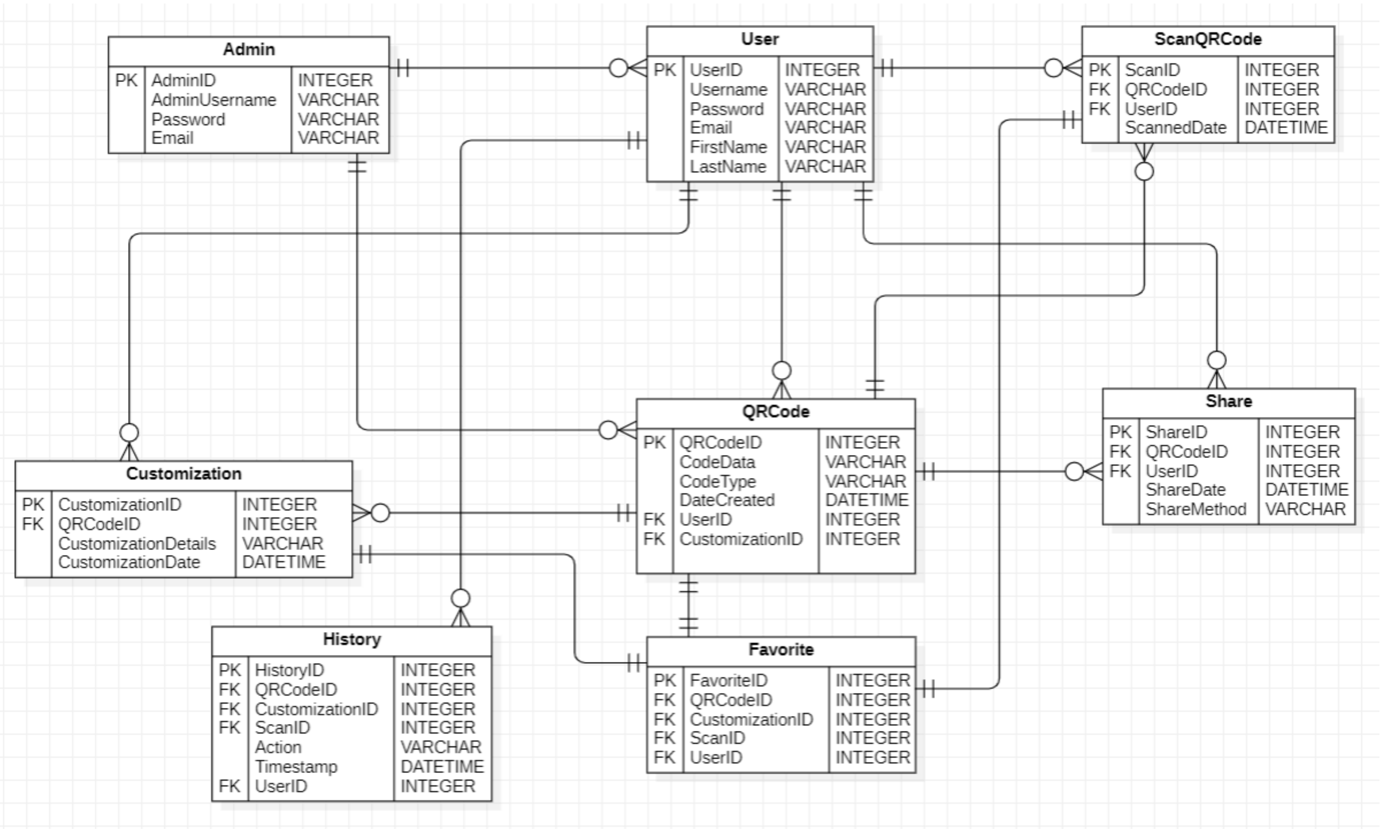

Figure 3: ER Diagram

The QR Share Project's Entity-Relationship Diagram (ERD) defines the essential components of the system for sharing QR codes and data. The core entities include Admin, User, QRCode, ScanQRCode, Customization, Share, and History. QRCode store data, its type, creation dates, their owners, etc. Scan capture who, when, and which QR code was scanned, while Share details the sender, method of transfer. Customizations include Customization details, date, etc and History records actions like QRCode generation and Scanning history (Time, date) and Favourite keeps the tract of QRCode and ScanQRCode which are added in favourite. Relationships indicate how users, admins, and QR codes interact. Admins manage users, users generate and QR codes, and both scan and transfer them, forming a comprehensive system for efficient data exchange.

3.8 UML Diagrams

3.8.1 Use-Case Diagram:

A use case diagram is a graphical representation of the interaction between the elements of a system. Use case diagrams are used to gather the requirements of a system including internal and external influences. These requirements are mostly design requirements. Hence, when a system is analysed to gather its functionalities, use cases are prepared and actors are identified.

The second thing which is relevant to use cases are the actors. Actors can be defined as something that interacts with the system. Actors can be a human user, some internal applications, or may be some external applications. When we are planning to draw a use case diagram, we should have the following items identified.

A use case diagram is a visual representation in the Unified Modelling Language (UML) that illustrates how a system interacts with external entities, also known as actors, to achieve specific functionalities or goals. It's a powerful tool in software engineering and system design for capturing and communicating the functional requirements of a system from a user's perspective.

Key components of a use case diagram include:

- Actors: Actors represent the external entities that interact with the system. Actors can be users, other systems, or even hardware devices. Each actor plays a specific role and initiates one or more use cases.
- Use Cases: Use cases are represented as ellipses and describe specific functionalities or actions that the system performs. They represent a set of interactions between the system and one or more actors to achieve a particular goal.
- Associations: Lines connecting actors and use cases illustrate the relationships or interactions between them. These associations show which actors are involved in which use cases.
- System Boundary: The system boundary, often depicted as a box or rectangle, represents the scope of the system being modelled. It encloses all the use cases and actors relevant to that system.

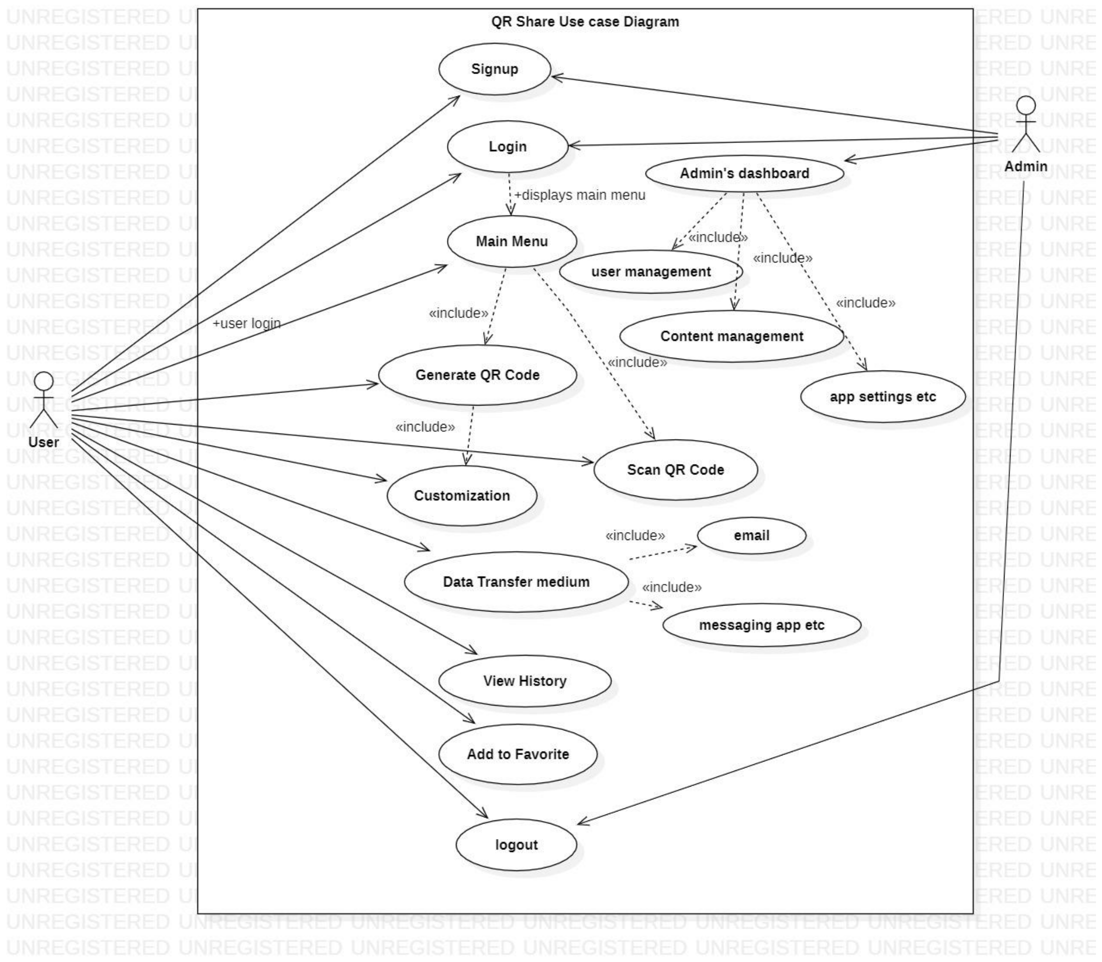

Figure 4: Use case Diagram

This use case diagram illustrates the interactions between actors (User and Admin) and the various use cases within the QR Share Android application project. Users can perform actions related to QR codes, manage their history, and mark QR codes as favorites. Admins have access to an admin dashboard for managing the app's content and user accounts, etc. The diagram provides an overview of the app's functionality and how users and admins interact with it.

3.8.2 Activity Diagram:

Activity diagram is basically a flowchart to represent the flow from one activity to another activity. The activity can be described as an operation of the system.

The basic purpose of activity diagrams is to capture the dynamic behaviour of the system. It is also called object-oriented flowchart.

This UML diagram focuses on the execution and flow of the behaviour of a system instead of implementation. The activity can be described as an operation of the system. The control flow is drawn from one operation to another. This flow can be sequential, branched, or concurrent. Activity diagram deal with all type of flow control by using different elements such as fork, join, etc. Activity diagrams consist of activities that are made up of actions that apply to behavioural modelling technology

Activity Diagram Notations:

- Initial State: The starting state before an activity takes place is depicted using the initial state. A process can have only one initial state unless we are depicting nested activities. We use a black filled circle to depict the initial state of a system. For objects, this is the state when they are instantiated. The Initial State from the UML Activity Diagram marks the entry point and the initial Activity State
- Action or Activity State: An activity represents execution of an action on objects or by objects. We represent an activity using a rectangle with rounded corners. Basically, any action or event that takes place is represented using an activity.
- Action Flow or Control flows: Action flows or Control flows are also referred to as paths and edges. They are used to show the transition from one activity state to another. An activity state can have multiple incoming and outgoing action flows. We use a line with an arrow head to depict a Control Flow. If there is a constraint to be adhered to while making the transition it is mentioned on the arrow
- Decision node and Branching: When we need to make a decision before deciding the flow of control, we use the decision node. The outgoing arrows from the decision node can be labelled with conditions or guard expressions. It always includes two or more output arrows.
- Guards – A Guard refers to a statement written next to a decision node on an arrow sometimes within square brackets.
- Fork – Fork nodes are used to support concurrent activities. n When we use a fork node when both the activities get executed concurrently i.e. no decision is made before splitting the activity into two parts. Both parts need to be executed in case of a fork statement. We use a rounded solid rectangular bar to represent a Fork notation with incoming arrow from the parent activity state and outgoing arrows towards the newly created activities.

- . Join – Join nodes are used to support concurrent activities converging into one. For join notations we have two or more incoming edges and one outgoing edge.
- Merge or Merge Event – Scenarios arise when activities which are not being executed concurrently have to be merged. We use the merge notation for such scenarios. We can merge two or more activities into one if the control proceeds onto the next activity irrespective of the path chose

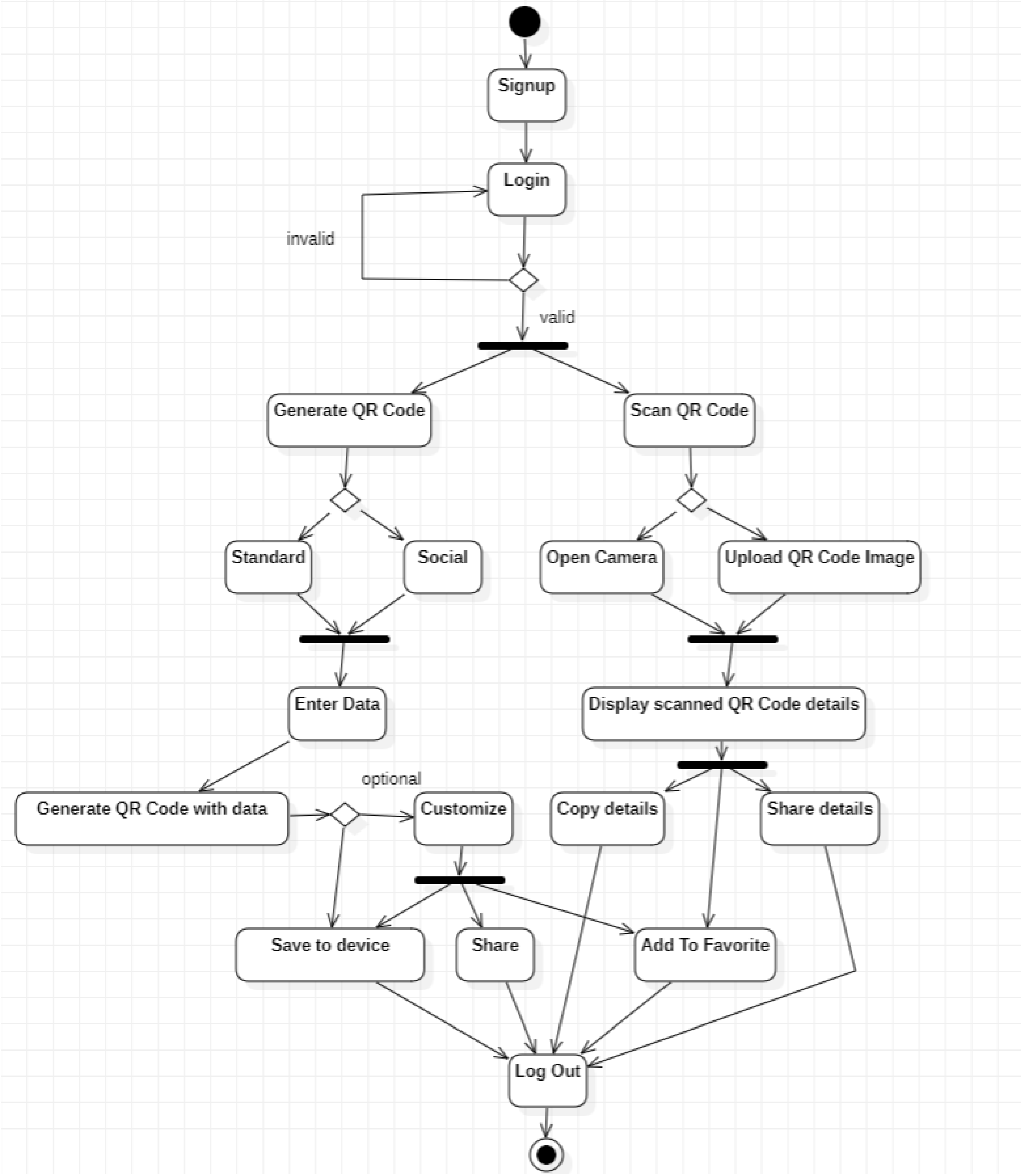

Figure 5: Activity Diagram

This activity diagram represents the data transfer process within the QR Share app. It outlines the major activities and decision points involved in generating, scanning, and sharing QR codes.

3.8.3 Sequence Diagram:

A sequence diagram is the most commonly used interaction diagram.

Interaction diagram: An interaction diagram is used to show the interactive behaviour of a system. Since visualizing the interactions in a system can be a cumbersome task, we use different types of interaction diagrams to capture various features and aspects of interaction in a system.

Sequence Diagrams: A sequence diagram simply depicts interaction between objects in a sequential order i.e., the order in which these interactions take place. We can also use the terms event diagrams or event scenarios to refer to a sequence diagram. Sequence diagrams describe how and in what order the objects in a system function. These diagrams are widely used by businessmen and software developers to document and understand requirements for new and existing systems.

Sequence Diagram Notations:

- Actors – An actor in a UML diagram represents a type of role where it interacts with the system and its objects. It is important to note here that an actor is always outside the scope of the system we aim to model using the UML diagram. We use actors to depict various roles including human users and other external subjects. We represent an actor in a UML diagram using a stick person notation. We can have multiple actors in a sequence diagram.
- Lifelines: A lifeline is a named element which depicts an individual participant in a sequence diagram. So basically, each instance in a sequence diagram is represented by a lifeline. Lifeline elements are located at the top in a sequence diagram. We display a lifeline in a rectangle called head with its name and type. The head is located on top of a vertical dashed line.
- Messages: Communication between objects is depicted using messages. The messages appear in a sequential order on the lifeline. We represent messages using arrows. Lifelines and messages form the core of a sequence diagram

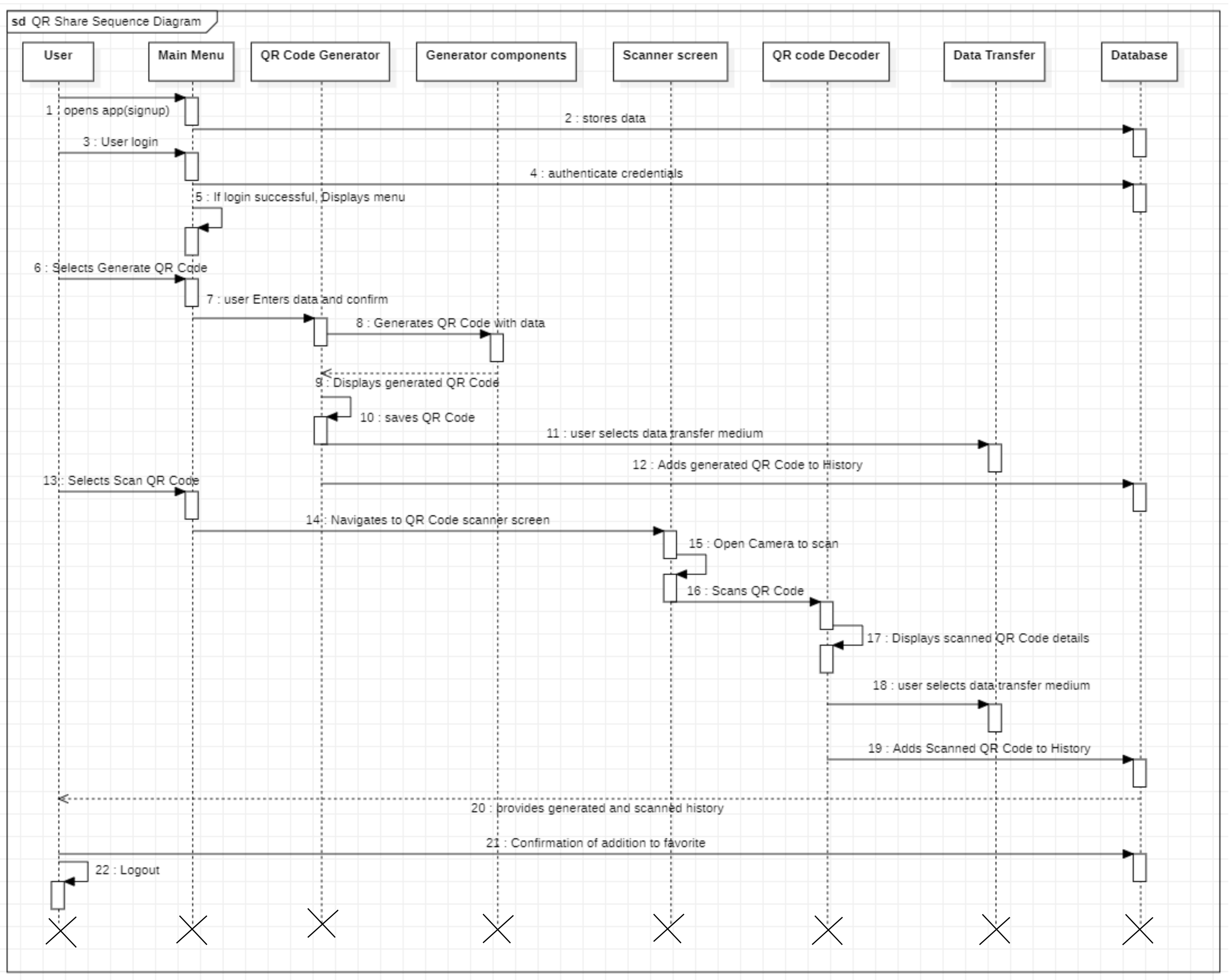
sd QR Share Sequence Diagram
User
Main Menu
QR Code Generator
Generator components
Scanner screen
QR code Decoder
Data Transfer
Database
1 : opens app(signup)
2 : stores data
3 : User login
4 : authenticate credentials
5 : If login successful, Displays menu
6 : Selects Generate QR Code
7 : user Enters data and confirm
8 : Generates QR Code with data
9 : Displays generated QR Code
10 : saves QR Code
11 : user selects data transfer medium
12 : Adds generated QR Code to History
13 : Selects Scan QR Code
14 : Navigates to QR Code scanner screen
15 : Open Camera to scan
16 : Scans QR Code
17 : Displays scanned QR Code details
18 : user selects data transfer medium
19 : Adds Scanned QR Code to History
20 : provides generated and scanned history
21 : Confirmation of addition to favorite
22 : Logout

Figure 6: Sequence Diagram

This sequence diagram illustrates the user's interaction with the QR Share application. The diagram showcases various components including the user interface, QR code generation, QR code scanning, QR code decoder, data transfer activities and the database.

The "Data Transfer" lifeline indicates the initiation of data transfer activities, which can activate specific messaging or email apps based on user choices.

This sequence diagram provides a high-level overview of the QR Share app's data transfer functionality, showing how users can generate, scan, and share QR codes seamlessly.

3.8.4 Class Diagram:

Class diagram is a static diagram. It represents the static view of an application. Class diagram is not only used for visualizing, describing, and documenting different aspects of a system but also for constructing executable code of the software application.

Class diagram describes the attributes and operations of a class and also the constraints imposed on the system. The class diagrams are widely used in the modelling of object-oriented systems because they are the only UML diagrams, which can be mapped directly with object-oriented languages.

Class diagram shows a collection of classes, interfaces, associations, collaborations, and constraints. It is also known as a structural diagram.

Classes: Classes represent an abstraction of entities with common characteristics. Associations represent the relationships between classes. Illustrate classes with rectangles divided into compartments. Place the name of the class in the first partition (centered, bolded, and capitalized), list the attributes in the second partition (left-aligned, not bolded, and lowercase), and write operations into the third

Relationships In UML, relationships are of three types:

- Dependency: A dependency is a relationship between two or more classes where a change in one class causes changes in another class. It forms a weaker relationship.
- Generalization: A generalization is a relationship between a parent class (superclass) and a child class (subclass). In this, the child class is inherited from the parent class. For example, The Current Account, Saving Account, and Credit Account are the generalized form of Bank Account
- Association: It describes a static or physical connection between two or more objects. It depicts how many objects are there in the relationship. For example, a department is associated with the college.

Aggregation: An aggregation is a subset of association, which represents has a relationship. It is more specific than association.

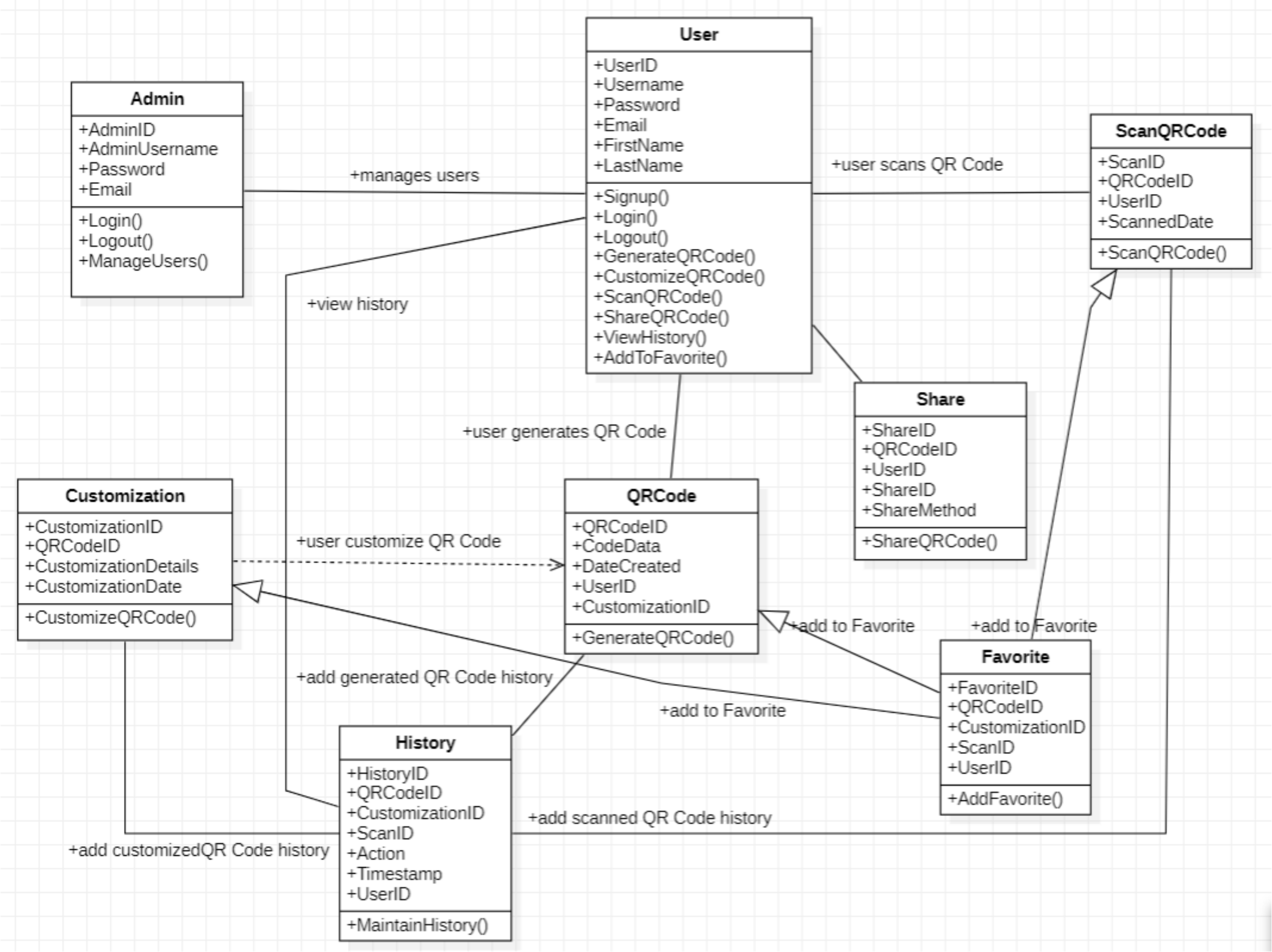

Figure 7: Class Diagram

The QR Share Class Diagram provides a detailed representation of the core components and interactions within the QR Share project. It comprises several essential classes, including User and Admin, representing users and administrative personnel, respectively. Users have the capability to generate, customize, scan, share QR codes, and view their action history. Admins possess the added privilege of managing users. QRCode class represents the QR codes created within the system, while ScanQRCode, Share, and Customization classes signify scanning events, data transfer events, and customization events, respectively. Lastly, the History and Favorite class maintains a record of Generated & Scanned QR Code history and Favourite QR Code in the system respectively.

This class diagram serves as a blueprint for the QR Share project, outlining the classes, their attributes, operations, and associations that govern the system's functionality and data flow. It offers a clear understanding of how users interact with QR codes and system's architecture, including data objects, user interactions, and administrative control, facilitating a clear understanding of the QR Share project's functionality.

3.8.5 Object Diagram:

In UML, object diagrams provide a snapshot of the instances in a system and the relationships between the instances. By instantiating the model elements in a class diagram, you can explore the behaviour of a system at a point in time.

An object diagram is a UML structural diagram that shows the instances of the classifiers in models. Object diagrams use notation that is similar to that used in class diagrams. However, while class diagrams show the actual classifiers and their relationships in a system, object diagrams show specific instances of those classifiers and the links between those instances at a point in time. You can create object diagrams by instantiating the classifiers in class, deployment, component, and use-case diagrams.

Before drawing an object diagram, the following things should be remembered and understood clearly −

- Object diagrams consist of objects.
- The link in object diagram is used to connect objects.
- Objects and links are the two elements used to construct an object diagram.

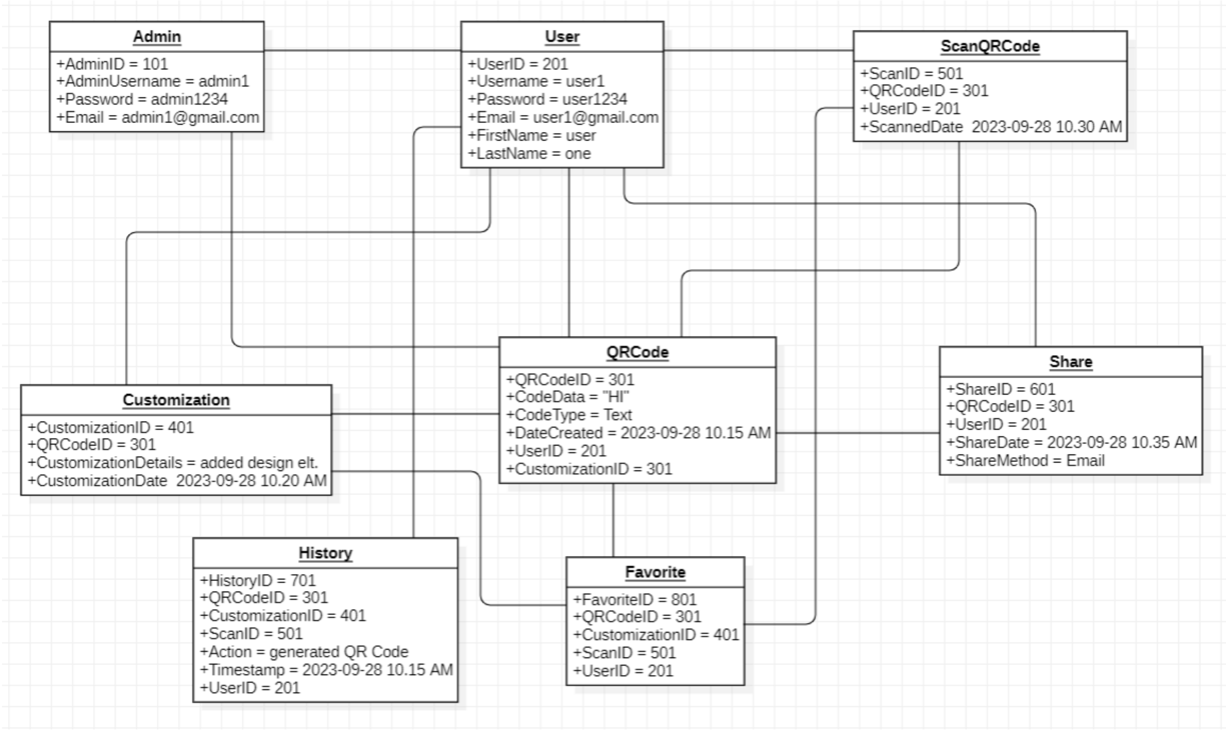

Figure 8: Object Diagram

The object diagram for the QR Share project includes classes representing various entities in the system, such as User, Admin, QRCode, ScanQRCode, Customization, History and Favorite. These classes have slots that match the ones described in the data dictionary. The diagram also shows associations between these classes, indicating their relationships, such as Admin managing Users, Users generating QR codes, Users scanning QR codes, and Users having a history of actions. This object diagram provides a visual representation of instances of these classes and their relationships within the QR Share system.

The Object Diagram for the QR Share project illustrates instances of key classes and their attributes, offering a snapshot of how users interact with QR codes and the system's functionalities. Users have their unique UserIDs and personal information. QRCode showcase individual QR code instances with details like QRCodeID, CodeData, CodeType, DateCreated, UserID and CustomizationID. ScanQRCode represent scanning events, while Share denotes a data transfer event, each capturing relevant details. Customization represents a QR code customization event. History record user actions related to QR codes. Favourite records the QR Codes which are added as Favourite. This Object Diagram provides a visual representation of these instances and their relationships, offering a concise overview of the system's functioning.

3.8.6 Component Diagram:

A component diagram is used to break down a large object-oriented system into the smaller components, so as to make them more manageable. It models the physical view of a system such as executables, files, libraries, etc. that resides within the node.

It visualizes the relationships as well as the organization between the components present in the system. It helps in forming an executable system. A component is a single unit of the system, which is replaceable and executable. The implementation details of a component are hidden, and it necessitates an interface to execute a function. It is like a black box whose behaviour is explained by the provided and required interfaces.

Key Concepts of Component Diagrams:

- Components: In a component diagram, components represent modular and self-contained units of software or hardware within a system. Components can range from large software modules to smaller, reusable classes or libraries. Each component encapsulates a set of related functionalities and may expose interfaces for interaction with other components.

- Interfaces: Interfaces define how components interact with each other. They specify a contract or set of methods that a component should provide to other components. Interfaces are depicted as small squares on the edge of a component, connected by lines to indicate dependencies or associations.
- Dependencies: Dependencies represent relationships between components, indicating that one component relies on another for its functionality. Dependencies can be directed (with an arrow) or undirected, depending on the nature of the relationship.
- Provided and Required Interfaces: Components often provide interfaces that define the services they offer, and they require interfaces from other components to access external functionality. These provided and required interfaces are typically labelled on the component shapes.

In summary, component diagrams are valuable tools for visualizing and designing the architecture of software systems. They help software architects and developers understand, organize, and manage the components of a system, facilitating better communication and decision-making during the software development process.

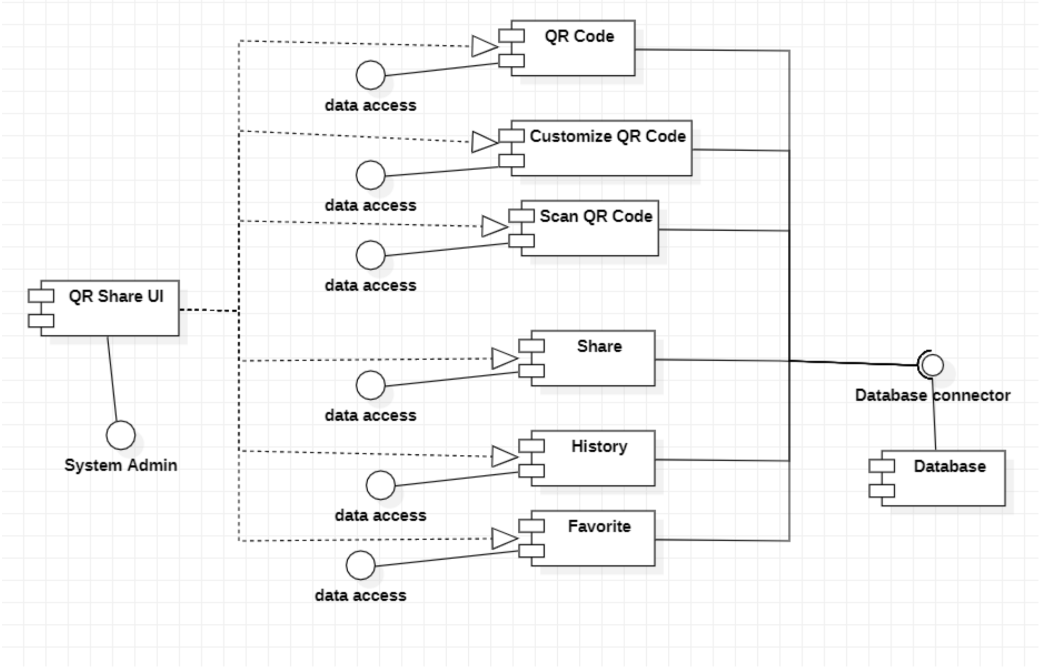

Figure 9: Component Diagram

A component diagram for the QR Share project provides a visual representation of the system's architecture and how its various components interact. In this diagram, key components include the User Interface, QR Code, Customize QR Code, QR Code Scanner, Database, Share, History and Favourite. The User Interface component serves as the user-facing part of the application, connecting users to the rest of the system. The QR Code and Scanner components handle the creation and scanning of QR codes, while the Database stores user data and QR codes. The Share component manages different data transfer methods, and the History and Favourite allows the user to access history and Favourite QR Codes respectively. These components communicate through interfaces, specifying how they interact and share information. This component diagram offers a clear overview of how different elements work together to provide the functionalities of the QR Share project.

3.8.7 Collaboration Diagram:

Collaboration Diagram shows the object organization, it is also known as "Communication Diagram".

- In this diagram the method call sequence is indicated by some numbering technique
- The numbers indicate how the methods are called one after another
- The method calls are similar to that of a sequence diagram.
- But the difference is that the sequence diagram does not describe the object organization whereas the collaboration diagram shows the object organization

Element and its description:

- Object: The objects interacting with each other in the system. Depicted by a rectangle with the name of the object in it, preceded by a colon and underlined.
- Relation/Association: A link connecting the associated objects. Qualifiers can be placed on either end of the association to depict cardinality.
- Messages: An arrow pointing from the commencing object to the destination object shows the interaction between the objects. The number represents the order/sequence of this interaction

Collaboration diagrams are particularly useful for visualizing and understanding the sequence of interactions between objects in a dynamic context. They are valuable during the design phase of software development when developers need to illustrate how different components or objects collaborate to achieve a specific task or behaviour.

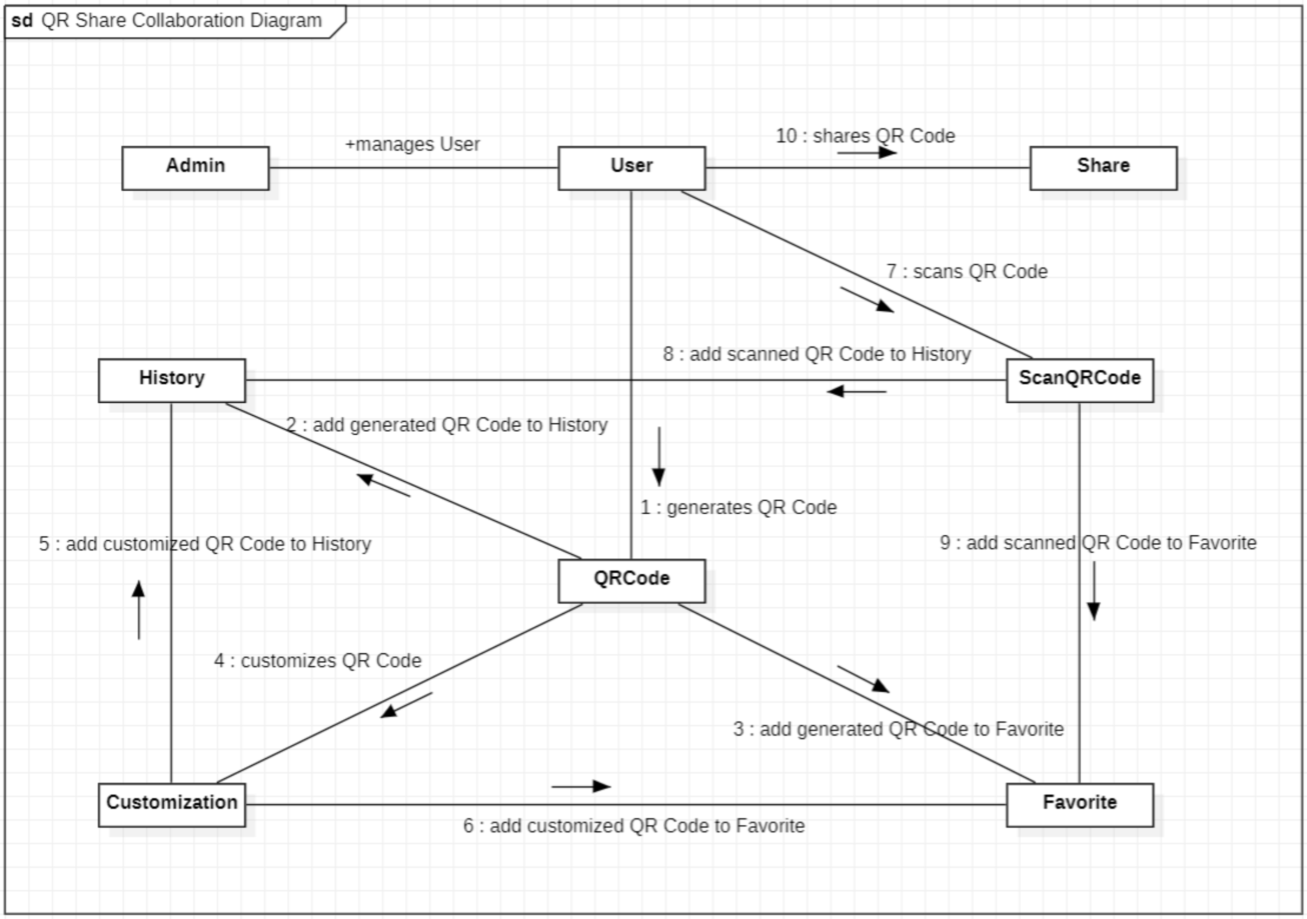
sd QR Share Collaboration Diagram
Admin
+manages User
User
10 : shares QR Code
Share
7 : scans QR Code
History
8 : add scanned QR Code to History
ScanQRCode
2 : add generated QR Code to History
1 : generates QR Code
5 : add customized QR Code to History
9 : add scanned QR Code to Favorite
QRCode
4 : customizes QR Code
3 : add generated QR Code to Favorite
Customization
Favorite
6 : add customized QR Code to Favorite

Figure 10: Collaboration Diagram

A collaboration diagram for the "QR Share: QR Code Generator and Scanner for Data Transfer" project would visually represent how various components or objects within the system interact to achieve specific functionalities. In this project, there are several key entities, including the QR Code Generator, QR Code Customization, QR Code Scanner, Users, Admins, Data Transfer Services, History and Favorite.

The diagram would illustrate how these entities collaborate to ensure smooth user experiences. For instance, the User interacts with the QR Code Generator, Scanner, sharing components for QR Code generation, scanning and sharing purpose. The Share Services come into play for data transfer, allowing users to share coded and decoded data conveniently.

Chapter 4

Implementation & Testing

4.1 Basic Modules

The QR Share project can be divided into several key modules, each responsible for specific functionalities. Below, we'll describe these modules and their functionalities in detail:

1. User Authentication Module

   Description: This module handles user registration, login, and authentication processes. It ensures that only authorized users can access the application's features.

   Functionality:

   - User Registration: Allows users to create new accounts by providing necessary details like username, email, and password.
   - User Login: Enables registered users to log in securely with their credentials.
   - Authentication: Verifies user identity and grants access to the app's features.
   - Password Recovery: Provides a mechanism for users to reset their passwords if forgotten.

2. QR Code Generation Module

   Description: This module is responsible for generating customized QR codes with various data types, catering to users' specific needs and preferences.

   Functionality:

   - Data Input: Accepts different data types, including text, URLs, contact information, and more.
   - QR Code Generation: Converts input data into QR codes using QR code generation algorithms.
   - Customization: Allows users to add logos, design elements, and personalize QR codes.

- Storage: Manages the storage of generated QR codes for user access.

3. QR Code Scanning Module

Description: This module facilitates the scanning of QR codes using device cameras. It ensures accurate and efficient scanning to retrieve shared digital resources.

Functionality:

- Camera Integration: Utilizes the device's camera for QR code scanning.
- Scanning Algorithm: Implements algorithms to detect and decode QR codes.
- Data Retrieval: Extracts information from scanned QR codes.

4. Data Transfer Module

Description: This module offers flexible data transfer options, allowing users to choose various methods for sharing decoded data, including messaging apps and email.

Functionality:

- Data Sharing: Enables users to send the decoded data to other users or platforms.
- Messaging Apps: Integrates with messaging apps for quick sharing.
- Email Integration: Allows users to send data via email.
- Local Storage: Provides the option to save data locally on the device.

5. Customization Module

Description: The customization module empowers users to personalize their QR codes, adding logos, design elements, and other attributes to enhance visual appeal and brand identity.

Functionality:

- Logo: Allows users to add logos or design elements.
- Preview: Offers a preview of customized QR codes.

6. Data Security Module

Description: This module ensures the secure handling and transmission of user data and generated QR codes. It adheres to relevant data protection regulations, fostering user trust and confidence.

Functionality:

- Encryption: Encrypts user data and QR codes to prevent unauthorized access.
- Privacy Compliance: Ensures compliance with data protection laws and regulations.
- Secure Storage: Safeguards user data stored within the app.
- Access Controls: Manages user permissions and access levels.

7. History Tracking Module

Description: This module incorporates a history feature that allows users to manage and conveniently reference previously generated and scanned QR codes.

Functionality:

- History Storage: Stores a record of generated and scanned QR codes.
- Search and Retrieval: Enables users to search for specific codes.
- Organization: Organizes the history for easy access and management.
- Data Reference: Allows users to re-scan or share QR codes from the history.

Following the divide and conquer approach, these modules can be developed separately and then integrated to create the complete QR Share system. Each module serves a specific purpose and contributes to the overall functionality and user experience of the application.

4.2 Data Design

Data design in the "QR Share: QR Code Generator and Scanner for Data Transfer" project plays a crucial role in ensuring efficient organization, management, and manipulation of data. This section outlines the key aspects of data design, including schema design and data integrity constraints.

4.2.1 Schema Design

- User

UserID	Username	Password	Email	FirstName	LastName

Table 3: User Schema Design

- Admin

AdminID	AdminUsername	Password	Email	FirstName	LastName

Table 4: Admin Schema Design

- QRCode

QRCodeID	CodeData	CodeType	DateCreated	UserID	CustomizationID

Table 5: QRCode Schema Design

- Customization

CustomizationID	QRCodeID	CustomizationDetails	CustomizationDate

Table 6: Customization Schema Design

- ScanQRCode

ScanID	QRCodeID	UserID	ScannedDate

Table 7: ScanQRCode Schema Design

- Share

ShareID	QRCodeID	UserID	ShareDate	ShareMethod

Table 8: Share Schema Design

- History

HistoryID	QRCodeID	CustomizationID	ScanID	Action	Timestamp	UserID

Table 9: History Schema Design

- Favourite

FavoriteID	QRCodeID	CustomizationID	UserID

Table 10: Favorite Schema Design

4.2.2 Data Integrity and Constraints

- User

Column Name	Data Type	Size	Constraint	Description
UserID	integer	-	Primary key	A primary key serving as a unique identifier for each User.

Username	varchar	30	Not null, Unique	Stores the Username of the user.
Password	varchar	20	Not null	Stores the Password of the user.
Email	varchar	50	Not null, Unique	Stores the Email of the user.
FirstName	varchar	20	Not null	Stores the First name of the user.
LastName	varchar	20	Not null	Stores the Last Name of the user.

Table 11: User Data Integrity and Constraints

- Admin

Column Name	Data Type	Size	Constraint	Description
AdminID	integer	-	Primary key	A primary key serving as a unique identifier for Admin.
AdminUsername	varchar	30	Not null, Unique	Stores the Admin Username of the Admin.
Password	varchar	20	Not null	Stores the Password of the Admin.
Email	varchar	50	Not null, Unique	Stores the Email of the Admin.

Table 12: Admin Data Integrity and Constraints

- QRCode

Column Name	Data Type	Size	Constraint	Description
QRCodeID	integer	-	Primary key	A primary key serving as a unique identifier for QRCode event.
CodeData	varchar	150	Not null	Stores the actual data encoded in the QR code, which can vary in content,

				such as text, URLs, contact information, etc.
CodeType	varchar	50	Not null	Indicates the type of data encoded within the QR code, allowing differentiation between text, URLs, contacts, and more.
DateCreated	datetime	30	Not null	Records the date and time when the QR code was generated.
UserID	integer	-	Foreign key	A foreign key referencing the User entity.
CustomizationID	varchar	-	Foreign key	A foreign key referencing the Customization entity.

Table 13: QRCode Data Integrity and Constraints

- Customization

Column Name	**Data Type**	**Size**	**Constraint**	**Description**
CustomizationID	integer	-	Primary key	A primary key serving as a unique identifier for Customization event.
QRCodeID	integer	-	Foreign key	A foreign key referencing the QRCode entity.
CustomizationDetails	varchar	60	Not null	Stores information about customizations made to the QR code, such as design elements, and other personalized attributes
CustomizationDate	datetime	30	Not null	Records the date and time when the customization occurred.

Table 14: Customization Data Integrity and Constraints

- ScanQRCode

Column Name	Data Type	Size	Constraint	Description
ScanID	integer	-	Primary key	A primary key serving as a unique identifier for ScanQRCode event.
QRCodeID	integer	-	Foreign key	A foreign key referencing the QRCode entity.
UserID	integer	-	Foreign key	A foreign key referencing the User entity.
ScannedDate	datetime	30	Not null	Records the exact date and time when the scanning event occurred.

Table 15: ScanQRCode Data Integrity and Constraints

- Share

Column Name	Data Type	Size	Constraint	Description
ShareID	integer	-	Primary key	A primary key serving as a unique identifier for Share event.
QRCodeID	integer	-	Foreign key	A foreign key referencing the QRCode entity.
UserID	integer	-	Foreign key	A foreign key referencing the User entity.
ShareDate	datetime	30	Not null	Captures the date and time when the data sharing took place.
ShareMethod	varchar	50	Not null	Indicates the method used for sharing the data (e.g., email, messaging app, local storage).

Table 16: Share Data Integrity and Constraints

- History

Column Name	Data Type	Size	Constraint	Description
HistoryID	integer	-	Primary key	A primary key serving as a unique identifier for History event.
QRCodeID	integer	-	Foreign key	A foreign key referencing the QRCode entity.
CustomizationID	integer	-	Foreign key	A foreign key referencing the Customization entity.
ScanID	integer	-	Foreign key	A foreign key referencing the ScanQRCode entity.
Action	varchar	50	Not null	Describes the action taken by the user, such as QR code generation, scanning, or data transfer.
Timestamp	datetime	30	Not null	Records the exact date and time when the action occurred.
UserID	integer	-	Foreign key	A foreign key referencing the User entity.

Table 17: History Data Integrity and Constraints

- Favorite

Column Name	Data Type	Size	Constraint	Description
FavoriteID	integer	-	Primary key	A primary key serving as a unique identifier for Favorite event.
QRCodeID	integer	-	Foreign key	A foreign key referencing the QRCode entity.
CustomizationID	integer	-	Foreign key	A foreign key referencing the Customization entity.

ScanID	integer	-	Foreign key	A foreign key referencing the ScanQRCode entity.
UserID	integer	-	Foreign key	A foreign key referencing the User entity.

Table 18: Favorite Data Integrity and Constraints

4.3 Procedural Design

Procedural design is a pivotal phase in the development of the "QR Share: QR Code Generator and Scanner for Data Transfer" project. It involves the systematic development of algorithms and procedures to drive the functionality of the application. In this section, we will discuss logic diagrams, data structures, and algorithm design.

4.3.1 Logic Diagrams

Logic diagrams are invaluable tools in software development, including the "QR Share: QR Code Generator and Scanner for Data Transfer" project. They define the systematic flow of procedures, improving comprehension for both developers and project stakeholders. In this project, logic diagrams take the form of Control Flow Charts and Process Diagrams, aiding in the understanding of the application's inner workings

In the context of the QR Share project, logic diagrams are used to visually represent the flow of procedures and operations within the application. They enhance comprehension, facilitate communication among team members, and assist programmers during the implementation phase.

- Control Flow Chart: A Control Flow Chart is a visual representation of the procedural logic within the application. It outlines the sequence of steps and decision points that guide the flow of control in the software.

  Below is a simplified Control Flow Chart illustrating the core processes of generating and scanning QR codes in the application:

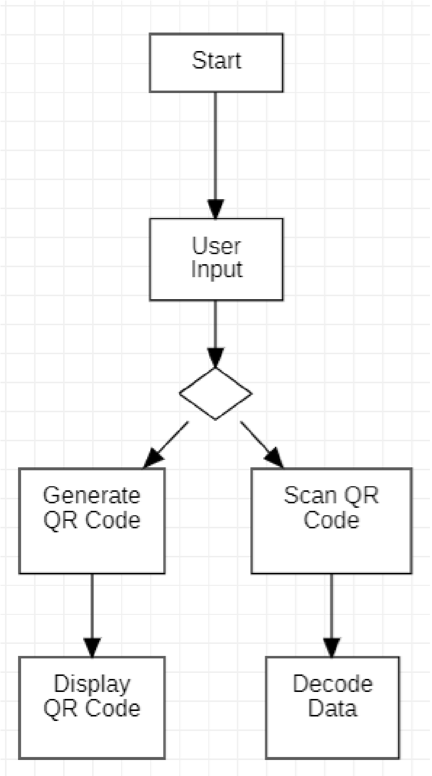

Figure 11: Control Flow Chart example

Description:

Start: The process begins.

User Input: The application gathers input data from the user.

Generate QR Code: The application generates a QR code based on the user's input.

Display QR Code: The generated QR code is displayed to the user.

End: The process concludes.

- Process Diagram: Process diagrams focus on the activities and tasks that occur within specific functions or processes of the application. They break down complex operations into manageable steps.

  Below is a simplified example of a process diagram for user registration

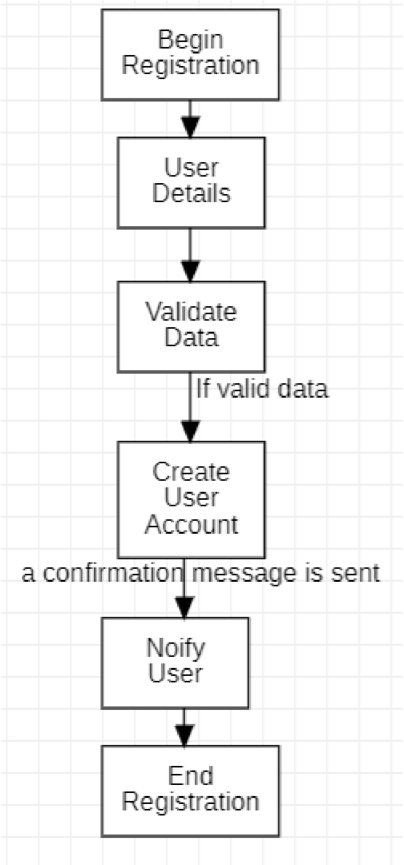

Figure 12: Process Diagram example

Description:

Begin Registration: The registration process commences.

User Details: The user provides their details.

Validate Data: The application validates the provided data.

Create User Account: If data is valid, the application creates a user account.

Notify User: A confirmation message is sent to the user.

End Registration: The registration process concludes.

4.3.2 Data structures

Data structures play a pivotal role in procedural design by defining how data is organized and accessed within the application. In the QR Share project, key data structures include:

- User Structure:

Attributes: UserID, Username, Password, Email, FirstName, LastName.

- QRCode Structure:

  Attributes: QRCodeID, CodeData, CodeType, DateCreated, UserID, CustomizationID.

- ScanQRCode Structure:

  Attributes: ScanID, QRCodeID, UserID, ScannedDate.

These data structures help organize user-related information and QR code data efficiently, enabling seamless operations within the application.

4.3.3 Algorithm design

Algorithm design involves the algorithms which helps in reducing the efforts and time require, using the algorithms it defines how to working is carried out by the help of the particular algorithm to make the end process error free and simple.

Let's take an example of the algorithm for QR Code generation:

Reed-Solomon Algorithm for a QR Code Generator

- Introduction:

In the field of image processing, you may have encountered the need to generate QR codes. QR codes are two-dimensional barcodes that store information in a matrix of black and white squares. They have gained tremendous popularity due to their ability to store large amounts of data and their ease of scanning with smartphones.

One of the key components of a QR code generator is the Reed-Solomon algorithm. In this part, we will explore what the Reed-Solomon algorithm is, how it works, and its importance in the generation of QR codes

- What is the Reed-Solomon Algorithm?

The Reed-Solomon algorithm is an error-correcting code that is widely used in various applications, including QR code generation. It was developed by Irving S. Reed and Gustave Solomon in 1960 and has since become a fundamental tool for reliable data transmission.

The main idea behind the Reed-Solomon algorithm is to add redundant data to the original message. This redundant data, known as error correction codewords, allows the receiver to detect and correct errors that may occur during transmission. The algorithm achieves this by generating a set of polynomial equations over a finite field.

- How Does the Reed-Solomon Algorithm Work?

To understand how the Reed-Solomon algorithm works, let's consider an example. Suppose we want to encode the message "HELLO" into a QR code. The algorithm performs the following steps:

1. Message Encoding: The message is encoded into a sequence of symbols using an appropriate character encoding scheme. In this case, the ASCII values of the characters in "HELLO" would be used.
2. Polynomial Representation: The encoded message is treated as coefficients of a polynomial. For example, the ASCII values [72, 69, 76, 76, 79] would correspond to the polynomial H(x) = 72x^4 + 69x^3 + 76x^2 + 76x + 79.
3. Error Correction Codewords: The Reed-Solomon algorithm generates a set of error correction codewords based on the polynomial representation of the message. These codewords are appended to the original message to form the final encoded message. The number of codewords depends on the desired level of error correction capability.
4. QR Code Generation: The final encoded message, along with other necessary information such as version and error correction level, is used to generate the QR code. The QR code consists of a matrix of black and white squares, with the encoded message embedded in it.

- Importance of Reed-Solomon Algorithm in QR Code Generation

The Reed-Solomon algorithm plays a crucial role in QR code generation due to its ability to detect and correct errors. QR codes can be easily damaged or distorted during printing or scanning, resulting in missing or incorrect data. The error correction capability provided by the Reed-Solomon algorithm allows QR codes to remain readable even when a portion of the code is damaged.

The level of error correction capability in a QR code depends on the number of error correction codewords added during the encoding process. Higher levels of error correction can tolerate more errors but require a larger number of codewords, which increases the overall size of the QR code.

By using the Reed-Solomon algorithm, QR code generators can strike a balance between the amount of data stored and the level of error correction required. This flexibility makes QR codes suitable for a wide range of applications, from storing URLs and contact information to encoding product details and inventory management.

- Conclusion

In this part, we have explored the Reed-Solomon algorithm and its significance in QR code generation. The algorithm’s ability to detect and correct errors makes it an indispensable tool for ensuring data integrity in QR codes. By understanding the underlying principles of the Reed-Solomon algorithm, data scientists and software engineers can develop robust QR code generators that offer reliable data transmission and error correction capabilities.

4.4 User Interface Design

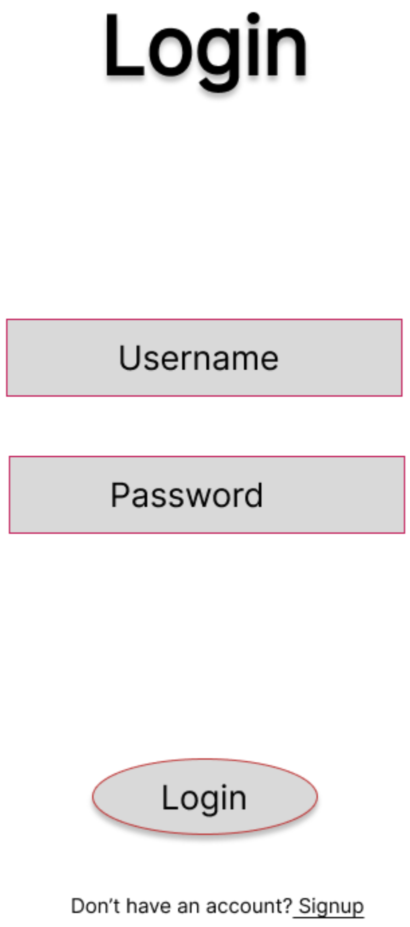

Figure 13: Login Page UI

- The Login page provides a secure entry point for registered users to access the app's features.
- Users will enter their credentials (username and password) to log in.

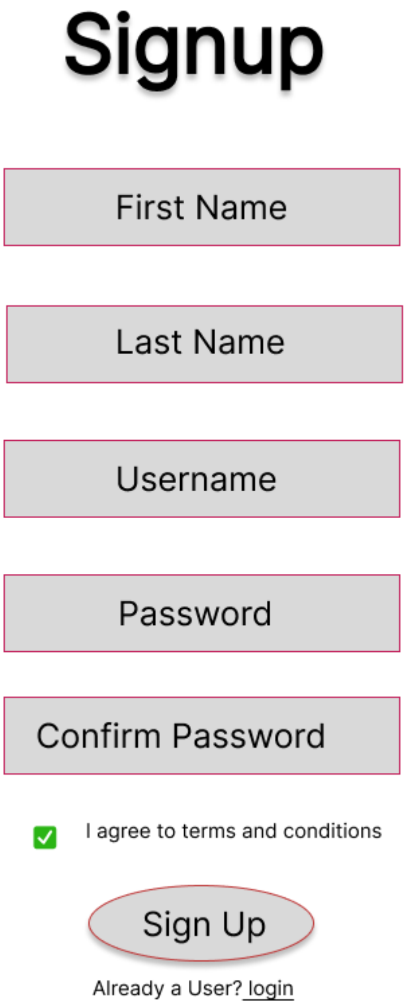

Figure 14: Signup Page UI

- The Signup page allows new users to create an account.
- It collects essential information (First name, Last name, Username, password) to set up their profile.

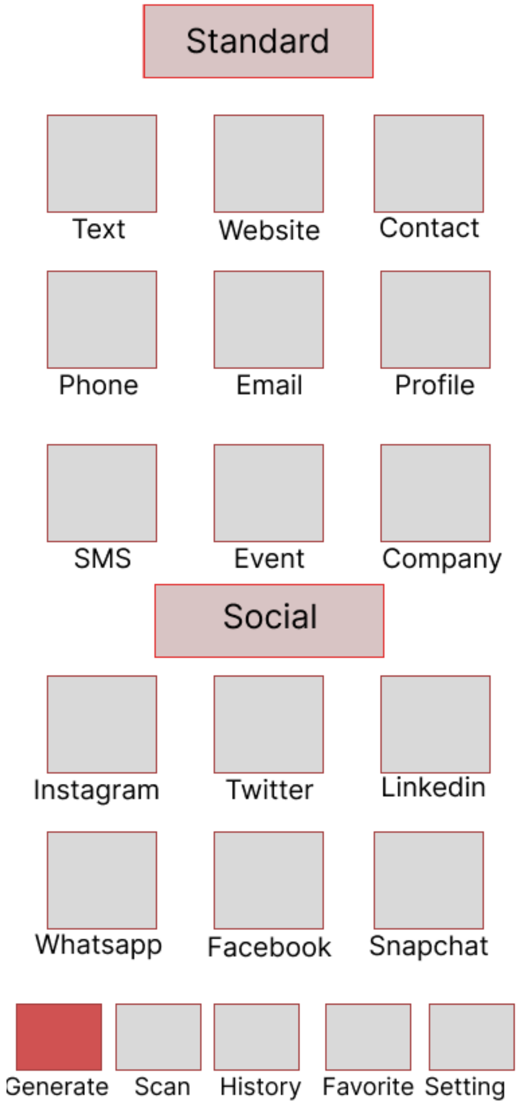

Figure 15: Generate Page UI

- This page enables users to Generate QR codes from various types of data, such as Website, text, email, phone, Contact information and many more.

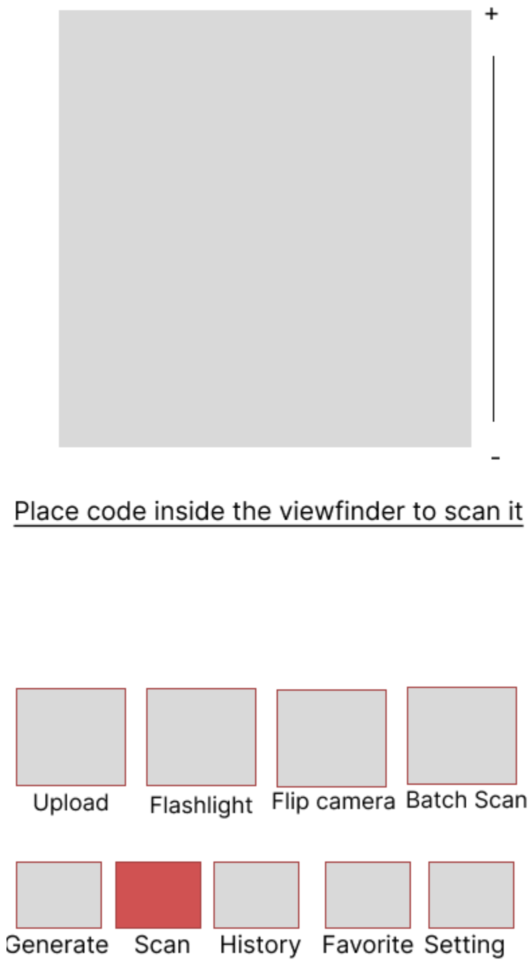

Figure 16: Scan Page UI

- The Scan QR Code page activates the device's camera to scan QR codes or user can upload image of QR Code.
- When a QR code is successfully scanned, it displays the relevant information or takes the specified action.

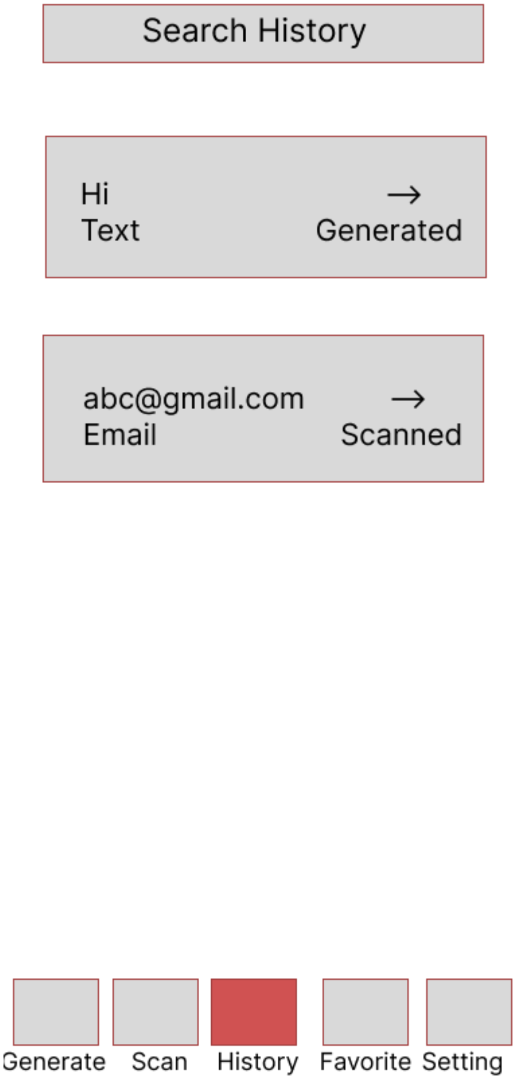

Figure 17: History Page UI

- The History page maintains a record of previously generated and scanned QR codes.
- Users can review their QR code activity history through History page.

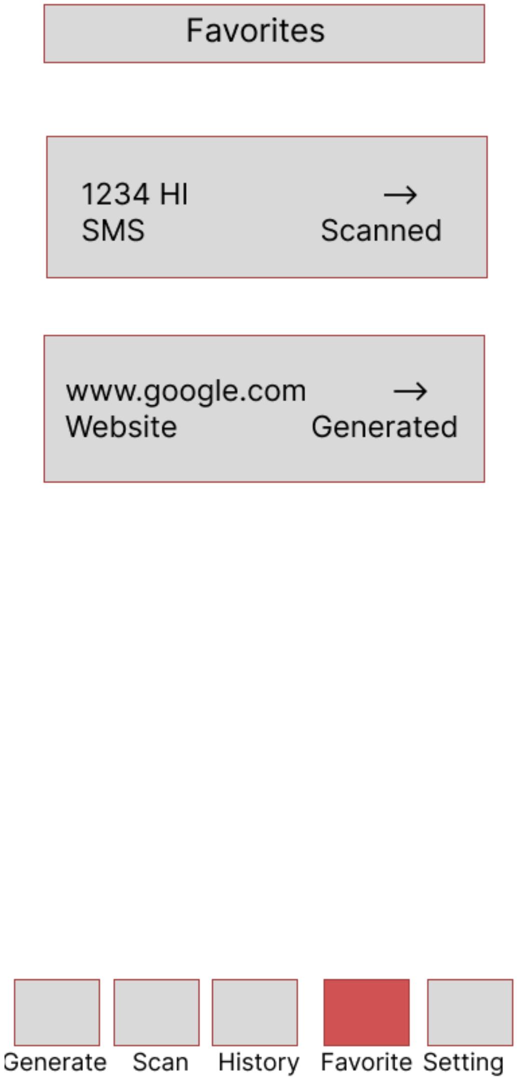

Figure 18: Favorite Page UI

- The Favorites page allows users to mark QR codes as favorites, making it easy to access and use frequently used QR codes.

4.5 Security Issues:

Security is a critical aspect of any android application, and QR Share is no exception. Here are some potential security issues and considerations related to the project, along with strategies to mitigate them:

1. Data Privacy and User Authentication:

- Issue: Protecting user data, including personal details and shared information, is paramount. Unauthorized access to user accounts can lead to privacy breaches.
- Mitigation: Implementing secure user authentication mechanisms, such as password hashing and encryption. Implementing multi-factor authentication for added security.

2. Secure QR Code Generation:

- Issue: QR codes can contain sensitive information. If QR code generation is not secure, attackers might generate malicious QR codes.
- Mitigation: Ensuring that the QR code generation process is secure and reliable. Using cryptographic libraries to generate QR codes securely. Validating user-generated content before encoding it into a QR code to prevent malicious data.

3. QR Code Scanning Security:

- Issue: Malicious QR codes can lead to various security threats, such as phishing attacks or directing users to harmful websites.
- Mitigation: Implementing a robust QR code scanning library that can detect and alert users about potentially harmful QR codes

4. Data Transmission Security:

- Issue: During data transfer, especially when sharing sensitive information, data interception and eavesdropping are concerns.
- Mitigation: Using secure communication protocols like HTTPS to encrypt data in transit. Ensuring that all API endpoints are secure and validating requests on the server side.

5. Authorization and Access Control:

- Issue: Unauthorized users gaining access to admin functions or other restricted areas can disrupt the application.
- Mitigation: Implementing role-based access control (RBAC) to restrict access to sensitive functionalities. Use proper session management and enforce user permissions at the server-side.

6. Data Storage Security:

- Issue: Data stored locally on the user's device can be vulnerable if not adequately protected.
- Mitigation: Encrypting sensitive data stored on the device using strong encryption algorithms. Implementing secure data storage practices and clear user data when necessary.

7. Code Security and Vulnerability Scanning:

- Issue: Security vulnerabilities in the application's code can be exploited by attackers.
- Mitigation: Regularly conducting security code reviews and use automated vulnerability scanning tools to identify and fix security issues. Staying updated with security best practices and libraries.

8. Secure File Upload and Download:

- Issue: Uploading and downloading files securely is essential, especially if QR codes contain attachments or documents.
- Mitigation: Implementing secure file upload and download mechanisms, including file type validation, ensuring that uploaded files do not execute code.

By proactively addressing these security issues and following a robust security plan, the QR Share project can provide users with a safe and secure environment for generating, sharing, and scanning QR codes.

4.6 Test Case Design

Index	Test Case	Test Data	State	Test Input Values	Expected Result
1	User Signup	User registration details (name, email, password)	Valid	Valid user registration details Name: abc Email: abc@gmail.com Password: abc123	User account created successfully, redirected to user dashboard
2	User Signup	User registration details (name, email, password)	Invalid	Invalid user registration details (incorrect number, email) Name: abc Email: abcdef Password: abc1223!!2	Please enter valid details
3	User Login	User login details (email, password)	Valid	Valid user login details Email: abc@gmail.com Password: abc123	User successfully logged in, redirected to user dashboard
4	User Login	User login details (email, password)	Invalid	Invalid user login details (incorrect email, password) Email: abc@gmail.com Password: abc122323	Please enter valid email or password
5	Admin Login	Admin login details (email, password)	Valid	Valid Admin login credentials Email: janhvibaraskar03@gmail.com Password: janhvi03	Admin successfully logged in, redirected to Admin dashboard
6	Admin Login	Admin login details (email, password)	Invalid	Invalid Admin login details (incorrect number, email)	Please enter valid email or password

				Email: janhvibaraskar0333@gmail.com Password: janhvi03123	
7	QR Code Generation	User inputs data for QR Code (text, url, email etc.)	Valid	User input data Email: abc@gmail.com	QR code generated with user data, displayed on the screen
8	QR Code Generation	User inputs data for QR Code (text, url, email etc.)	Invalid	User input data Email: abcde	Please Enter valis Details
9	Customization	User customizes a QR code (adds logos, design elements, etc.)	Valid	User customizes QR Code as per the preference	QR code appearance updated with user customizations
10	QR Code Scanning	QR code image scanned by the user's device camera	Valid	QR code for scanning or selecting QR code from device to scan	QR code decoded, displayed data matches the input data
11	QR Code Scanning	QR code image scanned by the user's device camera	Invalid	Invalid QR Code (Some other image)	Not a valid QR Code
12	Data Transfer	User selects a data sharing method (email, etc.)	Valid	Select data transfer option like: Gmail or messaging app, etc	Data transferred successfully to the selected method
13	History Tracking	User accesses the History feature	Valid	Accesses the history of QR Codes	System displays the user's history of generated and scanned QR codes
14	Favourite Feature	User marks a QR code as a favourite	Valid	Selects a QR code to mark as a favourite	QR code marked as a favourite for the user,

					stored for future reference
15	Favourite Feature	User removes a QR code from favourite	Valid	Selects a QR code to remove from favourite	QR code get removes from favourite section.
16	User/Admin logout	N/A	Valid	User/admin clicks on logout button	User/Admin is logged out of the system and redirected to the login page.

Table 19:Test Case

4.7 Event Table

Sr. no	Event	Trigger	Source	Activity	Response	Destination
1	User signup	User clicks on “sign Up button”	User	Provide required information and sign up	Confirmation message	Database
2	User Login	User clicks on “Login button”	User	Provide required information and Authenticate user	Redirect to user dashboard	System
3	Admin Login	Admin clicks on “Login button”	Admin	Provide required information and Authenticate admin	Redirect to admin dashboard	System
4	Generate QR Code	User selects datatype and inputs the data	User	Process data and create QR Cide	Displays generated QR Code	User interface
5	Scan QR Code	User scans QR Code	User	Capture QR Code data	Displays decoded data	User interface
6	Customize QR Code	User selects customization options	User	Apply chosen customization	Displays customized QR Code	User interface

7	Share QR Code	User selects sharing method	User	Initiate data transfer	Data is shared through chosen method	System
8	Store QR Code	User selects to store QR Code locally	User	QR code is saved on user's device	QR code is saved on user's device	Local storage
9	Manage QR Code History	User accesses QR Code History	User	Views previously generated/scanned codes	User sees a list of generated/scanned QR Codes	Database
10	Favourite feature	User marks QR code as favourite	User	Flag QR code as favourite	QR code marked as favourite	Database
11	Admin Access	Admin clicks "Admin Access" button	Admin	Gain admin-level access	Redirect to admin dashboard	System
12	Log out	User or admin clicks on log out button	User/ Admin	Log out from the App	User or Admin logged out	System

Table 20: Event

4.8 Testing Approach

Testing is an integral part of the software development process, ensuring that the product functions as expected and meets its quality standards. The testing approach for the "QR Share: QR Code Generator and Scanner for Data Transfer" project follows a systematic and comprehensive methodology to guarantee the reliability and efficiency of the application.

4.8.1 Unit Testing

- What is Unit Testing?

Unit testing is a software testing technique that focuses on evaluating individual components or units of code in isolation. A "unit" typically refers to the smallest testable part of an application, such as a function, method, or class. In unit testing, these components are examined independently to verify that they perform as intended.

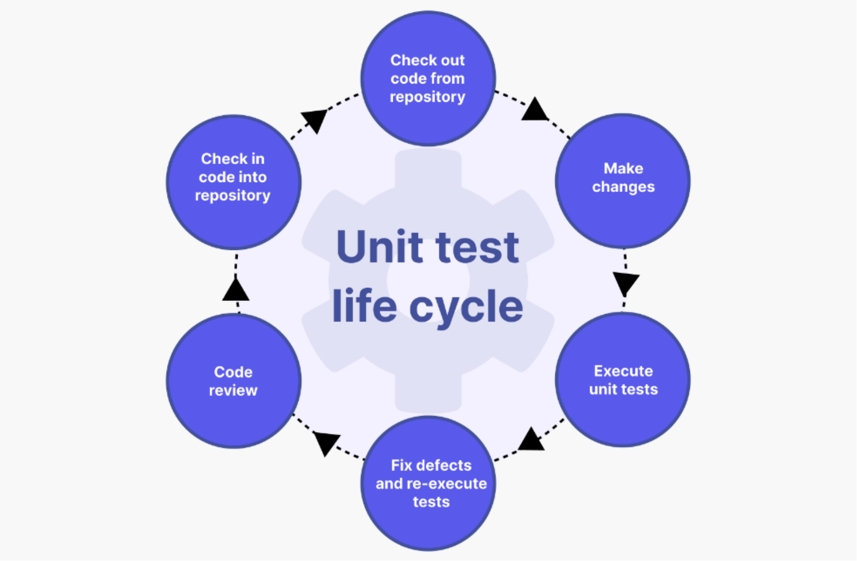
Check out code from repository
Make changes
Execute unit tests
Fix defects and re-execute tests
Code review
Check in code into repository
Unit test life cycle

Figure 19: Unit test life cycle

- Importance of Unit Testing:

  Unit testing serves several critical purposes within the software development process:

  - Bug Identification: It helps detect and rectify bugs or defects at an early stage, reducing the cost and effort required for later-stage debugging.
  - Isolation of Issues: By testing units in isolation, developers can pinpoint the source of errors more precisely, facilitating quicker resolution.
  - Code Verification: Unit tests validate that individual components conform to their design specifications, ensuring code correctness.
  - Regression Testing: Unit tests can be automatically rerun whenever code changes are made, preventing the introduction of new defects during the development process.

- Why is Unit Testing used?

  Unit testing is employed for various reasons, including:

  - Quality Assurance: It enhances the overall quality and reliability of the software by identifying and fixing issues early in development.
  - Code Refactoring: It provides confidence that code changes or optimizations do not introduce new defects.

  - Documentation: Unit tests serve as executable documentation, explaining how a component is intended to function.

- Advantages of Unit Testing:
  - Early Bug Detection: Bugs and issues are identified and addressed during the coding phase, reducing the likelihood of costly defects in later stages.
  - Enhanced Code Quality: It encourages developers to write cleaner, modular, and more maintainable code.
  - Improved Software Design: Unit tests promote a modular and component-based approach to software design.
  - Rapid Feedback: Developers receive immediate feedback on the correctness of their code, enabling faster development iterations.

4.8.2 Integration Testing

- What is Integration Testing?

Integration testing is a software testing approach that focuses on assessing the interactions between various components or modules of a system. Unlike unit testing, which tests individual units in isolation, integration testing examines how these units work together when integrated into a larger system.

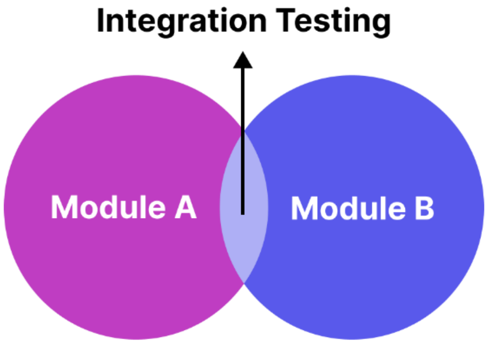

Figure 20: Integration Testing

- Importance of Integration Testing:

Integration testing plays a crucial role in ensuring the reliability and functionality of a software system:

    - Interaction Verification: It verifies that different components can interact correctly and share data as expected.
    - Data Flow: Integration testing evaluates the flow of data between modules, ensuring that data is processed correctly as it moves through the system.
    - Interface Compatibility: It ensures that the interfaces between components are compatible and that data is transmitted accurately between them.

- Why is Integration Testing Used?
  Integration testing is employed for several reasons:
    - Interaction Validation: It validates that various components interact seamlessly, minimizing the risk of integration-related defects.
    - System Validation: It helps assess whether the integrated system meets its design specifications and functional requirements.
    - Risk Mitigation: It identifies integration issues early, reducing the likelihood of costly defects emerging in later phases.

- Advantages of Integration Testing:
    - Defect Detection: It helps detect and address integration-related issues, such as data mismatches, interface problems, and communication errors.
    - End-to-End Validation: Integration testing verifies that the system functions correctly as a whole, rather than just individual components.
    - Confidence Building: Successful integration tests instil confidence in the software's reliability and readiness for subsequent testing phases and deployment.
    - Quality Assurance: By addressing integration issues early, it contributes to the overall quality and stability of the software system.

In summary, unit testing and integration testing are essential components of the testing approach for the "QR Share: QR Code Generator and Scanner for Data Transfer" project. Unit testing focuses on individual code units, ensuring their correctness and reliability, while integration testing examines the interactions and data flow between these units within the larger system, ensuring seamless operation. Both testing types are crucial for identifying and addressing defects early in the development process and ensuring the software meets its design and functional requirements.

4.9 References

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