



Android Application Development for Internet of Things: Door Notification System

A Summer Training Project Report
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For the Degree of
BACHELOR OF TECHNOLOGY

Trainee Name:

Mayank Mittal

Roll Number: 14376

IIT-Kanpur

Supervisor:

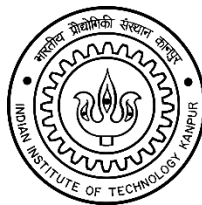
Mr. Amar Nath

Lead Architect

Sopra Group Inida Pvt.Ltd.

A-67, Sector-64

Noida-201307



**Department of Electrical Engineering
INDIAN INSTITUTE OF TECHNOLOGY KANPUR
KANPUR 208016, INDIA
June 2015**



CERTIFICATE

This is to certify that the project entitled '**Android Application Development on Internet of Things: Door Notification System**' is a record of the bona fide work done by Mr. Mayank Mittal, Roll No.: 14376 under my supervision and guidance. This report is submitted to Sopra Group India Pvt. Ltd., A-67, Sector-64, Noida in partial fulfillment of the requirements for the award of the **Degree of Bachelor of Technology in Electrical Engineering (EE)** during the year 2014-2018.

Mr. Amar Nath
Supervisor
Lead Architect
Sopra Group India Pvt.Ltd.
A-67, Sector-64
Noida-201307

Date: 14 July 2015



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To all relatives, friends and others who in way or another shared their support, either morally, financially, and physically, thank you.

With warm regards,

Mayank Mittal



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ABSTRACT

A lot of buzz has been there about the Internet of Things (IoT). The basic principle behind IoT is to connect every possible electronic device to existing internal infrastructure. With this in mind, the project picks one of the instance of 'smart-living'.

This project simulates a real life situation in which the user is notified on his handheld device whenever a 'doorbell' is pressed at his home or office. This would allow the user to remotely know who came to visit him during his absence.

However, it mainly concentrates on using the Java platform for android application development. The same has been done to create an application which simulates the doorbell and another application which centers on the back-end service for notifying the user.



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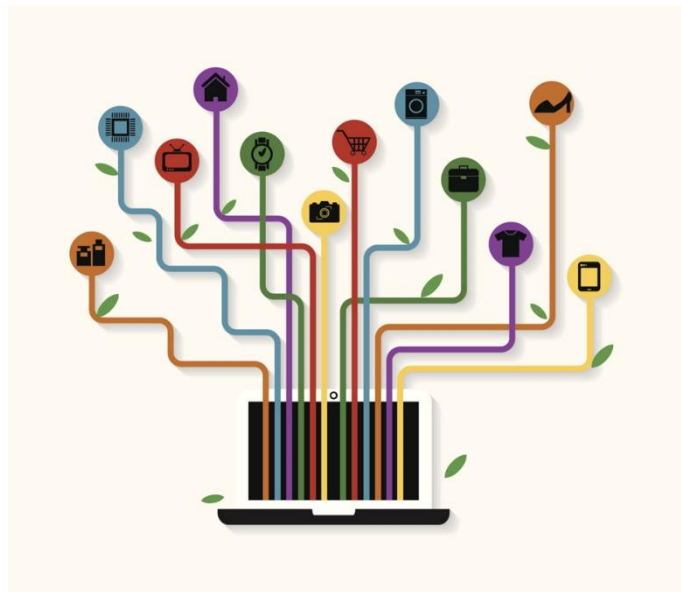
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INTRODUCTION

1.1 Internet of Things

The internet of things revolves around increased machine-to-machine (M2M) communications. It's built on cloud computing and networks of data-gathering sensors.

Machine-to-machine communication isn't limited to two devices 'talking' to each other. It refers to communication between physical objects or 'things' ranging from everyday things like shoes, wallets, watches to household appliances like microwave ovens, refrigerators to automobiles to assets and pets. These machines, which were earlier perceived as just tools or instruments, are now becoming 'smarter' by equipping



them with sensors, embedded circuits and software. Source: <http://www.computing.co.uk/IMG/774/276774/internet-of-things.jpg>

A sensor evaluates and measures the surroundings that is in short, it gathers data. The Internet of Things provides the infrastructure for real time analysis of this data using cloud-based applications. They are the key to using the leveraged data.

In other words, the Internet of Things is directed to create a 'smarter' world where everything is connected and communicate in an intelligent fashion, which in a way will transform the physical world into a big information system.

This project essentially focuses on one of the possible application of Internet of Things- a Doorbell Notification System.

1.2 Objective of the Project



Source:

<https://lh6.googleusercontent.com/>

The project aims to tackle the daily life situation in which a person does not get to know who visited his home during his absence, by **making an android application** through which the user can be provided this information, once the application is connected through a cloud- based application to a doorbell embedded circuit.



PROJECT METHODOLOGY

The Internet of Things is a very broad field and creating a project on it involves several sub-projects, namely:

1. Designing and manufacturing the required embedded circuit
2. Extraction of data from the sensors and transmission of this data to a cloud-based application
3. Building a back-end service like a device application for the user

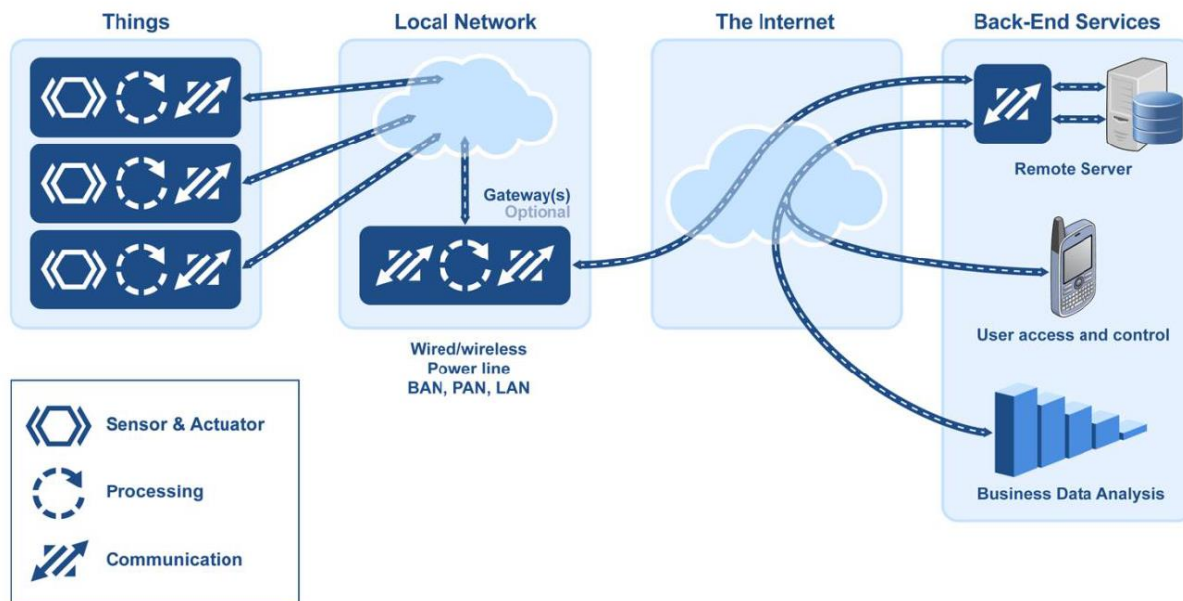


Figure: A basic layout of Internet of Things (IoT) Architecture with four main blocks:

1. The thing itself (the device)
2. The local network, which moves data in and out of the device. This may include a gateway to translate propriety communication protocols to IP family of protocols.
3. The Internet itself
4. End user devices (desktop, smartphone, laptop) or cloud devices (enterprise data systems that receive and manipulate data)

Source: <http://micrium.com/wp-content/uploads/2014/03/internet-of-things.png>

2.1 Flow Chart of the Doorbell System

The following is the flow chart design of the application, initially made, displaying how the doorbell notification system is supposed to work.

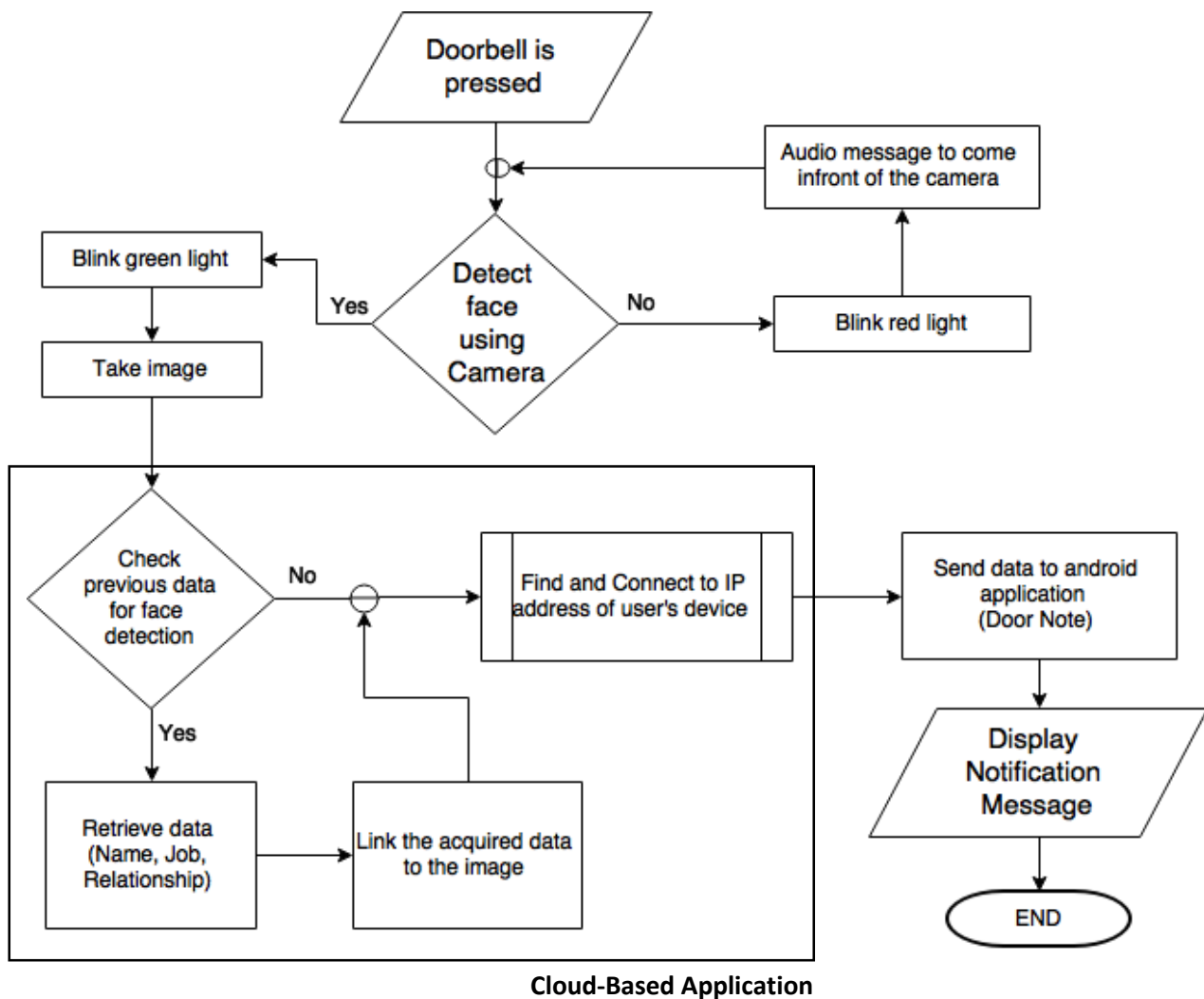


Figure: Flowchart displaying the key entities involved in the doorbell notification system.
(Made using www.draw.io)

2.2 Technical Requirements

The projects requires prior knowledge of object-oriented programming namely Java, with a well-understanding of the concept of classes, inheritance, encapsulation and abstraction; as well as a basic knowledge of XML coding and relational database management system.

The software used in the development of this project includes:

1. Android SDK Studio
2. Amazon Web Services

While the required hardware is a laptop and a hand-held device running Android operating system (with minimum API 11).

2.3 About the software used

Android Studio is a software development Kit (SDK) intended for the creations of applications for the Android operating system. It provides a comprehensive set of tools which include debugger, libraries, a handset emulator based on QEMU along with sample codes and tutorials.

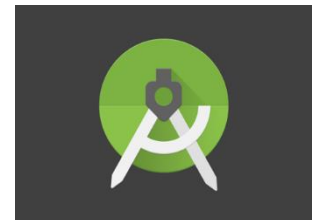


Figure: Android Studio Logo

Amazon Web Services (AWS) are a series of services provided by the Amazon for undifferentiated tasks like authentication of users, sending push notifications, storing and sharing of data, synchronizing data across different platforms. These services make things easier for the developer, as he or she no longer needs to focus on management of data at the cloud-end, and can be called using RESTful APIs.



Figure: AWS Logo

2.4 Application Sketching

The following is the basic application graphic interface made preceding the application development. It contains the various layouts as planned for the application named Door-Note, which is, as earlier mentioned, the back-end service for user control and access.

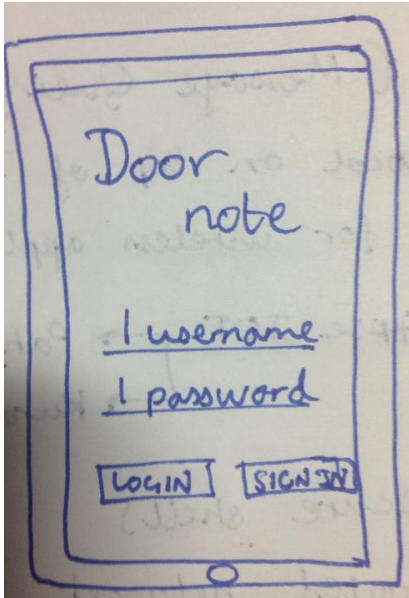


Figure 1: When the app is first opened, this layout appears to authenticate access

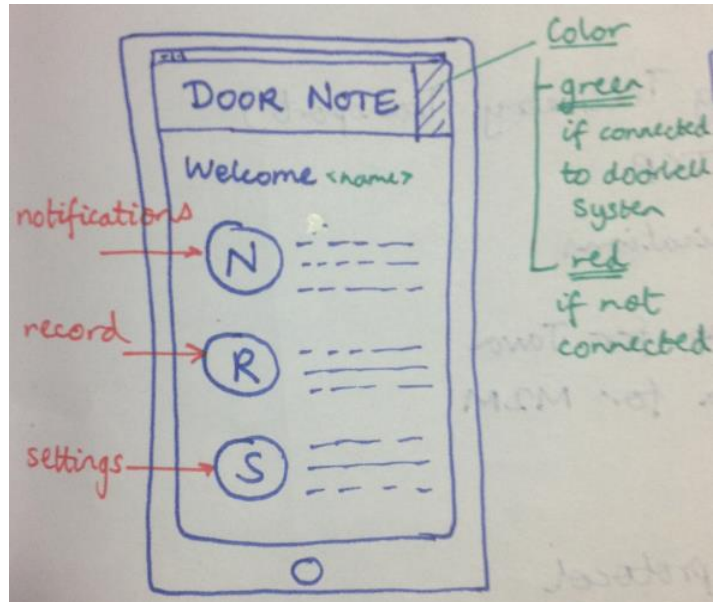


Figure 2: The main home-screen of the application

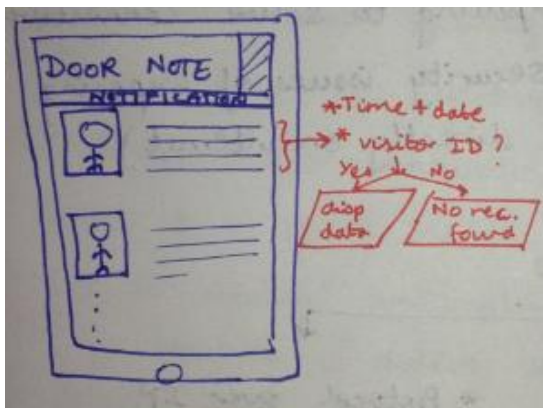


Figure 3: The Notification layout which displays all the notifications received by the user.



Figure 4: The Record layout which shows the contacts or images of people, who visited, known and unknown.

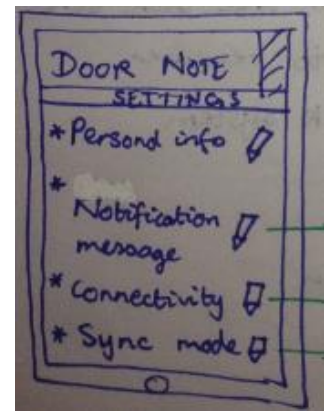


Figure 5: The Settings layout

APPLICATION I: DOORBELL

This android application aims to provide a replacement for the doorbell embedded circuit. When the 'bell' icon is clicked a notification is sent, that is on a database the time and date at which the icon was clicked is stored along with an application generated visitor id.

For future development, the face recognition feature, which hasn't been included currently, can be implemented. When a face is recognized the green light can be 'lightened' and image is taken, otherwise the red light is to be 'lightened'.

3.1 Bell.xml

3.1.1 Graphic Interface Layout



The door icon on the top-right corner of the screen would be green in color if the application is successfully connected to the internet, otherwise it will be red.

The two green and red boxes shown are there for face-recongintion feature, as earlier mentioned.

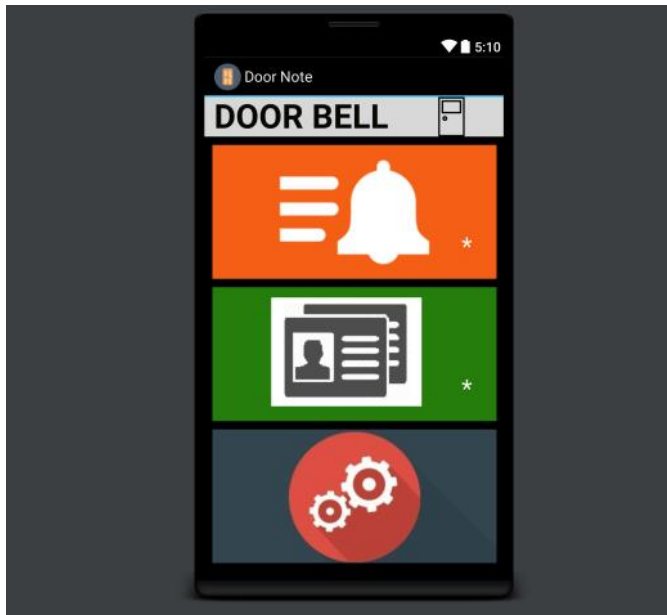
The 'big-bell' icon is the doorbell.

APPLICATION II: DOORNOTE

This android application is the main back-end service for the user. The user can view the notifications received through this application as well as the 'Visitor Diary' which keeps an account of the personal information of the visitors.

4.1 Homescreen.xml

4.1.1 Graphic Interface

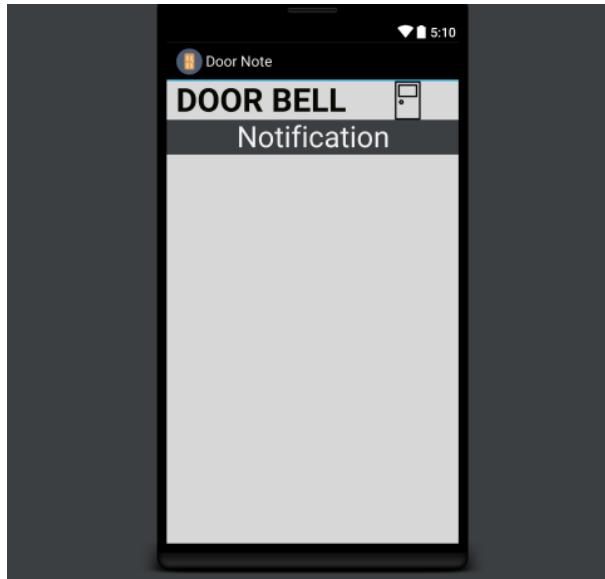


This is the main layout of the application from where the user can go to the notifications, records and settings layout by just clicking the appropriate icon.

The '*' shown will be replaced by the number of notifications and records present.

4.2 Notification.xml

4.2.1 Graphic Interface

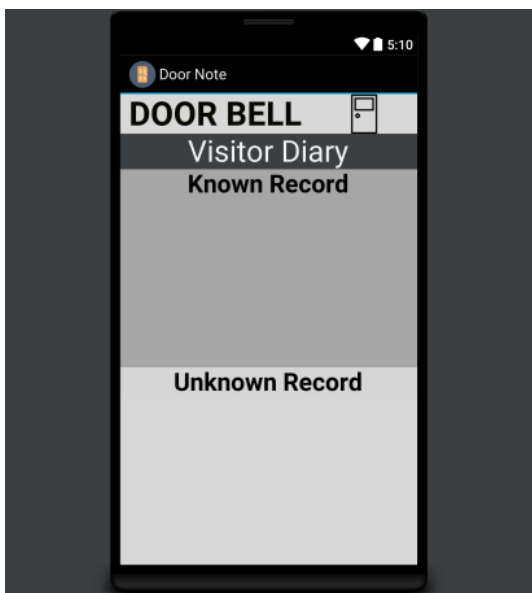


The door icon on the top-right corner of the screen would be green in color if the application is successfully connected to the internet, otherwise it will be red.

This is the notification section of the app. It will display the details of the time and date when the doorbell was pressed, by reading the data from an existing database.

4.3 Homescreen.xml

4.3.1 Graphic Interface

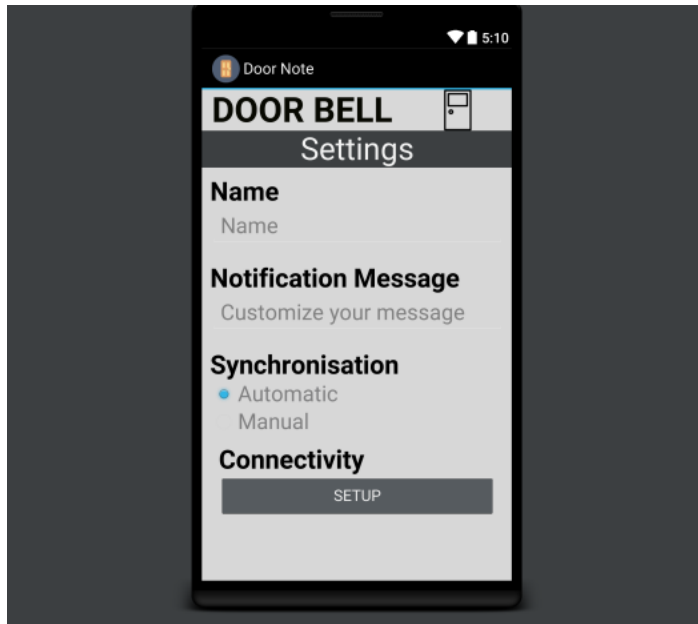


The door icon on the top-right corner of the screen would be green in color if the application is successfully connected to the internet, otherwise it will be red.

This is the records section of the application which will display the known and unknown contacts saved in the database. It is still under development.

4.4 Settings.xml

4.4.1 Graphic Interface

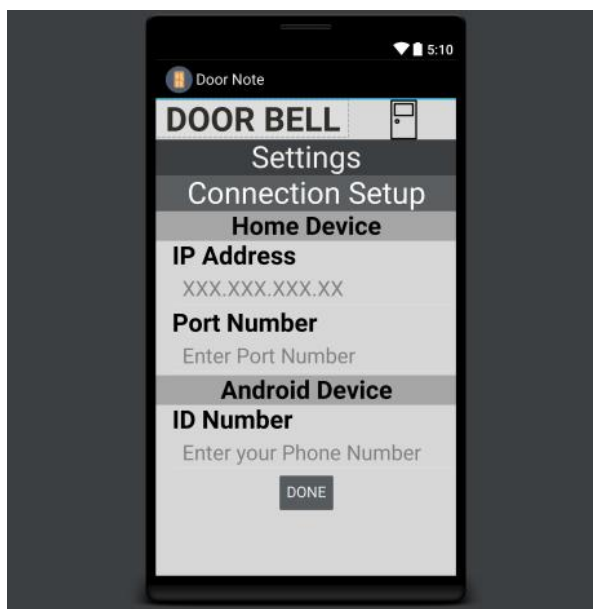


This is the settings section of the application. Over here the user can change his name and also customize the notification message which the application will display as a toast.

The application is supposed to sync data with the cloud which is upto the user to do it manually or automatically.

4.5 Connectivity.xml

4.5.1 Graphic Interface



The door icon on the top-right corner of the screen would be green in color if the application is successfully connected to the internet, otherwise it will be red.

This is the connectivity section of the app. It is meant for usage when the application needs to be connected to a real embedded circuit system using interned protocols and sockets.

IMPROPER ATTEMPTS TO FEATURES

This section includes the code snippets which were tried out but didn't work out. The reasons for their failure is still not completely known.

The 'ServerActivity.java' and 'ClientActivity.java' aimed to create a peer to peer communication between two android devices, one of which would have the Door-Bell application while the other would have the Door-Note application.

The 'SimpleDB' was used to enable the usage of Amazon Web Services. It aimed to create a database on the cloud to which the two applications could access enabling them to read and write data onto it.

5.1 ServerActivity and ClientActivity

It enables connection to internet and enable WiFi Peer-2-Peer communication for the client device. However, it doesn't work properly due to insufficient knowledge of internet protocols and sockets.

5.2 SimpleDB

It aims on using the SimpleDB service provided by Amazon Web Services However, it failed due to inability of creating a simple database by developer.



FUTURE WORK

The application developed in the project is just at its initial stage. There is currently a lot of scope of improvement present. The application doorbell system just stimulates the real life situation and still needs to be developed further for a usable model in the outside world.

1. Image processing can be implemented for facial recognition. One of the tools available for doing so is Intel Real Sense SDK.
2. Cloud services like those provided by Amazon should be used to store databases and for other requirements like user authentication.
3. The 'Visitor Diary' layout can be made better to display the records in a more organized manner.
4. Cross operating system synchronization can be introduced.

Besides the above mentioned suggestions, the application can be made user-friendly and has better interface for the user.



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