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Offline Payment App

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ABSTRACT :

The aim of this project is to create an Android app that allows users to make payments through simulated GSM voice calls and QR code scanning in locations without access to the internet. The app solves the problem of financial inclusion in underserved regions by offering a payment method through a dual-mode transaction system – USSD GSM. It enables customers to make international transactions without the need for an internet connection, allowing people in rural areas to access digital payments.

The application has an Android interface with a scanner and a QR code generator, making it very user-friendly. The app stores transactions in an encrypted local SQLite database to ensure the integrity and privacy of the data. In order to limit the scope to a college assignment, a dummy database simulating transactions is created so that real-world integration with GSM or NPCI (National Payments Corporation of India) is not required.

Keywords: Offline Transactions, QR Codes, USSD, GSM, NPCI

Introduction :

This project's goal is to create an Android application for offline payment processing via mocked GSM payment and QR code payment in areas with little or no internet connectivity. The internet remains dormant in many rural and remote areas, which makes digital payments impossible. This offline payment processing app provides a simple yet effective solution. Due to the college project's limitations, the app will function on a dummy database to avoid complex integration of GSM or NPCI, the National Payments Corporation of India. This solution guarantees that the project stays within the academic boundaries, while dealing with a real-life issue.

To ensure flexibility and ease of payment methods, the app will incorporate dual-mode transaction capabilities through the use of GSM-simulated USSD, alongside QR code scanning. The QR code scanning feature will allow users to receive payments by simply scanning the QR codes issued from other users' devices, giving users more opportunities for unobstructed transactions. In combination with that, the GSM-simulated USSD feature will imitate the function of traditional USSD-based payment systems, where users are able to execute transactions without having access to the internet.

Users will also be able to interact with the Android-based user interface since it will feature a QR code generator and scanner for further simplicity. To retain privacy and data integrity, the app will feature an encrypted local SQLite database that allows for secure storage of offline transaction records. This will enable users to view their transaction history and manage their finances, all while offline.

Addressing the difficulties experienced by underprivileged communities, the app will enable effortless and dependable offline payments through the powerful features provided. This will allow users from regions with poor internet access to engage in digital transactions and unlock financial inclusivity as well as economic development. Although the app is limited to a college project, its implementation can certainly be used in the real world. This demonstrates technical capability while also proving that there is a need for worthy and accessible solutions for at-risk communities.

The app will feature dual-mode transaction capabilities, combining GSM-simulated USSD (using a 99# mimic) and QR code scanning to offer flexibility in payment methods. The Android-based user interface will include a built-in QR code generator and scanner, enabling seamless transactions between users. Additionally, the app will incorporate an encrypted local SQLite database to securely store offline transaction records, ensuring data integrity and privacy. By leveraging these key features, the app will provide a reliable and user-friendly platform for offline payments, addressing the challenges faced by underserved communities while staying within the scope of a college project.

Methodology :

The development of the Android application for offline payments through simulated GSM and QR code scanning follows a structured and systematic approach to ensure functionality, usability, and reliability. The methodology is divided into several key phases, including requirement analysis, system design, implementation, testing, and deployment. Each phase is carefully planned to align with the project's objectives and constraints.

Requirement Analysis:

The first phase involves understanding the problem statement and identifying the key requirements of the application. The primary goal is to create an offline payment solution for regions with limited internet access. Key features include dual-mode transactions (GSM-simulated USSD and QR code scanning), an Android-based user interface, and an encrypted local SQLite database for secure offline storage. The app must also be user-friendly and accessible to individuals with limited technical expertise.

System Design:

1. *User Interface (UI):* The UI is designed to be intuitive and easy to navigate, with options for GSM-simulated USSD transactions and QR code scanning. The interface includes a QR code generator and scanner, enabling seamless transactions between users.
2. *Backend Logic:* The backend handles transaction processing, including the simulation of GSM-based USSD functionality and QR code validation. A dummy database is used to simulate transactions, ensuring the app operates within the project's scope.
3. *Database:* An encrypted SQLite database is implemented to store transaction records securely. The database is designed to function offline, allowing users to access their transaction history without an internet connection.

Implementation:

1. *GSM-Simulated USSD:* A mock USSD interface is created using a 99# mimic, allowing users to initiate transactions offline.
2. *QR Code Scanning:* The ZXing library is integrated to enable QR code generation and scanning. This feature facilitates peer-to-peer transactions without requiring internet connectivity.
3. *Local Database:* SQLite is used to create an encrypted database for storing transaction records. Encryption ensures data security and privacy.
4. *User Interface:* XML is used to design the app's layout, ensuring a clean and responsive design.

Testing:

1. *Unit Testing:* Individual components, such as the QR code scanner and database, are tested for functionality.
2. *Integration Testing:* The entire system is tested to ensure all components work together seamlessly. Simulated transactions are conducted to validate the app's performance in offline scenarios.

Deployment

Once testing is complete, the app is packaged into an APK train for deployment. The app is designed to run on Android bias with minimum tackle conditions, icing availability for druggies in underserved regions.

Literature Review :

Evolution of Payment Systems

Payment systems have experienced significant metamorphosis over the decades, driven by technological advancements and changing consumer requirements. Traditional cash- grounded systems were gradationally replaced by electronic payment styles similar as credit and disbenefit cards, which offered lesser convenience and security(Humphrey et al., 1996). The arrival of the internet further revolutionized payments, enabling online banking and e-commerce platforms (Kolkata & Whinstone, 1997). In recent times, mobile payment systems have gained elevation, particularly in developing countries. Mobile plutocrat services like M- Pesa in Kenya have demonstrated the eventuality of mobile- grounded payments to drive fiscal addition(Jack & Suri, 2011). These systems influence mobile networks to grease deals, indeed in regions with limited banking structure. still, their reliance on internet connectivity remains a hedge in areas with poor network content.

Technologies Enabling Offline Payments

Offline payment results have surfaced as a critical area of exploration, particularly for regions with limited or unreliable internet access. Offline payments enable deals without real- time connectivity, counting rather on original storehouse and synchronization mechanisms. Studies have explored colorful approaches to offline payments, including SMS- grounded systems, USSD(unshaped Supplementary Service Data), and QR canons.

SMS- grounded payment systems, similar as those used in early mobile banking, allow druggies to conduct deals via textbook dispatches(Duncombe & Boateng, 2009). While these systems are accessible in low- connectivity areas, they frequently warrant robust security features. USSD- grounded systems, on the other hand, give a more secure and interactive platform for offline deals. USSD canons, similar as * 99#, are extensively used in countries like India for mobile banking and payments(NPCI, 2018). still, these systems bear integration with telecom networks, which may be beyond the compass of a council design.

QR law- grounded payments have gained fashionability due to their simplicity and versatility. QR canons can store sale details and be scrutinized offline, making them ideal for peer- to- peer payments (Chen et al., 2019). The combination of QR canons and offline databases has been explored in several studies, pressing its eventuality for fiscal addition(Zhang et al., 2020).

Security and Fraud Prevention

Security and sequestration are critical considerations in the design of offline payment systems. Offline deals are innately vulnerable to fraud and data breaches, as they warrant real- time confirmation mechanisms. Encryption and secure storehouse are essential to cover stoner data and ensure sale integrity(Sharma & Singh, 2020). Original databases, similar as SQLite, are generally used in offline payment systems to store sale records securely. Encryption ways, similar as AES(Advanced Encryption Standard), can be employed to guard sensitive information(Patel et al., 2019). also, stoner authentication mechanisms, similar as Legs or biometrics, can enhance the security of offline payment systems.

fiscal Addition and Availability

QR canons and GSM technology have played a vital part in advancing fiscal addition, particularly in underserved regions. QR canons give a low- cost and accessible payment system, taking only a smartphone with a camera. Their offline functionality makes them suitable for areas with limited internet access(Gomber et al., 2018). GSM technology, particularly USSD, has been extensively espoused for mobile banking and payments in developing countries. USSD- grounded systems don't bear internet connectivity, counting rather on GSM networks to grease deals(Aker & Mbiti, 2010). While these systems are effective, their perpetration frequently involves collaboration with telecom providers, which may not be doable for small- scale systems.

The integration of QR canons and GSM- dissembled USSD offers a promising result for offline payments. By combining the availability of QR canons with the familiarity of USSD, this approach can give a stoner-friendly and inclusive payment platform. Several studies have explored the eventuality of similar mongrel systems, emphasizing their capability to bridge the digital peak(Kumar et al., 2021).

DFD LEVEL 0-

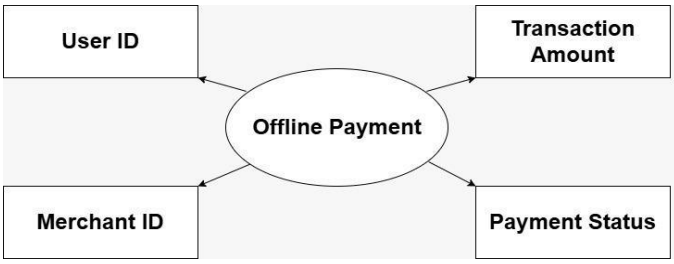
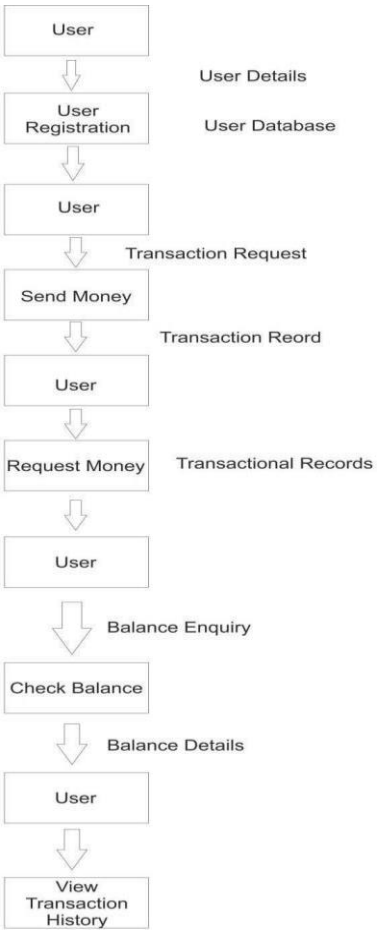


Figure- DFD LEVEL 1



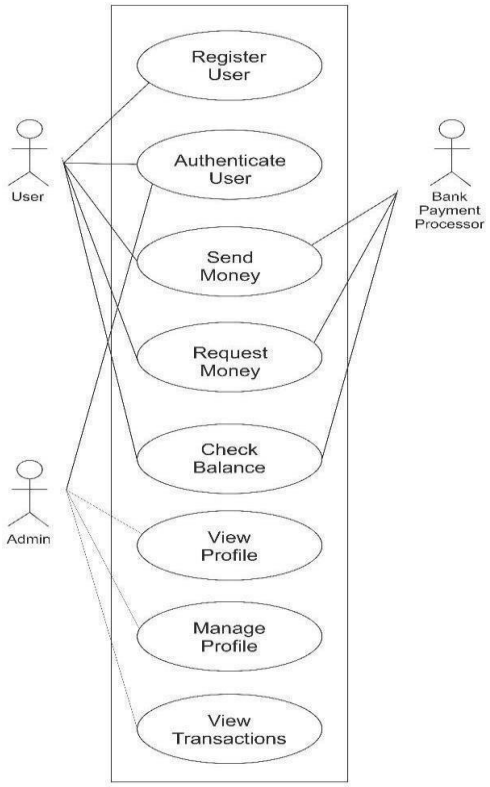


Figure :- Use Case Diagram

- A data inflow illustration(DFD) is a way of representing the inflow of data through a processor or system(generally an information system).
- The DFD also provides information about the labors and inputs of each reality and the process itself. A data- inflow illustration has no control inflow — there are no decision rules and no circles. Specific operations grounded on circles can be explained by a flowchart.
- It also gives sapience into the inputs and labors of each reality and the process itself. The DFD doesn't have control inflow, and no circles or decision rules are present. Specific operations depending on the type of data can be explained by a flowchart. It's a graphical tool, useful for communicating with druggies, directors, and other labor force. It's useful for assaying being as well as proposed systems.
- Data inflow must be from a reality to a processor or a process to an reality. There can be multiple data flows between one reality and a process.
- Data inflow must be from a data store to a processor or a process to a data store. Data inflow can do from one data store to numerous processes.
- Every process must have input data inflow to reuse the data and an affair data inflow for the reused data.
- Every data store must have input data inflow to store the data and an affair data inflow for the recaptured data.

Conclusion :

The development of the Android operation for offline payments using dissembled GSM and QR law scanning provides an innovative result to the challenges faced by underserved communities with limited or no internet access. The app combines QR canons for peer- to- peer payments and GSM-dissembled USSD for offline deals, icing availability and ease of use in regions with poor connectivity.

By integrating a translated SQLite database, the app ensures secure storehouse of sale data, maintaining sequestration and integrity indeed in offline surroundings. This binary- mode sale system allows individualities in remote areas to pierce digital payments, promoting fiscal addition and participation in the digital frugality without the need for nonstop internet access.

While the design is confined to an academic compass, it demonstrates the eventuality for real- world operations. By using these technologies, the app offers a practical, stoner-friendly, and secure result that could contribute significantly to fiscal addition and give a model for unborn developments in offline payment systems.

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