Department of Electrical and Electronic Engineering

電 機 電 子 工 程 系

Mobile Web Application-Electronic Payment System

Free Yeah Payment

Zicong ZHU (3035142132)

Supervisor: Dr. W. H. Lam

Abstract

Since the last few decades, smart phone has become necessary for everyone in the daily life, instead of just tools for communications. Due to the rapid development of mobile system, the mobile applications made people's life more convenient such as map applications and delivering applications. Among the large quantities of mobile applications, electronic payment applications have become an important part of the application family. It has become significant for developing and improving electronic payment applications with great qualities.

In this project, a mobile web application for electronic payment will be designed and implemented. This electronic payment application will be focusing on providing users with convenient and safe electronic payment experiences. Multiple kinds of functions will be implemented in this application including QR code and face recognition, which have been widely applied in mobile application fields to simply the procedures of payment.

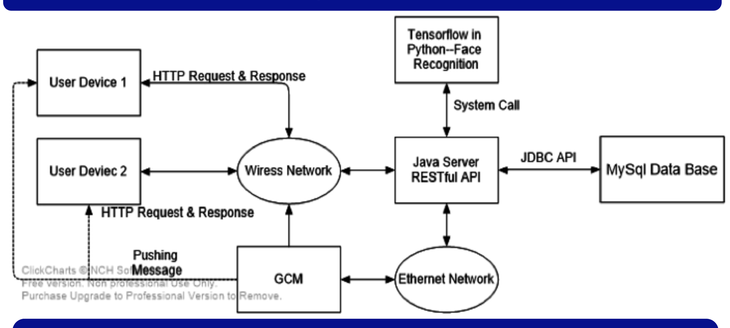
In the design and development of this project, a RESTful structure will be used with android front-end application, Java back-end server, MySQL database and Google Cloud Message pushing service. Furthermore, face recognition parts will be implemented by Tensorflow in Artificial Neural Network field, a method called Eigenface will be referenced.

A convenient and safe electronic payment systems will be developed as the goal of this project. Compared to other existing applications, it is focusing on a brand-new system architecture, better payment experiences among users, especially the implementation of face identification payment method. However, there're quite a lot limitation in the final product, like safety method and capacity of the application, which shall be improved for further considerations.

Background

The electronic payment is generally defined as "Users send payment orders to bank systems directly or indirectly via electronic devices, to achieve currency payment and fund transfer". However, in the recent decades while the smart mobile phones are being developed rapidly, a great number of mobile applications for electronic payment are carried out like Alipay, WeChat Pay and PayPal, which are developed as professional commercial applications and shows significant influences on users' daily lives.

Overall System Architecture



Objective

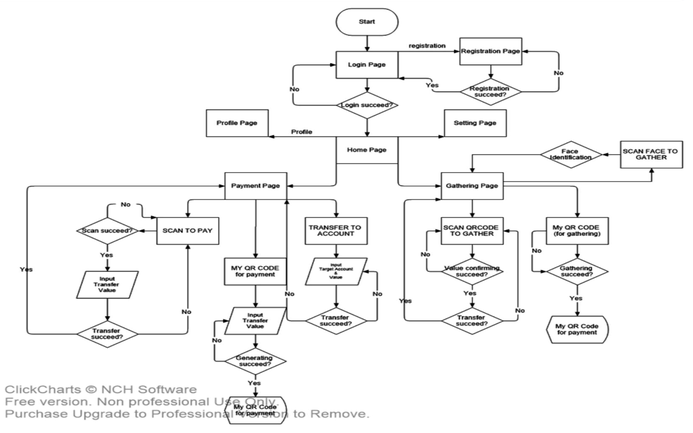
In this project named "Mobile Web Application - Mobile Electronic Payment System", an Android mobile application called "Free Yeah Payment" (denoted as FYP in the following) will be developed.

FYP applications are developed based on ideas of "Better electronic payment experiences on interactions within users". In other words, bank is not a considerable role in this project, all functions are designed for interactions between users and users.

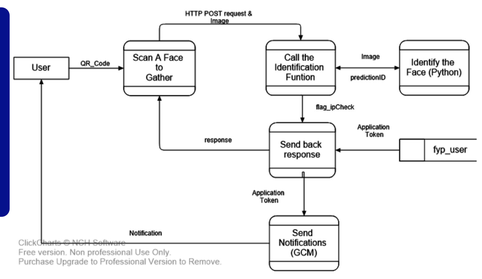
As a professional application system, it is necessary to implement the following components: mobile application, main server and back-end database. And platforms, structures and languages for each parts, connections and communication methods between them shall be considered.

Particularly speaking, besides all the basic functions like login and registration, electronic payment methods are the most important parts to be considered. Three kinds of methods for electronic payment will be developed in this project: payment by directly transfer, payment by QR code and payment by Face Recognition. Function of payment by directly transfer is added as a backup choice for users, which can make the whole application more completed and professional. Function of payment by QR code is implemented as the main method in FYP, which satisfies the payment needs in different scenarios. In other words, any two users can use QR code in serval ways to achieve the goal of payment. As for the last function of payment by Face Recognition, this is considered as the new feature in electronic payment systems. In this feature, the final goal is to achieve "Payment by scanning faces on portable(mobile) devices." Until the current moment, there're still many works to be done in this field, even Alipay does not support face recognition on mobile devices.

User Interface Flow Diagram



Gathering by Scanning a Face Function



This application supports scanning a registered member's face to start a transaction. Once the face is scanned, the file will be uploaded to sever by a HTTP POST request. If the face identification is successful, the payment user will receive a notification from GCM and the user can click the notification to start the payment.

When the user opens the camera by clicking "SCAN FACES" in gathering page, the user can press the black bar to take a face picture. Meanwhile, this image will be stored in the local memory. Later, the client application will send the HTTP POST request with the face image to the server, and then server will call the identification file in Python to identify the image. Once the predicated user ID has been returned by the Python identification file, the server retrieves the predicated user's application token from database, which is used for the GCM server to send a notification to the predicated user.

Sample Test

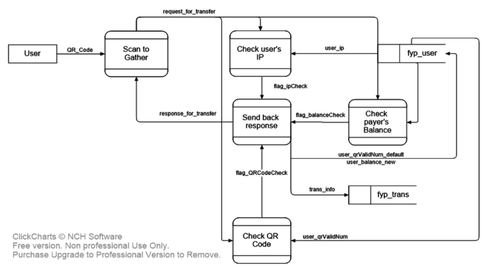
In this test, the client application took a face photo and transferred to the server for identification. The complete face identification function was tested in this section.

There photos were taken on a registered member with user ID 1, the following results were got:

The result contained 3 parts: "true" mean this identification is successfully been done; the matrix showed the final weights of the label, the highest weight represented the predicated ID; the final number indicated the target user ID, which was the predication result.

According to the three test cases, the result was accurate and acceptable, even the target user showed different motions or wore glasses.

Gathering by Scanning a QR code



When the user clicks the "SCAN TO PAY" button, the camera for scanning QR codes will be launched. If the user focuses the camera on a QR code, it will automatically scan it and send the corresponding HTTP request to the server.

The QR code carries basic information like username, QR code type which identifies the QR code is for payment or gathering. Because in this case which scans a QR code to pay to another user, the payment user is required to enter transfer value, which means the QR code only provides the receiver information.

After the user successfully scan and enter the transfer value, like payment by transfer function, the server will check user's current IP address with login IP address and balance before completing the transaction and responding to the client.