VEHICLE NUMBER RECOGNITION SYSTEM USING MOBILE DEVICES

---For Vehicle Identification---

ACKNOWLEDGEMENT

I am extremely grateful to Mr. SASTRY PULLELA (Director & Executive Vice President) and Mr. SANDEEP PULLELA (Human Resource) for giving me this internship opportunity as it was a great chance for learning and professional development. I also take this opportunity to sincerely thank Mr. RAVI KUMAR for assigning me a great project and for his guidance at each step.

I would like to express my gratitude towards Mr. VENKATESH for his support and constant monitoring throughout the course of the project. Also, I would like to thank Ms. Sowjanya for helping in through various stages in the project.

I am grateful towards everyone at Xinthe who have cooperated with me and helped in successfully completing the project.

Contents

1. ABOUT XINTHE

Xinthe is an emerging global corporate specializing in customized software applications development, Product development, Consulting Practices, Testing and GIS services. We are continuously working with fortune 500 customers as an extension of their team to develop highly intuitive and technologically advanced business applications allowing them to provide their clients with reliable Industry leading software solutions.

Xinthe was established in March 2001 with a dream to become one of the world's most admired software development and IT services Organization. Since then, Xinthe has emerged as leading software solutions provider across various Industry sectors in USA and APAC. People at Xinthe are domain experts and they challenge the knowledge with complete expertise and experience, and attitude of "uncompromising" process and quality.

Xinthe constantly strives to solve customer problems with thorough understanding of business needs and change required. By adapting and implementing new generation customer centric Project Management processes, moving hand in hand with various industries to ensure that the solutions are not just successful, but authentic and emerging. Thus, ensuring the changes are vehicle owner friendly and adaptable. As a service provider, their vision is to enhance software development by encouraging not only advanced development skills, but also the ability to discuss business logic with the clients, without the technical jargons.

1.1 PRODUCTS:

COMPLIANCE SOLUTIONS:

Our teams of technical experts and analysts have a hands-on knowledge of the compliance domain with respect to various environmental and human rights related issues, which helps them develop compliance applications, which will enable effective and responsive management of compliance activities throughout your organization. Our Solutions are robust, scalable and tailored to suit your specific industry and compliance requirement.

With 13 years of experience and a wide spectrum of deep domain knowledge as well as functional and technology expertise, we have the diverse expertise and the ability to undertake software development to meet the business objectives of our clients. Since 2004, we have been providing compliance solutions, which are cost and time effective and helps you to streamline critical

processes.

The manufacturing and retail organizations are using our solutions for their compliance management, which not just helps them to promote compliance but also increases visibility and improves overall performance.

OMNI CHANNEL FULFILMENT SOLUTIONS

Omni Channel Retailing is the recent evolution in retail industry to fulfill the needs of the customers with best possible consumer experience. It is anticipated that, by end of 2020, Buy Anywhere Get Anywhere and Return Anywhere will be a default solution for most of the retail chains. We have extensive knowledge pertaining to implementations of Order Management System, Supply Chain Management and B2B solutions according to industry standards like NRF, PCI.
We provide solutions for front end sales channels, integration of sales channels with order management systems and integration of order management systems with ERP solutions. Xinthe has extensive experience in OMS practices and training program, to support resources in these areas.

SHOPSLICK

The Retail industry is growing at an exponential rate. However, the brick-&-mortar retail outlets are lagging behind their ecommerce counterparts and competitors. Instant gratification still lures customers to retail outlets even though ecommerce sites provide them the convenience of shopping from the comforts of their home. Today, the only point of differentiation is the way we understand the customers and customize their shopping experience.

Tracking and analyzing your customers' needs will help you make that differentiation and lead you to success. Online sites have been doing so since their inception, now it is your turn to get started. Get ahead in the game with our Retail Customer Tracking & Analyzing solution called "Shopslick".

1.2 MOBILE WEB APPLICATIONS:

Mobile Web Applications are essentially the same as traditional web applications except that they have been designed to work on smaller screens typically used by mobile devices. Responsive applications will adapt their vehicle owner interface according to the screen size and also the aspect of the screen i.e. (horizontal or vertical). Some applications go further and use adaptive rendering, which means that they will change their look and feel to the type of device being used.

For example, an application used on an Android device will adapt to make itself look like an application specifically developed for the Android platform. Typically applications will render themselves to iOS, Android etc. The advantages of Mobile Web Applications are the same as normal Web Applications, although applications are typically designed to take into account that they are running on a mobile device.

Our team of well-experienced developers uses updated technologies to give both responsive and adaptive rendering capabilities to our mobile web applications

2. OBJECTIVE

Developing vehicle number recognition system which involves two apps, one for vehicle owner and another for operator. Transactions can be accomplished between vehicle owner and operator using the details provided by vehicle owner. Vehicle owner details can include contact details and financial transaction details such as credit cards or wallet ids. The process involves operator taking photo graph of number plate on vehicle using the system to identify the vehicle, which allows operator to transact with vehicle owner.

3. INTRODUCTION

The era of mobile technology opens the windows to android applications and use of mobile phones has been emerging at an exponential rate. Android software development is the process by which new applications are created for devices running the Android operating system. Officially, apps can be written using Java, C++ or Kotlin using the Android software development kit (SDK). Mobility is at the core of every enterprise's digital strategy. There are numerous platforms offering easy mobile app development for Android, iOS, Windows and other operating systems.

The Android OS, however, has progressed by leaps and bounds acquiring 87.7 percent of global market share. An ever-growing number of enterprises are adopting Android to build custom mobile apps to considerably boost their revenues and attain tremendous business growth. Android is free and an open platform built on Linux. It is an open source solution for mobile devices offering a complete software stack including operating system, middleware, and key mobile applications. Apart from its speed, scalability, and performance, there are many other advantages of Android application development.

Vehicle Number Recognition System using Mobile Devices includes two android applications – Vehicle owner Application and Operator Application, working simultaneously meeting at a single solution causing an intelligent payment experience for vehicle owners. In the past, the drivers often had to get stop and interact with the operators about payment method i.e. whether to pay in cash or card and additional waste of time is caused by waiting for change and receipt. While this doesn't seem that problematic, it might lead to long lines during peak hours. Vehicle number recognition system using mobile devices allows automatic recognition of license plate from a picture and electronic payment. This reduces interaction between drivers and operators and speeds up the payment process as well.

4. SYSTEM FEATURES

4.1 VEHICLE OWNER APPLICATION

1. REGISTRATION

Description:

This feature will give the vehicle owner a secure and simple registration screen. The vehicle owner is asked to enter their vehicle number, phone number, UPI id and name. Each vehicle owner can have multiple vehicles which is why name is not used to differentiate between each registration entry. For examples, if a vehicle owner has a car, he will register with his car number and if the same vehicle owner also has a bike, when he registers with his bike number, the information should not be overwritten in the database but instead be stored a different registration. This is the reason why vehicle number is used as a primary field used to differentiate between multiple registrations.

Stimulus/Response Sequences:

It consists of four basic fields: Vehicle Number, Phone Number, Unified Payments Interface id and Name. There is a button 'Register' for submitting the entered details. On successful entry, vehicle owner will be provided with a pop up message 'done data insertion' implying data is successfully entered into the database. There is no change of screen at this point allowing the vehicle owner to go ahead with another registration if needed.

Functional Requirements:

The most important function of the registration page is to store data in a database and when a registered vehicle is to be requested for payment by the Operator application, the database is searched for the scanned vehicle license number. This is further used to get their UPI id and token id generated when registered which are used to send a payment request. Additionally, the vehicle owner has the control to register for the same vehicle number multiple times and it updated with the latest information provided.

2. PUSH NOTIFICATION

Description:

This feature will give the vehicle owner real time update notification. When the Operator applications sends a payment request, a push notification is sent to the vehicle owner application notifying him that payment should be made and also specifying the amount.

Functional Requirements:

The most important function of the notification is to alert the vehicle owner every time a payment is to be made.

3. PAYMENT REQUEST

Description:

When a payment is requested by the Operator application, push notification is sent which is further followed by a payment request screen. A message is boldly displayed asking if the vehicle owner is willing to proceed with the payment.

Stimulus/Response Sequences:

It consists of two buttons, ‘yes’ and ‘no’. Clicking on ‘no’ gets the vehicle owner back to the registration page. vehicle owner need not register again as the details are already in the database, instead he can wait for another payment request. If the vehicle owner chooses ‘yes’, the application automatically gives all the payment applications in that respective mobile phone as options from which the vehicle owner can choose one to make the payment.

Functional Requirements:

This function allows Unified Payment Interface (UPI) integration into the application and the vehicle owners can choose if they want to proceed with payment or they can click no to decline the payment request. This way, payment is not automatically made and the vehicle owner can have control over it. Otherwise, security issues might arise and spam payments could be made from the vehicle owner’s account. Another advantage is that the payment is made at no additional interest or charge as UPI payments are direct bank to bank transfer with 0% charge.

4.1 OPERATOR APPLICATION

1. PAYMENT REQUEST

Description:

This application is used by operators. The home page has an input field to enter the amount for payment request to the customer and has a button to take a picture of the license plate. The license plate picture is scanned to detect the text in the picture which is the license plate number. An example image is displayed which shows how license plate image is used to recognize the vehicle number.

Stimulus/Response Sequences:

It consists of two input fields, one for entering the amount which is to be requested by the customer and button that redirects to options of camera applications. A picture is taken as an input by one of the selected application. Further, the picture is displayed as a bitmap image on the screen. Picture cannot be taken without entering the amount.

Functional Requirements:

This is the most important feature as the automatic license plate recognition works here and if a human enters the vehicle number instead of this automations, it is prone to errors in typing. An error in one digit or alphabet might lead to requesting payment from the wrong person. Also, it is mandatory to enter the amount before taking a picture to ensure that no errors occur i.e. amount entered is verified to be correct, after which picture is taken.

5. SOFTWARE REQUIREMENTS SPECIFICATIONS

5.1 PRODUCT PERSPECTIVE

Vehicle Number Recognition System using Mobile Devices is a new Android based system with two applications. It is implemented with Android Studio.

5.2 VEHICLE OWNER CLASSES

Our application hopes to draw all groups of vehicle owners. Most of the students use smart phones and more than half of those are Android phones. They will find it extremely convenient to use an application instead of interacting with the operators directly. Also, application will be helpful to parents, professionals, or older people who often send their drivers or other people on their works as they can directly approve payment from their mobile. This way, they do not need to give anyone cash or their credit cards. Also, most of the vehicle owners will find this application more convenient at the times when the card reader machine fails and these days, hardly anyone carries cash with them for safety reasons and comfort.

5.3 OPERATING ENVIRIONMENT

The application is designed only for Android operating systems and is compatible with android devices or Android emulator. The vehicle owner shall use this application on Android API 22 and later versions of the Android OS. No further hardware devices or interfaces will be required.

5.4 DESIGN AND IMPLEMENTATION CONSTRAINTS

Implementation restrictions:

- The programming language used is Java for both the applications
- The database used is Firebase Real Time database for storage and data sent should be in the required JSON format

Resource limitations:

- Both the applications need internet which is why the devices running either of these applications should have a working data plan or wifi connection
- The vehicle owner's device should have sufficient memory storage to install the application
- The vehicle owner's device should have sufficient battery life to run the application

5.5 USER DOCUMENTATION

All the pages or screens have the necessary information that the vehicle owner needs to know and sufficient guidance to proceed with using the application. The input fields have hints asking as to what information the vehicle owner should be providing there. Any errors that the vehicle owners commit will lead to toasts or pop up messages being displayed and letting the vehicle owner know where an error occurred. The vehicle owner is also updated after he enters the registration details with toasts like 'registering' and 'done data insertion'.

5.6 ASSUMPTIONS AND DEPENDENCIES

Dependencies:

- The applications shall be used with the assumption that the Android API and licensing agreement remains the same
- The Firebase and google cloud vision API dependencies are added to the applications as they are needed for running the applications

Software Component Dependencies:

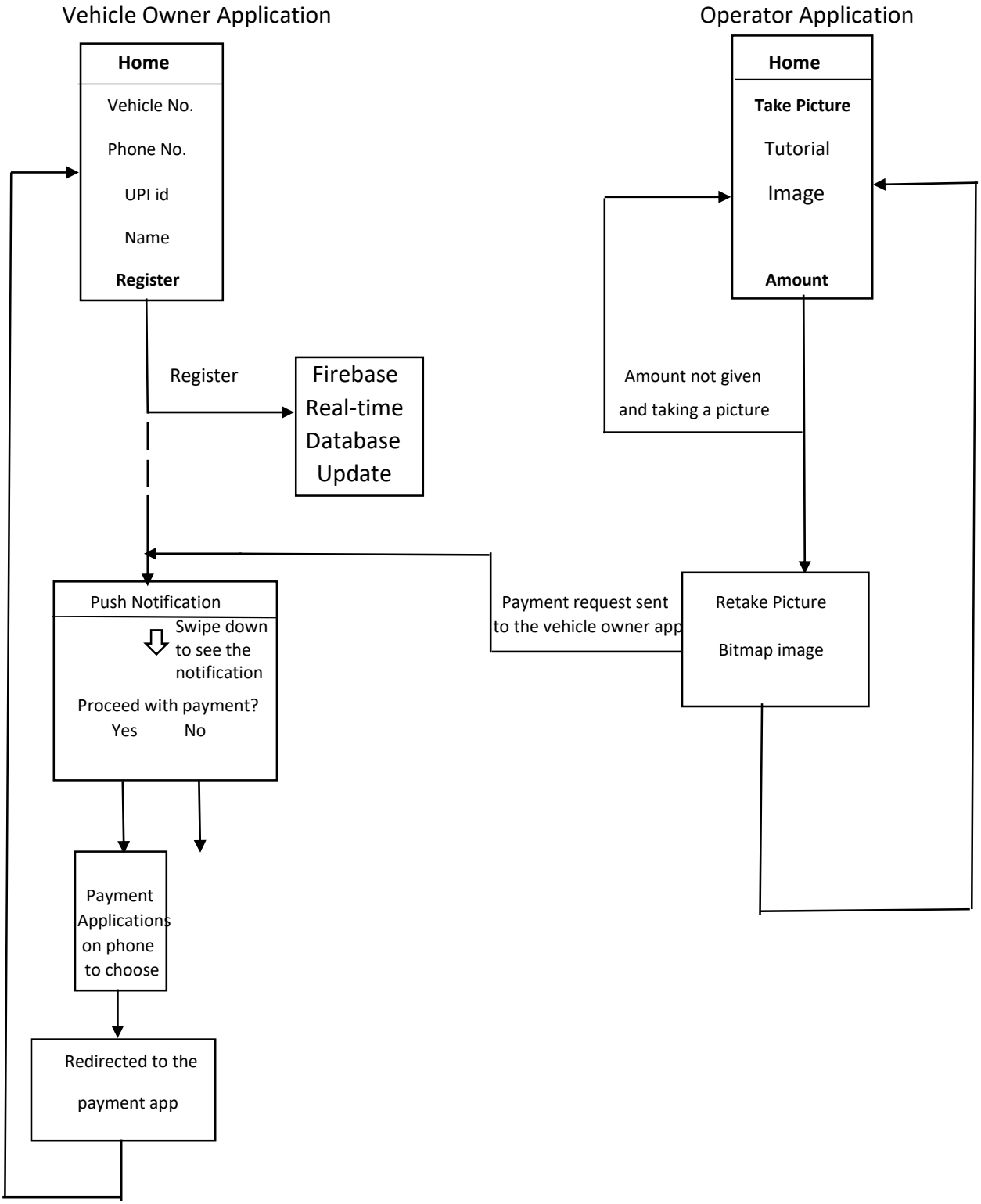
- The Operator application shall be used with the assumption that the built in camera application operates correctly
- The applications shall be used with the assumption that the device's network interface card and driver are operating correctly

5.7 COMMUNICATION INTERFACES

The application shall communicate with the various databases and software services via API function calls. Because the application is written in Java, Java functions will make these calls to the APIs. The exact formats and protocols for incoming and outgoing messages should be abstracted by the APIs.

- The Google Cloud Vision API is called for text recognition in the license plate image. The data sent is in a JSON format as accepted by the Vision API.
- Firebase Real Time Database and Firebase push notifications are used. Each application registered with Firebase has a distinct token key which gets regenerated every time the application is reinstalled and Firebase account itself has a server key using which the firebase is accessed. The data is stored in a tree format i.e. parent node and child nodes. The push notification to be sent to the application is also sent in a JSON format.

6. PROJECT DESIGN



7. DETAILED DESIGN

The project is divided into 3 modules:

Module 1:

In the module, first process is registration in the vehicle owner application. In the registration process, the vehicle owner can input his unique vehicle license plate number, phone number, UPI id and name. If the vehicle owner has already registered, he need not register again and can just wait for notification to make the payment.

Module 2:

In the operator application, inputting the payment and clicking a picture of the vehicle's license plate to get the UPI id and token key of the owner of the vehicle.

Module 3:

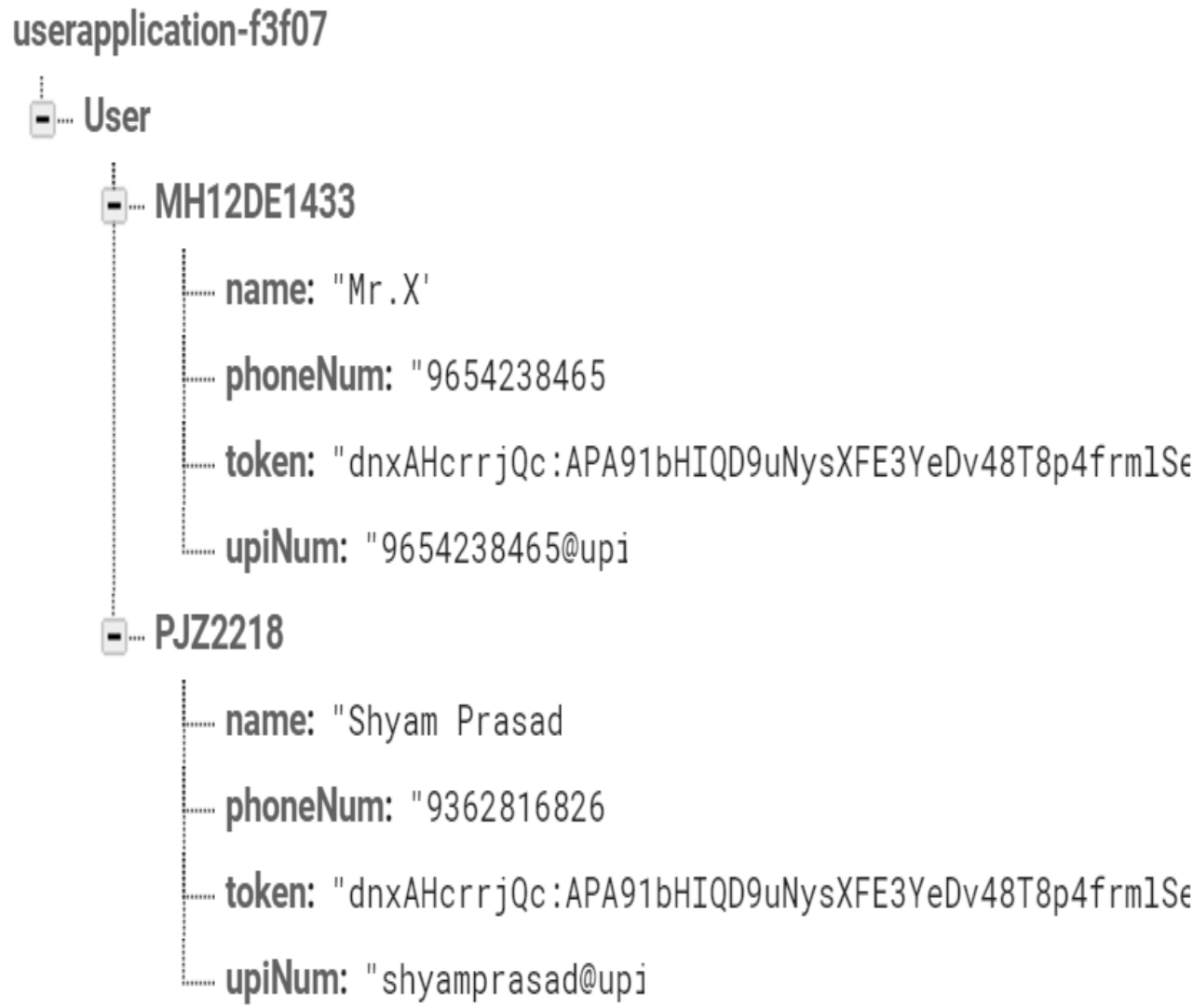
A push notification alerting the vehicle owner to make the requested payment and the amount needed to be paid is sent. Also, a new screen is displayed for the vehicle owner to accept or decline the request. Accepting the request automatically redirects to the chosen default payment application in the mobile phone or another application chosen.

8. IMPLEMENTATION DETAILS

Vehicle owner Application registration page:

Updates displayed to the vehicle owner while registering and storing the data into the database:

Registration information stored in the Firebase Real-time database:



This is how the vehicle owner registers and each of the registration details goes into the database. At any point of time, if the vehicle owner decides to register again for the same vehicle number, the information is overwritten i.e. updated.

Number Plate Recognition application home page:

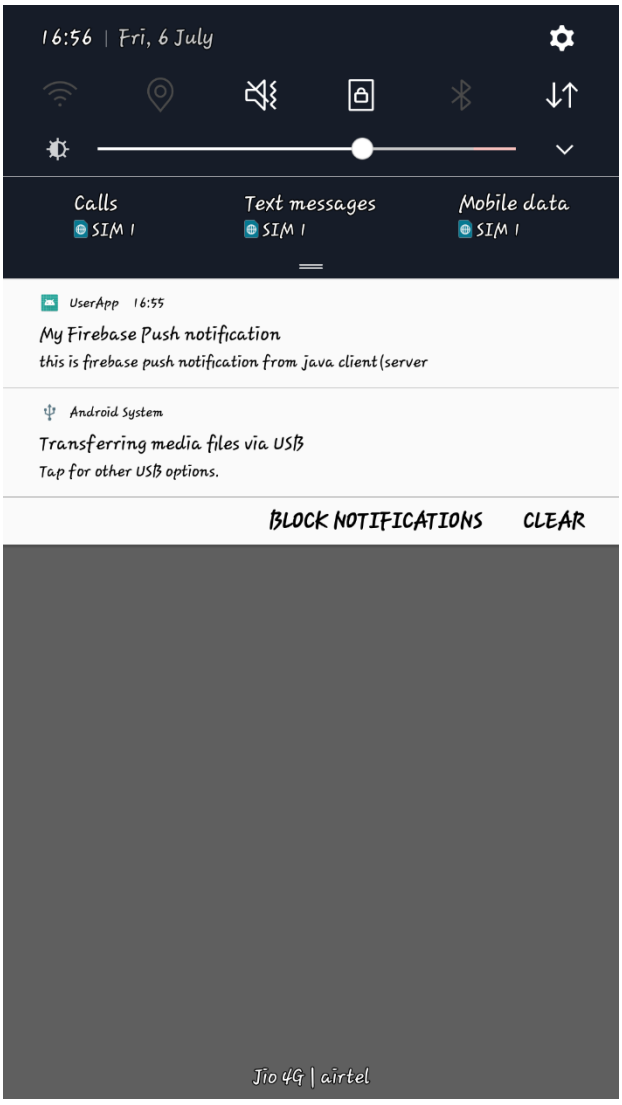
It is mandatory that the amount should be entered before a picture of the number plate is taken. This way, the vehicle owner is less prone to errors. If the amount is not entered and an attempt to take a picture is made by clicking on the button, a message is prompted saying ‘please enter the amount to proceed.

Amount of Rs.10 being entered:

Picture of this license late taken:

The following process continues in the vehicle owner application once the picture is taken.

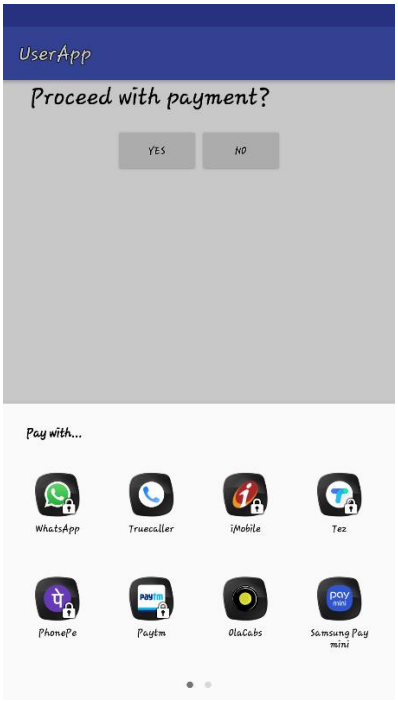
A push notification is sent to the vehicle owner application:



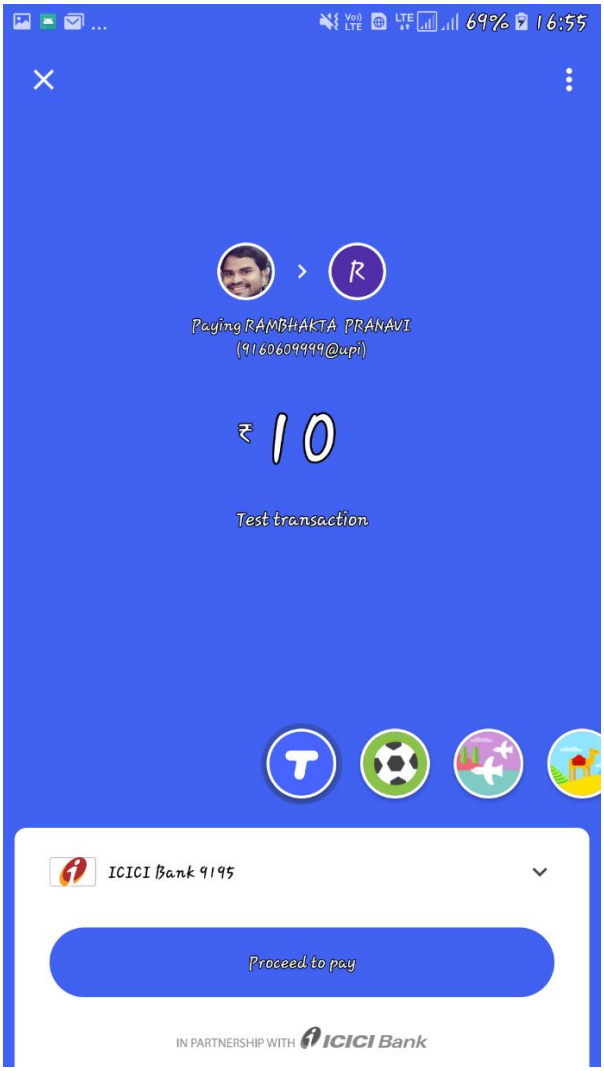
The push notification title and message can be customized as per the need. Other key value pairs can also be sent to the vehicle owner application. Here, we also send the UPI url which includes all the payee's upi details and also the amount.

This screen appears in the vehicle owner application asking the vehicle owner to accept or decline the payment.

If yes is clicked, the application shows all the payment applications in the device:



When ICICI payment application is chosen:



Because of the UPI url, the payee's details and the amount to be paid is already present. This way payment can be made conveniently, easily and with great efficiency.

9. CONCLUSION

The era of mobile technology opens the windows to android applications and use of mobile phones has been emerging at an exponential rate. An ever-growing number of enterprises are adopting Android to build custom mobile apps to considerably boost their revenues and attain tremendous business growth. Vehicle Number Recognition System using Mobile Devices is an android based project that is being introduced here and it would be a great added advantage to all classes of vehicle owners by allowing electronic payments at with the help of license plate recognition system and minimizing the interaction between the drivers and the operators. This is going to highly speed up the payment process.

10. FUTURE SCOPE

Currently, the Android applications have very limited features. The vehicle owner still has to communicate with the operators for other details that the application does not ask yet. This could also be incorporated into the application. There could be a messaging service built between the two applications which would the communication easier and eliminating direct face to face talks. This way, there will be no miscommunication due to hearing or talking inabilities and a substantial proof always exists for future sake if something goes wrong. All the vehicles not paying the bill can be blacklisted and shared with other operators. This way, vehicle owners would be left with no choice other than paying for the purchased product.

11.BIBLIOGRAPHY

1. https://code.tutsplus.com/tutorials/how-to-use-google-cloud-machine-learning-services-for-android--cms-28630

2. https://vision.googleapis.com/$discovery/rest?version=v1

3. https://firebase.google.com/docs/cloud-messaging/android/send-multiple

4. https://stackoverflow.com/questions/23456488/how-to-use-okhttp-to-make-a-post-request

5. https://firebase.google.com/docs/database/android/start/

6. https://firebase.google.com/docs/database/android/read-and-write

7. http://developine.com/how-to-send-firebase-push-notifications-from-app-server-tutorial/

8. http://developine.com/firebase-cloud-messaging-push-notification-android-tutorial/

9. https://stackoverflow.com/questions/40353967/invole-psp-app-with-upi-url

10. https://www.npci.org.in/sites/default/files/UPI%20Linking%20Specs_ver%201.6.pdf