# Project Report

## on

# CROSS PLATFORM MOBILE APPLICATION DEVELOPMENT

*In partial fulfillment for the award of the degree* of **B. Tech. (CSE)**

*Session: 2018-2019*

*in*

*Under the Supervision of:*

**Dr. Pradeep Kumar Singh**

Assistant Professor (Senior Grade)

*Submitted By:*

**Shivam Sharma**

Univ. Roll No. 151436

Department of Computer Science & Engineering and Information Technology

**Jaypee University of Information Technology Waknaghat, Solan-173234, Himachal Pradesh**

## Certificate

# Candidate's Declaration

This particular report entitled "Cross Platform Mobile Application Development" at partial satisfaction of the needs for the awarding of the B.Tech. degree at CSE/IT filed at the Department of CSE/IT, (JUIT) Waknaghat is a real record of my work completed over a period from August, 2018 to May, 2019 under the oversight of (Dr.Pradeep Kumar Singh) (Assistant Professor, Senior Grade, CSE/IT).

The content included in the report hasn't yet been filed anywhere for awarding of any other diploma/degree.

(Student Signature)

Shivam Sharma, 151436

It is to certify that the preceding statement made by the candidate will be accurate to the best of my understanding.

(Supervisor Signature)

Supervisor Name: Dr.Pradeep Kumar Singh

Designation: Assistant Professor (Senior Grade)

Department name: CSE/IT

Dated:

# ACKNOWLEDGEMENT

I want take this chance to thank almighty for blessing me with his grace and taking my job to a successful culmination. I extend my sincere and heartfelt thanks to my esteemed project supervisor, Dr. Pradeep Kumar Singh, for providing me with the important guidance and advice at the crucial junctures during coding, while preparing project report and also for guiding me towards right way. I expand my sincere thanks to our respected Head of Department, CSE/IT. In end, I'd like to thank my friends and family for the support and encouragement they have given me throughout the course of my work.

# TABLE OF CONTENTS

# LIST OF FIGURES

# ABSTRACT

To resolve separate app development issue, cross platform applications are investigated and have been found to resolve device functionality features, device and platform coverage issues. Nevertheless, framework choice in cross platform development was hard, it had been proposed that React Native and Xamarin were chosen as a preliminary starting point. So, among those cross-platform frameworks, the one named React Native was used to produce the Water Complaint Redressal System App called HimIPH and it acts an interface to decrease the efforts of engineers and largely the citizens to get their issues/requests solved.

# CHAPTER 1

# INTRODUCTION

The primary objectives and goals of this project are mentioned here. Following aims and objectives will be achieved after this project completion:

• Online water related complaint booking.

• Request for providing new connection, installing hand-pump etc.

• Customer login where user/citizen can login and view status of the complaint/request that has been made.

• Updates regarding newer schemes.

Previously a phone was used in offices, business/market areas and at houses by individuals to do different tasks. Its purpose was mainly for receiving and making calling. The concept of mobile for keeping contacts, displaying telephone numbers, SMS, shooting photos, making/capturing videos was far away from older devices. Then Motorola created a revolutionary device called using height of ~15 inches from now standard, crude apparatus.

In recent years towards end of 20th century, the idea of cell phone and real implementations of cellular services began to gain ground concerning criteria definition and establishing successful industrial solutions utilizing mobile devices. In this time period, the greatest use of mobiles was

chiefly for voice solutions. Services started growing as a method of conveying the changes on effective advancements or performance extensions.

From 21ˢᵗ century, mobiles became completely separate to there predecessors. Cell phone subscribers amount grew to a massive amount, standing at more than billion subscribers throughout the world. Aside from the generally fancy shared cellular devices features such as contact information, infrared, multimedia and also Bluetooth in mobiles began encouraging more smart software instigated by support suppliers needed to generate income and fulfill enormous desires of end users to use their solutions.

Mobile applications situations became so much. The subject of computiation in mobiles watched programming from complete versatility to finish network while progressing into intangible and wearable figuring to perfectly clear stable spilling to HD video into charge answers for area based answers for navigational answers for mass betting answers for spot and setting mindful to programming of any sort. Too less we can perform using static pc but much more using mobiles.

These days, versatile projects are in an extraordinary method for sense very together with all the right and astutely structured program powerful at destroying over their weight to fight with ordinary stationary PCs. Presently as more noteworthy number of programming projects will jump up wherever particularly made for cell phones. Programming can be

created with an immense exhibit of utilizations, procedure and utilizing the customary life cycle of programming improvement. The quantity of instruments that ensure an issue free, squeaky clean UI, lightning rate development interim, and most extreme interoperable applications item could essentially be depicted as stunning. The portable programming advancement field has partitioned into in any event two classes indigenous and cross stage improvement. In this report, the attention will be on investigating the stage free cell programming/application improvement territory of portable figuring and making a program for the equivalent.

## 1.1  OBJECTIVE

The best method for making an application will be to point local programming with local trusting, local objective and purposefully local advancements other than it runs speedier, better usefulness and is every now and again a relatively solid yet expensive master help.

A couple of the issues as per indigenous development would be wide scope of projects and cell phones in the commercial center which makes development of mobile application end up with noteworthy improvement structures and costly programming improvement plans.

The multiplatform programming with a way for composing the backend code deploying it anywhere. Presently, the market is full of high variety of cross-border Improvement Tools and frameworks. Below is the listing

of cross platform development programs. That demonstrates the rising need to find an approach to comprehend this development design.

**Table 1: Cross-platform mobile apps development tools**

| Adobe Air | BlackBerry | ReactJS | NS Basic |
|---|---|---|---|
| Marmalade | Bluepring | lwGame Engine | OpenPlug |
| alcheMo | BREW | Jmango | Particle SDK |
| AppFurnace | Canappi | July Systems | PhoneGap |
| Application Craft | CellSDK | Kony | Rhomobile |
| Appcelerator | Celsius | Lazarus | Ionic |
| Appception | CloudPact | Meme IDE | Total Cross |
| appMobi | CoStore | MobiFlex | Unity |
| Aqua | Corona SDK | React Native | WebORB IS |
| Apache Cordova | DragonRAD | Moscrif | Adobe Phonegap |
| BatteryTech | FeedHenry | MoSync | IBM worklight |
| Bedrock | GeneXus | NeoMAD | Fivespark |

# CHAPTER 2

# LITERATURE SURVEY

A careful review of research diaries, books, expositions, theory and different wellsprings of data on the issue to be explored is one of the significant strides in planning of any project work. Other than this likewise causes engineer to familiarize himself with current information in the field of region in which he is going to design and build up his project work. It encourages developer to maintain a distance from unfruitful and accidental duplication in the field of study/project.

**React Native: A framework for building native apps using React**

React Native helps create apps using JavaScript. It uses a comparative structure as React, allowing us to make a rich flexible UI using explanatory segments. The applications manufactured utilizing React Native aren't flexible web applications in light of the way that React Native uses a comparable crucial UI building obstructs as standard Android and iOS application. React Native manufactures application rapidly. Using hot reloading, new code compiles immediately and runs retaining application state.

**JavaScript in mobile applications: React native vs Ionic vs NativeScript vs Native Development**

This article by H. Brito, A. Gomes and Á. S. e. J. Bernardino published in 2018 states that the mobile applications advancement is made out of 3 groups: natives, hybrids and web. In this paper a correlation between the

native and hybrid applications based on JavaScript (React Native, NativeScript and Ionic) is done. This paper demonstrates that React Native shows the best outcomes in all the examined standards & as yet having advantages in the hybrid development in connection to native. This article demonstrates the best alternatives among the frameworks utilized, continually comparing with native development.

**React Native - Building Mobile Apps with JavaScript**

The book has been written by Vladimir Novick (2017). It's a manual for making truly native Android and iOS mobile applications utilizing ReactJS. Build cross OS best seller native applications in JavaScript with React-Native framework. This book helps to learn about applications, for example, Instagram, Twitter and so on. Helps get acquainted with different APIs present in React Native framework. Helps get acquainted with significant Android and iOS native APIs and access them utilizing React Native. Helps understand application release process to the App Store and Play Store in detail. The rise of React Native has made creating mobile apps in JavaScript simpler for developers.

**Hybrid Mobile Application Based on Ionic Framework Technologies**

The article was written by Dunka, Bakwa, Emmanuel, Edim, Oyerinde & Yinka. The objectives of this research article were to analyze native, web and hybrid mobile approaches to apps development and also to demonstrate how hybrid mobile apps can be built using Ionic framework. The approach used in this research is the adoption of the Ionic framework as a modern and emerging approach to offer solutions to the cross

platform mobile app development problems. In my perspective, the solution offered in this paper is expected to be straightforward yet adaptable. The historical progression in development started with web design approach then native app approach followed by hybrid mobile app approach.

# CHAPTER 3

## MOBILE APP DEVELOPMENTS

To help drive portable applications ideas home, a rundown of key gadgets, versatile stages and general difficulties of portable applications advancement will be very valuable. This segment incorporates an exchange with that impact.

## BACKGROUND

# 3.1 MOBILE DEVICE EVOLUTION

The cellphone phone will be telephone equipment that is fit for connecting to a telephone framework foundation using radio frequencies rather than wired connection. In starting, cell gadgets were all around but restrictively expensive, vast in size, incredibly limited in computational apparatuses and furthermore with short battery lifetime.

A Motorola device of ~$4,000, around 30 minutes of conversation, around 15 inches tall figure, and almost a kilogram weight free of screen, but believed a cutting-edge tech in 1985. Evidently, that wasn't designed for pocket but to be utilized inside automobiles.

In any case, this spearheading gadget place an upheaval which will totally modify the cell phone circumstance in the awfully wasteful unbalanced thing to you should have mobile that gave individuals freedom, consistent nearness and capacity to take care of business the entry of an altogether new reality.

**Figure 1: Motorola DynaTAC 8000X**

Following the thousand years, versatile types of gear started to get more brilliant and more slender with sufficient screens, network decisions infrared and Bluetooth once in a while Wi-Fi, and furthermore most extreme number of extravagant highlights conceding them to be private gadgets being transported for around all day, every day. By and by, cell endorsers' sum is anticipated to remain at 5 billion worldwide alongside being in a situation to make being among the best 10 biggest developments in the media communications advertise.

## 3.1.1 MOBILE DEVICES

A cell phone is a fresh out of the plastic new type of convenient registering gadget with imaginative processing apparatuses and outfitted no sweat access to the web, run web programming and so on.

A cell phone packs a whole pontoon of highlights like a video and still camera, a morning timer, a watch and a betting focus trademark that are heading to elimination specialized contraption that used to lead these characteristics freely.

Regardless of their sleek design and undependable battery, cell phones have been reclassifying the PC business and have given some region of computing to some degree dull, yet-to-sparkle region of wearable processing to reduce or constrained them to realign and revise themselves making cell phones as their control focus.

Multicore handling of processes has been among well known example of processing for a critical couple of years on PCs that are inert, yet amid the ending of 2010, a few cell phone produces conveyed to the commercial center a very scaled down cell phone which brag dual-core chip ready, around 1GB memory and an abundant capacity up to 32GB, alongside the capacity to perform and catch HD Video, connecting to HD screens, which may make these gadgets promptly go as a veritable substitute for stationary framework parts for almost all clients - by far most reason being content preparing, surfing, gaming people.

Following the absolute first quad-core chip gadget by LG, Motorola came after additional with a fresh out of the box new cell phone which had 1GHz quad-core chip, HD in addition to a phone which will transform into completely working PC when appended to a bigger screen through a HDMI interface an extremely clear sign that versatile figuring is progressively taking a right hand turn into a predominant stage than cell phone since we comprehend it now.

**Figure 2: Various newer smartphones**

## 3.2 CHALLENGES OF OLD MOBILE APPLICATION DEVELOPMENT

Innately, mobile application/programming improvement accompanied its own one of kind difficulties which required a time of exertion to evacuate such innovative obstacles. The innovative leap forward from cell gadgets add to the multiplication of difficulties to reach adaptation gadgets with differing models, gadget limit and characteristics likewise there were, as are as yet three exemplary cell programming improvement challenges, that must be considered while imagining versatile projects either local or cross stage programming.

### PORTABILITY OF MOBILE DEVICE

At the point when an application is to hit with end clients onto a cell phone, the cell phones require being modest, and simple to oversee none on mind or transported clinched. Little and helpful gadgets touch base

with decreased power as a result of littler battery measurements, tightened screen and UI requiring elective info, for example, language acknowledgment, and littler stockpiling ability which could render the gadget pointless concerning business and friends data escalated programming or media material. Another fundamental issue to consider is threat to data in view of robbery, misfortune or harm to cell gadgets.

## MOBILITY CHALLENGES

As cell phones achieve full opportunity, accomplishing smooth network turns into a noteworthy issue. Cell phones require getting an association spot and setting association as they continue on an activity that could deplete the battery rapidly in addition to likewise an unpleasant component for ordinary association rendition. Address movement, place subordinate design like IP address, and bolster territory starts to hinder simple tasks of an associated mobile program.

## WIRELESS COMMUNICATIONS

More noteworthy transfer speed rendition from top to low data transfer capacity, defenselessness to security issues, signal defilement, demonstrate blocking structures, and regular landscapes and this prompts extra overhead in wireless systems. The challenges mentioned must be considered when creating mobile applications and there should be a strong software development procedure.

## 3.3 CELL PHONE PLATFORM

The meaning of cell framework is vastly improved characterized by the point of view of exemplary working frameworks. A working framework is the decreased degree focus programming including the uncovered equipment alongside the product application. Working frameworks offer equipment deliberation, driver and media plan, security structure, memory and procedure the executives offices for ideal use of equipment source.

Cell phone operating systems might be described as, "A mobile OS is the OS which controls a smartphone, tablet, computer, PDA and/or other wireless devices. Newer mobile OSs includes the characteristics of a computer operating system using touch screen, mobile, NFC, bluetooth, Wifi, GPS, camera, voice recorder, audio player, PDAs and other features".

# CHAPTER 4

# MULTI-PLATFORM APPLICATION DEVELOPMENT

## 4.1 MOBILE APPLICATION DEVELOPMENT

In case of mobile software development, various major tasks whether it is native or cross platform mobile app/software development are required. These tasks include:

## DEVELOP

In versatile programming advancement, among the central exercises is the improvement technique. The development procedure includes utilizing exhaustive information for the applications clients, the objective stage, the programming dialects and the instruments. Moreover, there are frameworks that may potentially be considered to oversee and design the strategy. MOWAHS structure is only one of these. MOWAHS structure helps in inspiring requirements for a phone stage, composes a game plan, how and if each task in a phone framework will be instituted. On the off chance that it concerns the creating instruments for cell applications, the alternative can be so differing and may require a cautious choice on prerequisite that a software engineer has an objective stage, an individual stage and innovations as a top priority. The improvement target could be local or cross stage. Versatile programming advancement can cling to a web rendering using HTML5, CSS, JavaScript.

## INTEGRATE

Integration point is where the versatile application can be made to work with business IT focuses, cloud foundation and local gadget limits. Incorporation can enable it to grow its functionalities with extra highlights that depend on an alternate framework. All these extra administrations might be in-application charging, investigation programs, analytic devices, internet based social storage.

## BUILD

Build is a job which involves program compiling, change, and streamlining of the program code to executable pairs or packages happen. Most extreme conceivable cross platform programming improvement for individual stages have been practiced inside this stage.

## DISTRIBUTION

App distribution involves addition of developed apps on stores such as Play Store or App store. It's the procedure of making it available for downloading or without charge for curious user.

## MANAGE

Services for management like remote establishment or expulsion, giving purchasers the correct variation of program for their mechanical assembly, drive informing, information stream the board, program execution data gathering is provided. Stage improvement apparatuses

which additionally offer administration focuses are ReactJS, Appcelerator Titanium, Angular JS, Ionic and so on.

There are two fundamental strategies for making applications in each advancement procedure various systems are used to locate the particular same impact in the event that one creates with a solitary methodology or another.

## 4.1.1 NATIVE APPS DEVELOPMENT

Native program development includes making applications explicitly made for particular equipment, chip and its very own arrangement of bearings. Different focal points of this sort of software development are predictable functionality, native interface, local API, rational library overhauls. Native development requires stage explicit SDK programming language and it includes some significant pitfalls of making various applications for various OS.

Native projects are executable parallel documents of a program which will be added to the cell phone with no requirement for extra reflection layering into the working framework. Notwithstanding how native programming improvement requires stage specific aptitude and experience, this methodology conveys an incredible encounter to end client compared to other cellular application development procedures. Native programs will also be best dispersed through an app store.

# 4.1.2 CROSS PLATFORM APP DEVELOPMENT

Sun Microsystems endeavored to convey the idea of code once run wherever to acclaim during the 1990s. With various gadgets, for example, pagers, PDAs, set-to-boxes, DVD players coming to advertise from different producers, Sun Microsystems thought of a Java 2 Micro Edition.
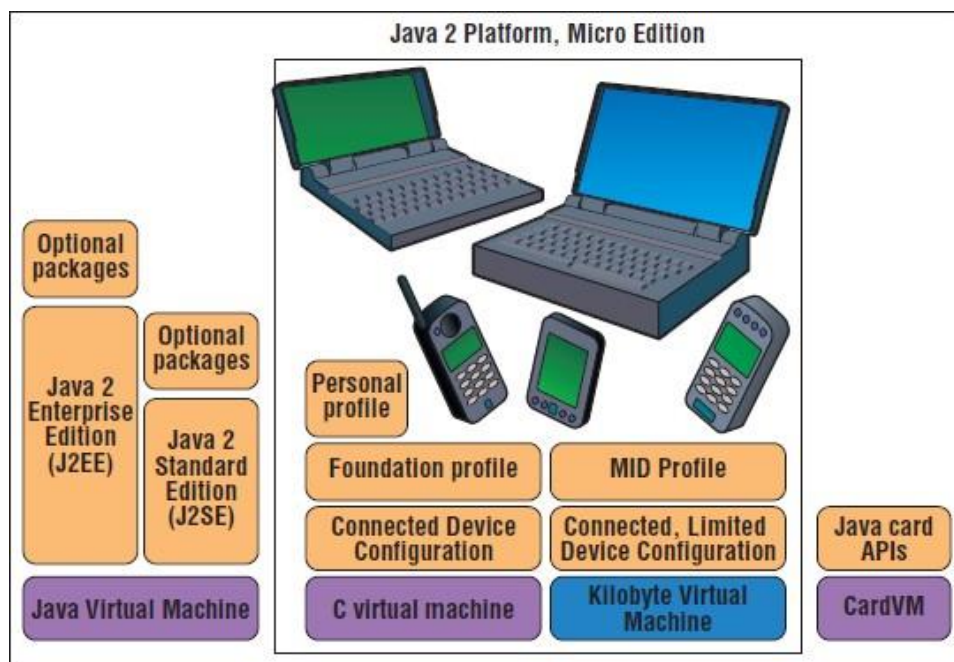


**Figure 3: J2ME**

The arrangement from Java ME was going to supply shared and basic stage layering surroundings on to that equipment producers and application engineers work on. Java ME ensured an institutionalized program advancement condition for all sort of cell phones at the time. In view of nonattendance of institutionalized execution of this thought, the idea itself transformed into an issue to applications designers and gadget producers. To achieve cross stage programming advancement, usage and particular were partitioned into various elements. Java ME endeavored to

empower different stage improvement using profiles and setups however that didn't do a lot to help developers from actualizing programming by utilizing different variations to satisfy JSR detail for various gadgets.

One factor that is basic to cell phones is that it knows JavaScript that is the thing that now most cross stage applications are outfitting to make cross platform running projects.

## 4.2 ADVANTAGES OF PLATFORM INDEPENDENT MOBILE APPLICATION DEVELOPMENT

Cross OS development guarantees lesser time and cost of development as it creates one code base to keep and compose this code for focusing on numerous devices & platforms.
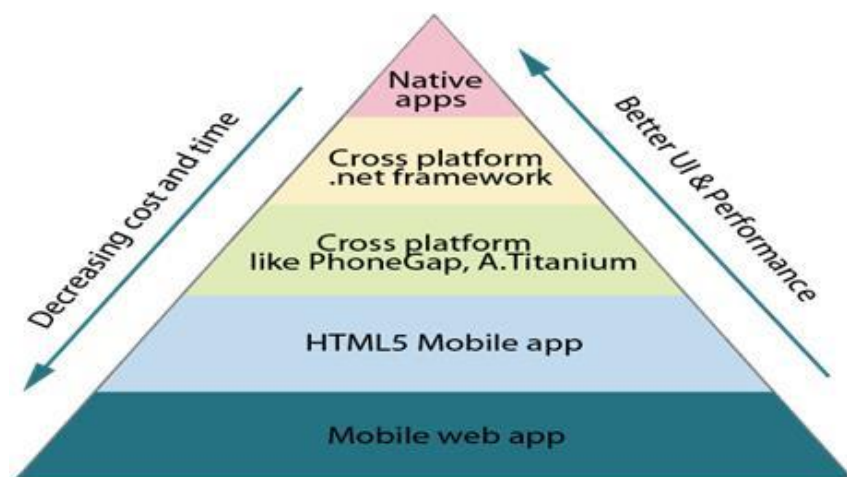


Cases that cross OS development may repress future advancement in the field since it may focus just to make it simple for designers than on development. Some critical advantages of OS independent development are:

(i)    Cross stage advancement is generally founded on using HTML5 innovation and software engineers in site improvement might be in a situation to use their ability.

(ii)    Learning web innovations might challenge that contemplating an all new stage.

(iii)    Devices come in a wide range of advancements and trademark that through cross stage improvement it might be conceivable to build up a program which functions admirably on everything about with fundamentally less exertion.

(iv)    Cross stage portable projects composed utilizing a solitary SDK, OS and improvement condition requiring less money related venture.

(v)    Cross stage programs attempt better to classify locally composed applications.

(vi)    It may benefit software engineers achieve mass contraption by means of their equipment.

## 4.3  MULTI-PLATFORM MOBILE APPLICATION DEVELOPMENT TOOLS

### 4.3.1 APPCELERATOR TITANIUM

Its development tool for developing app for Android/iOS or Windows. It professes to use open web measures, plan and pursues open source activities. As expressed by the Appcelerator Titanium's site, it supplies

cell OS APIs to make native, for example, programming. Utilizing the application, a developer might be equipped to create programming which will be kept running on tablet PCs, tablets & workstations.
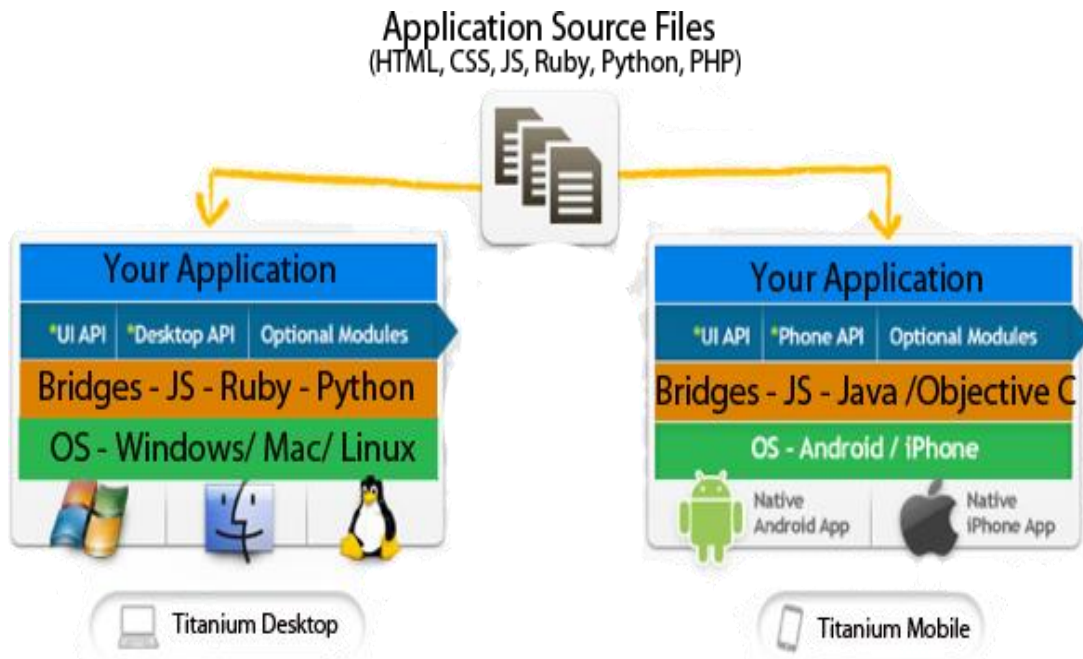


**Figure 5: Architecture**

This SDK is based on HTML, JS and CSS to permit the growth of platform independent mobile programs. More than 1.5 million software engineers are using it globally, more than 25000 projects are created with it.

It is a program with possesses IDE that is utilized to form and test programming together with an emulator. It supports media, telling & different other local cell phone highlights. It permits coders to make native & tablet PC applications utilizing web techniques.

Streaming a sound clip may require up to 100 lines of code of Objective-C or Java, while in this, software engineer can just keep in touch with one

line of JS code to start clip streaming. It incorporates two components in its frame. The previous oversees mappings to local UI from cross-stage codes while the ensuing adapts utilizing mappings to local characteristics for the phone like database & its framework.

## 4.3.2 PHONE GAP

PhoneGap is a tool used to develop platform independent apps. It uses HTML5/JS and CSS3, .NET innovations to create stage autonomous portable applications that misuse local characteristics of a cell phone.

PhoneGap underpins the best number of projects for various OS. PhoneGap created programs are projects which are neither pure web programs nor local programs. Using it, an individual can make a abstraction based cross OS applications by utilizing internet.

PhoneGap uses jQuery library at its own improvement stage and made it much simpler to develop jQuery Base portable projects to local property acquiring programming. It includes camera, compass, camera, document, telling and capacity.

## 4.3.3 XAMARIN

Xamarin is a business stage autonomous programming improvement apparatus. Xamarin empowers to deliver programs for Android/iOS by using .NET structure and C# programming language. Versatile programming improvement using Xamarin is guaranteed to bring the upside of sharing codes including programs, utilizing present .NET understanding, simple availability to local APIs, the amenities of well off

IDE Visual Studio in case of Android and developing programming utilizing specifically programming together with refuse gathering highlight of .NET system. Xamarin IDE works as MonoDevelop for android and as a Visual Studio module part for windows and Mac OSX and as Monotouch for Mac OSX only.

Xamarin pursues a local setting cross stage program. The codes made for the two iOS and Android are mapped straightforwardly to local codes. Xamarin states to have 1:1 mapping for 4000 C# and 1700 C# courses for the two Android and iOS separately.
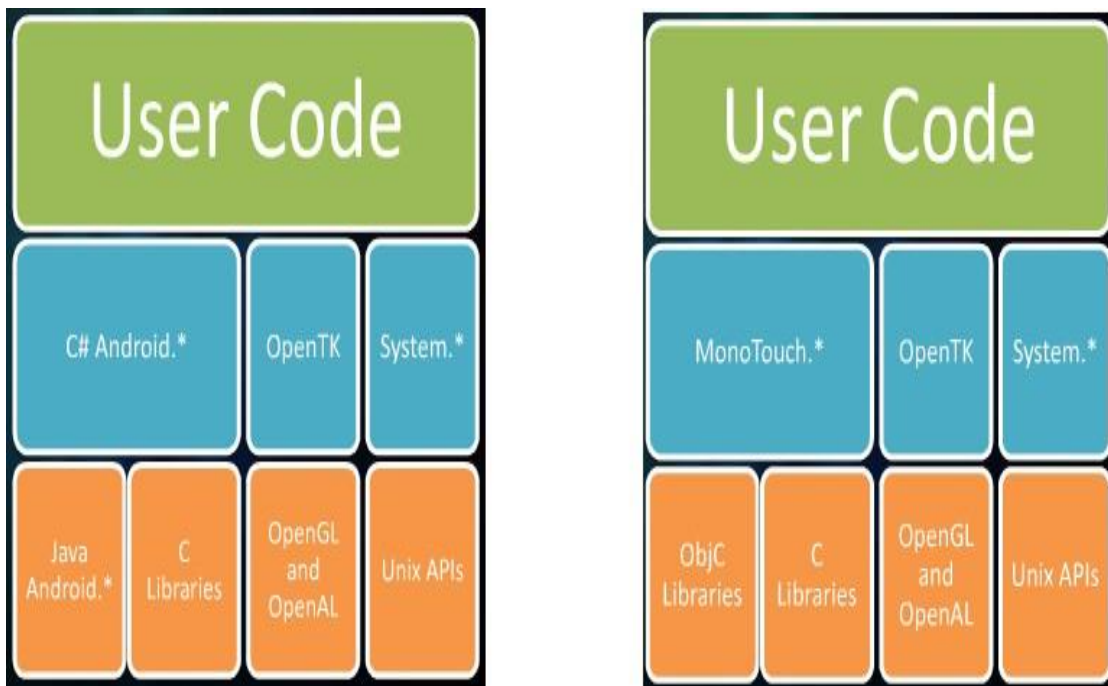


**Figure 6: Xamarin architecture for iOS (left) and Android (right)**

## 4.3.4 IBM WORKLIGHT

It is an exclusive stage free versatile programming advancement instrument. It's utilized to create portable web applications or reflection based versatile projects utilizing HTML5/JS and CSS3. Much like

Rhomobile, the most significant focal point of Worklight is business programming with backend frameworks, for example, databases and servers. Worklight SDK incorporates four components including its studio, gadget runtime, server alongside a comfort.

Its Studio is an IDE that is incorporates offices to concocted Worklight standard local or web programming and contains outsider and backend availability focuses. Worklight uses PhoneGap components to wrap its JavaScript code to get local gadget getting to limits. Worklight programs, as a rule focusing on business clients and developers, aren't imprinted on application stores rather they're imprinted in an inside host or individual application has. The gadget runtime part gives server coordination system, secure host availability, confirmation, remote incapacitate, telling and cross stage similarity while Worklight Server offers quick access to backend value-based information openness and Worklight Console handles programming variation the board, examination, and managerial dashboards. Worklight alongside PhoneGap's JavaScript-to-local contraption API translator gives enterprise software development platform.
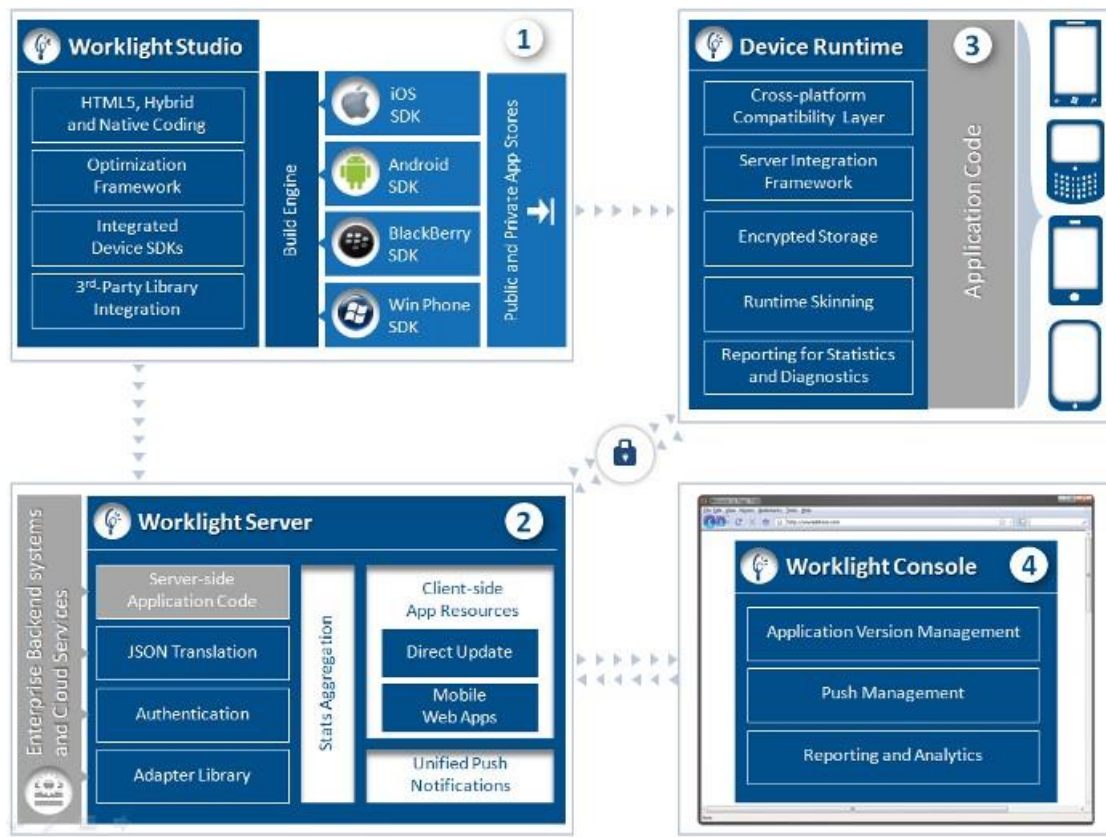
**Figure 7: Worklight Architecture**

## 4.3.5 ADOBE AIR

It is a runtime-based stage autonomous programming tool. It uses various web techniques for development of applications that work on platforms & devices.

Adobe Air is a restrictive instrument and it utilizes deliberation set up cross stage advances. Viewed as sent on in excess of a billion mechanical assembly, which comes as moment after JME. Adobe Air is known for its advances to make inventive and expand Looking UIs and for projects that need bottomless sight and sound amusements and Mobile projects. Adobe Air joins various advancements inside it, most Especially Adobe Flex and ActionScript to program applications.

Adobe Air consults with the stage explicit Adobe Air runtimes to get the local APIs of their phones. All through its runtime, Adobe Air gets to the network, database and different APIs.

## 4.3.6 IONIC FRAMEWORK

It is a development framework aimed at constructing hybrid apps. Hybrid programs are basically tiny sites running in a browser shell within a program to which have access to the native system layer. Hybrid programs have many advantages over pure native programs, especially concerning platform support, rate of growth, and access to 3rd party code.

Consider Ionic as the frontend UI framework that manages all of the feel and look and UI interactions that the program needs to be compelling. Kind of like, "Bootstrap for Native", but with assistance for a wide assortment of common native cellular elements, slick animations, and gorgeous design.

Ionic framework includes quite native-styled interface components and designs that we would get using an native SDK on Android/iOS but did not actually exist before on the internet. Ionic also provides some effective methods to develop apps that eclipse existing present HTML5 development frameworks. As Ionic is a HTML5 framework, it requires a wrapper such as PhoneGap/Cordova to operate as a native program.

## 4.3.7 REACT NATIVE

It uses an architecture of Flux to deal with the data flow inside the program. It is an option to traditional MVC model, throughout evolution of React. Also, this architecture makes it simpler to find any mistakes as there is one direction flow.
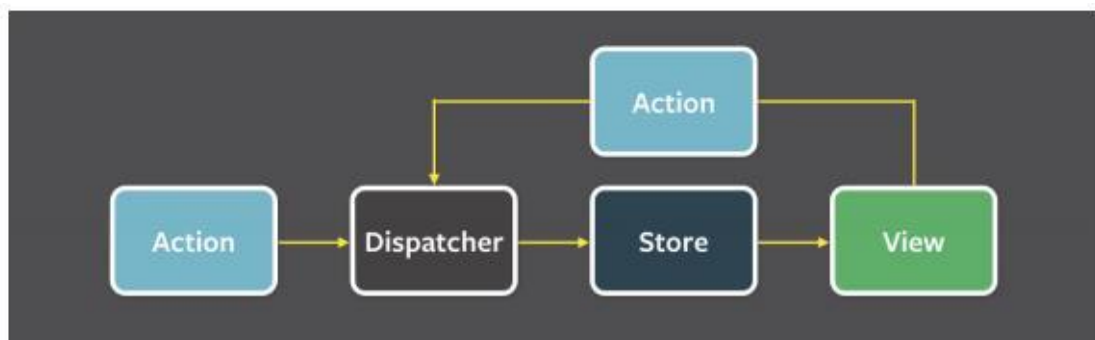


The Flux information stream decreases the multifaceted nature of the MVC information stream by not using two-way ties and requiring the majority of the exercises to be passed into the unified dispatcher. Transition averts falling overhauls that often occur in the MVC model. Motion shares similitudes utilizing down to earth near programming and stream based programming. The main dispatcher handles the majority of the changes to the different stores, inside the information layer of this program. No extra exercises are activated until the store has finished refreshing with the data esteems. The perspective on the program is re-rendered dependent on the progressions made.

## Why built app using React Native framework?

The app was created using React Native due to the thought that Node.js would rule mobile with time, just as it's on the PCs web softwares. After

desktop computers became strong enough and browser technologies had progressed enough, nearly everyone was spending their calculating time in browser and programmers were building web applications. With recent improvements in cellular technologies, many of the exact same web software are running on tablets and smartphones, more of the platforms are being used with Node.js in backend.

As its an open-source versatile application structure used to create applications for Android, iOS & Windows telephone by empowering designers to utilize React alongside native stage abilities as opposed to cell destinations, so we used it since we believed there were excellent tools for cellular site development.

And most importantly, we believed there were multiple frameworks which were technically open source, but weren't open source in spirit or were impossible to utilize in the closed source and open source projects without purchasing a paid license for it.

## 4.4 COMPARISON OF FRAMEWORKS

Platform independent mobile programs come in numerous forms. Each tool may approach platform independent mobile software/app development in lots of methods. Some come as runtime usage or significantly interpreter abstraction layers and if there should arise an occurrence of permitting a couple is totally open source while others are business and exclusive. The level of native component backing of a cell phone changes comprehensively that much.

The native service tools give is more extensive notwithstanding a variety of different ones likewise outfit a confined help yet may likewise offer a distinctive element a particular engineer could be happy to use. For some engaged with stage autonomous portable programming advancement, picking one apparatus might be a precarious one. With every one of these alternatives, conditions and highlights to survey preceding settling on any decision, arrival one programming and moving cross stage may demonstrate to be a significant troublesome encounter. In the wake of having seen a few devices, picking one is substantially less straight forward..

## SUPPORT FOR DEVICE FEATURE SET

When an application is chosen, another assessment will be the measure of local property the instrument accommodates the period it supports and how great it underpins them. Thinking of some as particular element one instrument gives different people can't appreciate cloud information synchronizing, interpersonal interaction reconciliation.

## PROGRAMMING LANGUAGE THE TOOLS USES

Finding a more current coding language may procure a software engineer less profitable or might build time and exertion. Software engineers will likewise think about the advancement/coding language of the assets in their instruments seeing sessions. Somebody that has been in web advancement will discover it significantly simpler to hold onto tools, such as, PhoneGap while someone with C# development foundation may think that it's simpler to embrace tools like Flutter, Xamarin.

## 4.5 MULTI-PLATFORM SYSTEM ARCHITECTURE

Making an application that could keep running on different OS can be a precarious assignment mulling over the measure of innovative executions which incorporates each stage. But attempts are made to create platform independent running program a possibility.

## 4.5.1 MOBILE WEB APPS

All these are standard web programming particularly intended to target portable contraption. In any case, the program is created utilizing HTML, CSS, JavaScript and other similar innovation which are used to develop a site application for our work area perusing background. This kind of versatile program runs totally from the constrainments of their portable programs. It gets to no local qualities of the mobile phone. These sorts of use are gotten by entering the addresses of this site on the mobile phone programs address bar. They can keep running on each kind of gadget having a program.

## 4.5.2 ABSTRACTION BASED CROSS PLATFORM SYSTEM

The second type of building up a cross stage program is using a reflection model. These projects are composed to a great extent various web technologies having a design which abstracts stage or gadget form for uniform device highlight accessibility.

**Figure 9: Abstraction based cross platform overview**

The application code is changed to work inside the specific versatile stages WebView and even JS interpreter. In any case, what makes hybrid applications improvement unmistakable is there isn't any need to start a program to utilize the projects, there'll be a symbol that will start up the projects, and above all else of the shot of access to local highlights of their phone through APIs of the specific stage using JS.

Despite the fact that these types of projects offer access to local attributes, complete API availability & snappier execution & couple of the latest UI advancements backing may not be guaranteed.

Abstraction variant based cross OS programs are frequently created with frameworks that help with creating applications utilizing phase autonomy objective like web techniques.

## 4.5.3 HIMIPH APPLICATION BACKEND

As previously mentioned, the purpose is to produce an application having great functionality along with cross platform service, thus here we've

attempted to create a cross platform water complaint redressal system application with an Apache Cordova powered frame named Ionic.

From the backend, for admin, there's an admin panel dash from where admin can handle users/engineer, insert them and update their details/password etc. Additionally, for keeping details of users/engineers, complaints/requests details, MySQL database was used. The status updates may also be observed in form of program notifications (Its development is currently in progress).

In case of frontend, both the engineers and users/citizens can use just through HimIPH program. The users/citizens can enroll using program, then login and enroll complaint/demand, assess status. The complaint registered is delegated to some junior engineer if he can solve, he enters marks and description the enrolled complaint/request as fixed or forwards it to his senior and same measures might be obtained in his/her case too. Additionally, the user may upload picture linked to the criticism that is registered.

**The Use Case Diagram of React Native app and Backend panel:**

In mobile app, any Administrator/Engineer or Citizen can login and create a new ticket/complaint. They can also check the replies and steps that have been taken to resolve their issues. Users are allowed to register only from backend for security. Engineers can also manage users who have registered their accounts and also check complaints' report having information regarding the number of complaints, still unassigned or open.
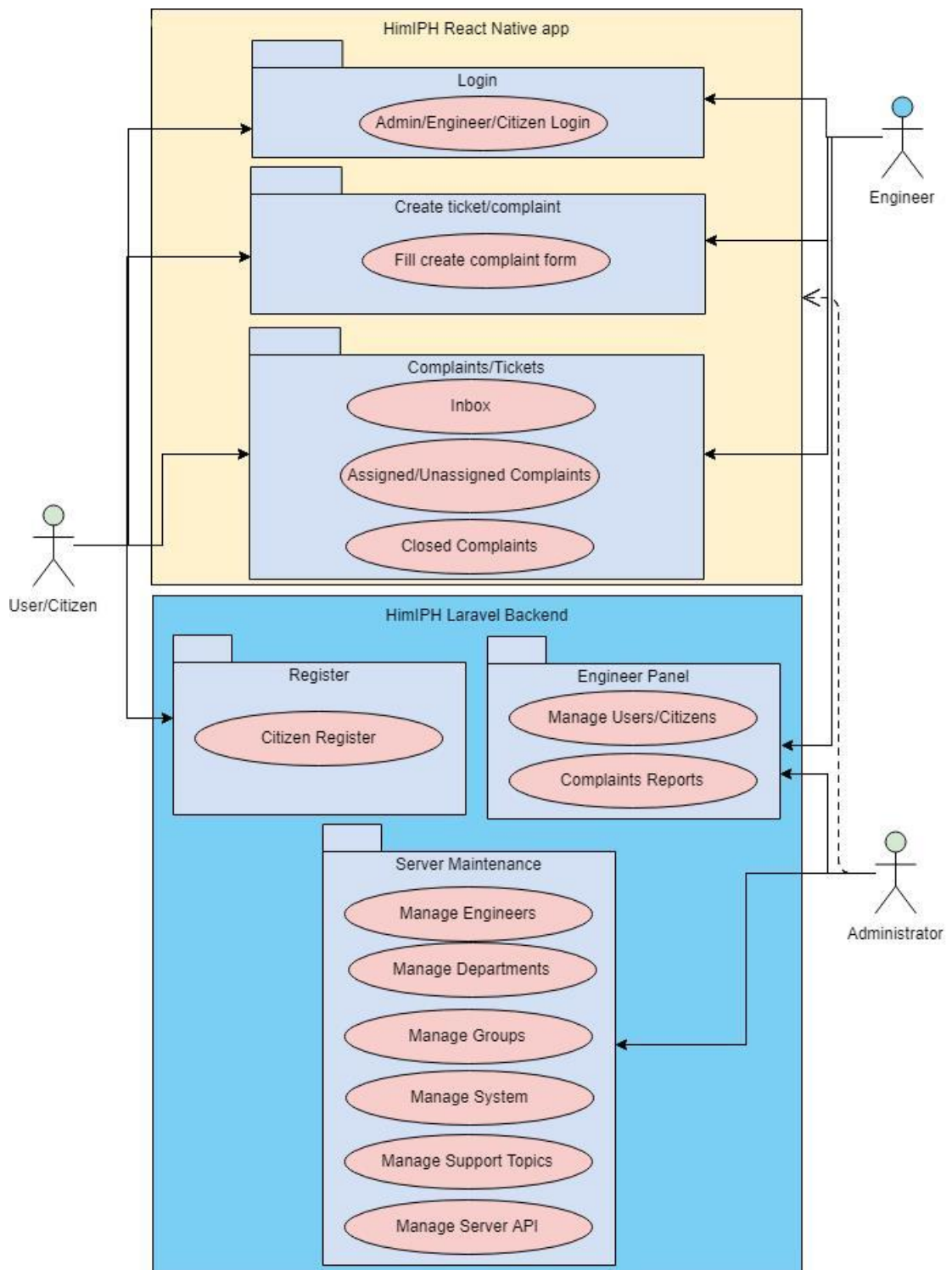
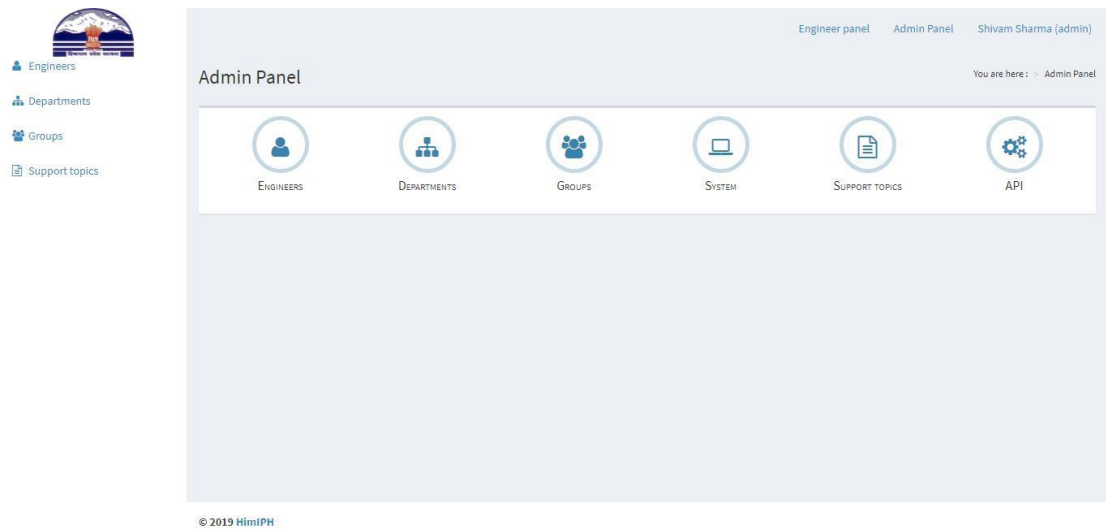Here are the some of the screenshots of the panel/dashboard of admin:



**Figure 11: Admin Panel Dashboard**

Administrator can perform server maintenance tasks using the options present on admin panel dashboard.
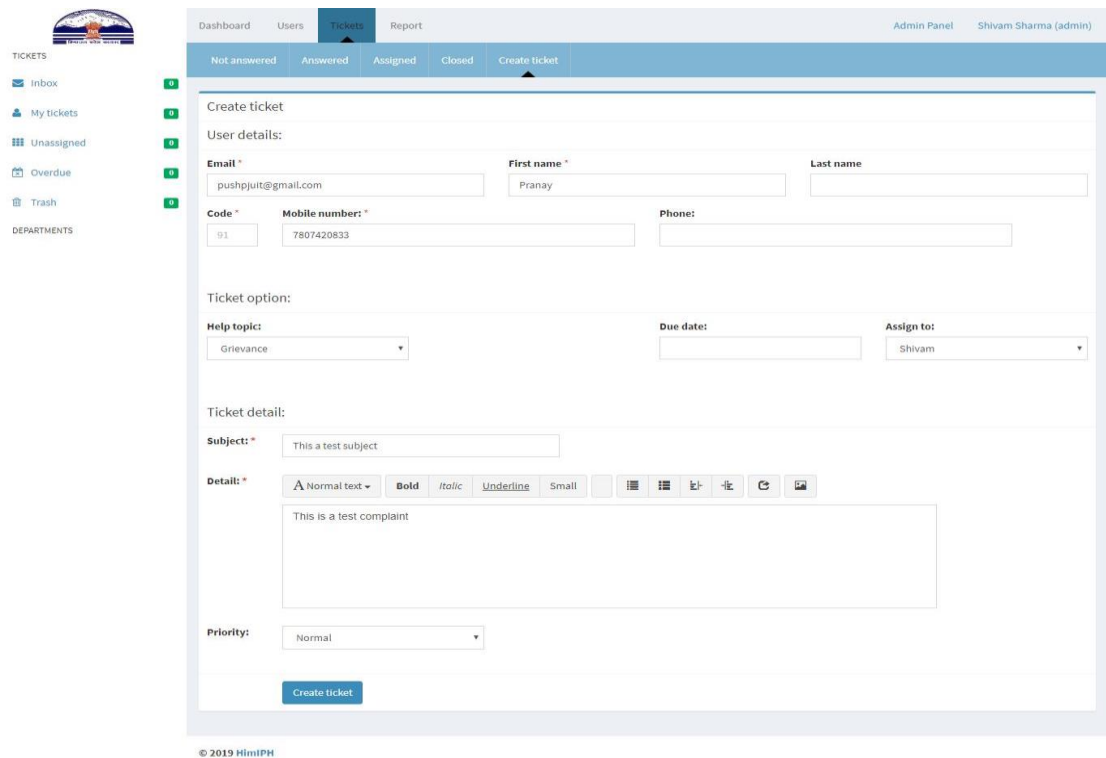


**Figure 12: Create Ticket**
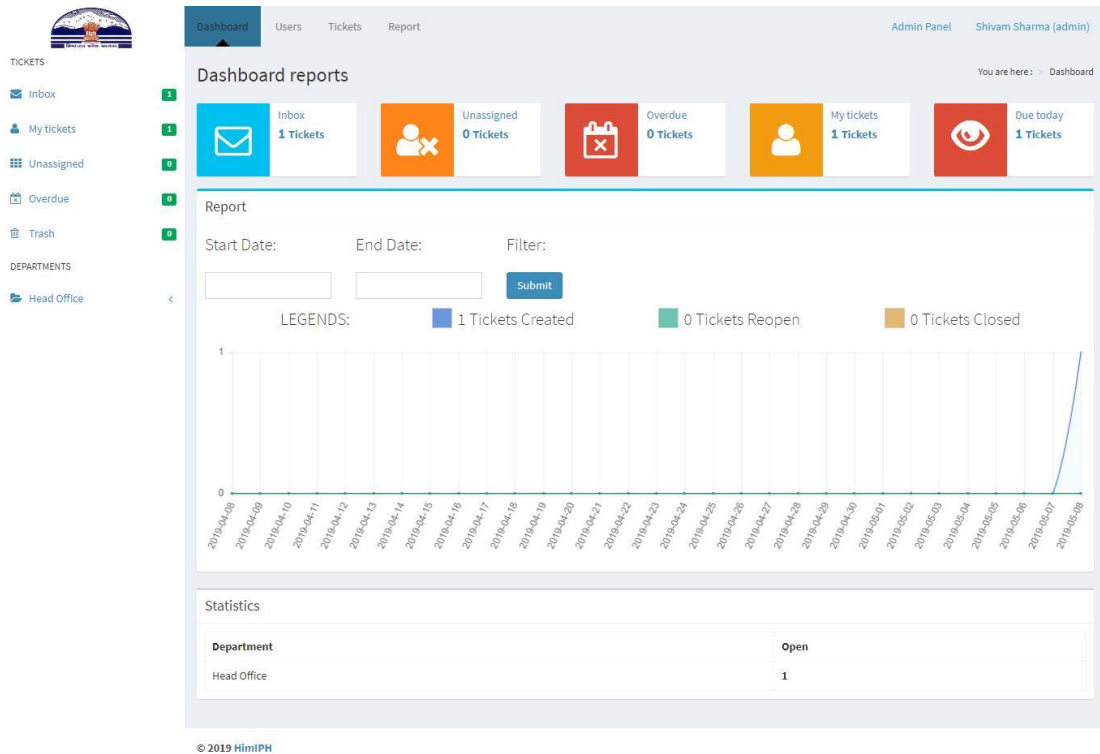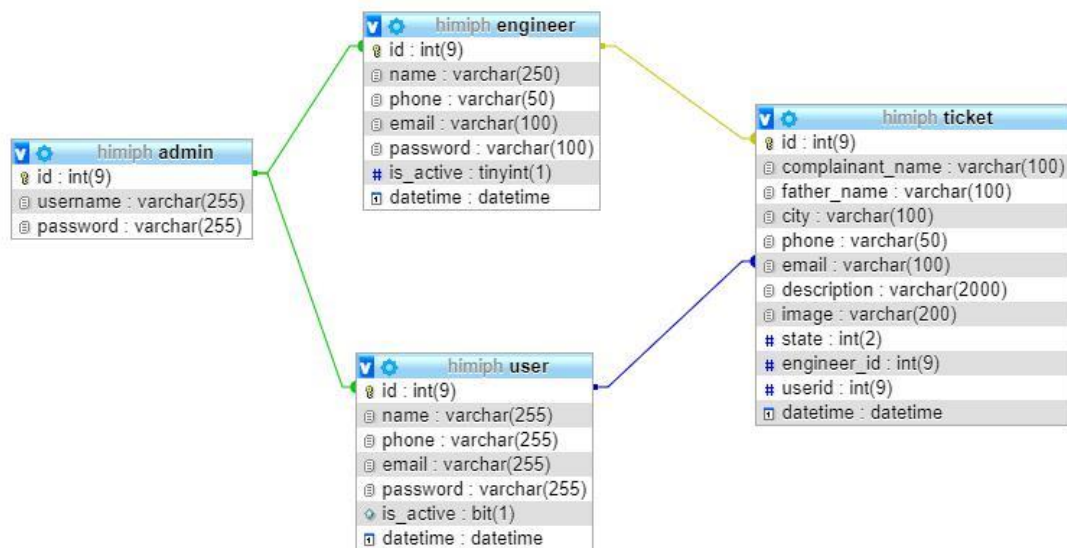
**Figure 13: Engineers**



**Figure 14: Users**

**Figure 15: Assign Ticket**

## 4.5.4 DATABASE OF HIMIPH BACKEND AND RELATIONSHIP BETWEEN TABLES

Relation between tables of database:

Tables in HimIPH database:

- tblticket

| Name | Type | Collation | Attributes | Null | Default | Comments | Extra | Action |
|---|---|---|---|---|---|---|---|---|
| id | int(10) | | UNSIGNED | No | None | | AUTO_INCREMENT | Change ⊖ Drop ▼ More |
| ticket_number | varchar(255) | utf8_unicode_ci | | No | None | | | Change ⊖ Drop ▼ More |
| user_id | int(10) | | UNSIGNED | Yes | NULL | | | Change ⊖ Drop ▼ More |
| dept_id | int(10) | | UNSIGNED | Yes | NULL | | | Change ⊖ Drop ▼ More |
| team_id | int(10) | | UNSIGNED | Yes | NULL | | | Change ⊖ Drop ▼ More |
| priority_id | int(10) | | UNSIGNED | Yes | NULL | | | Change ⊖ Drop ▼ More |
| status | int(10) | | UNSIGNED | Yes | NULL | | | Change ⊖ Drop ▼ More |
| help_topic_id | int(10) | | UNSIGNED | Yes | NULL | | | Change ⊖ Drop ▼ More |
| closed | int(11) | | | No | None | | | Change ⊖ Drop ▼ More |
| assigned_to | int(10) | | UNSIGNED | Yes | NULL | | | Change ⊖ Drop ▼ More |
| last_message_at | datetime | | | Yes | NULL | | | Change ⊖ Drop ▼ More |
| last_response_at | datetime | | | Yes | NULL | | | Change ⊖ Drop ▼ More |
| created_at | timestamp | | | Yes | NULL | | | Change ⊖ Drop ▼ More |
| updated_at | timestamp | | | Yes | NULL | | | Change ⊖ Drop ▼ More |

- tbluser

| # | Name | Type | Collation | Attributes | Null | Default | Comments | Extra | Action |
|---|---|---|---|---|---|---|---|---|---|
| 1 | id | int(9) | | | No | None | | AUTO_INCREMENT | Change ⊖ Drop ▼ More |
| 2 | name | varchar(255) | latin1_swedish_ci | | No | None | | | Change ⊖ Drop ▼ More |
| 3 | phone | varchar(255) | latin1_swedish_ci | | No | None | | | Change ⊖ Drop ▼ More |
| 4 | email | varchar(255) | latin1_swedish_ci | | No | None | | | Change ⊖ Drop ▼ More |
| 5 | password | varchar(255) | latin1_swedish_ci | | No | None | | | Change ⊖ Drop ▼ More |
| 6 | is_active | bit(1) | | | No | None | | | Change ⊖ Drop ▼ More |
| 7 | datetime | datetime | | | No | CURRENT_TIMESTAMP | | | Change ⊖ Drop ▼ More |

# 4.5.5 HIMIPH REACT NATIVE MOBILE APPLICATION

As the app is using React Native framework, so let's first take into consideration directory/folder structure of any new React Native app.

```
rn-app/
  README.md
  node_modules/
  package.json
  public/
     index.html
     favicon.ico
  src/
     App.css
     App.js
     App.test.js
     index.css
     index.js
     logo.svg
```

**Now here is the explanation of React Native folder structure:**

- src/index.js : It is the JavaScript entry point.

- public/index.html : It is a page template. Similar page templates can be created as per requirement.

- node_modules : This folder/directory is for build tools. It contains all the required and added node modules being used for the development of React Native app.

- package.json : This in the app root defines what libraries will be installed when "npm install" is run, into node_modules folder.

- src/App.js : App.js contains main cross OS code for React Native mobile application.

- src/App.test.js : App.test.js contains main cross OS code for test/debug for React Native mobile application.

- src : In src folder, there are many important folders such as api, assets, components, features, navigation, reducers and styles.

**The various core components of React Native app:**

1. **View :** In React Native, View is a built-in component. The view is like div, it is used in mobile apps. The view is a content area where the content is displayed. Using this, content can be arranged in a very good manner.

    **Usage of view:** When you need to wrap your content inside the container. When you need to use different style for different element. When you need a nested element. It supports for Synthetic touch events, which is used for different purpose.

2. **State :** There are two types of data which controls a component. They are state and props. The state is mutable. It means a state can change the value at any time. The variable data is stored in state. Initialize the state in a constructor and change the value by calling the function 'setState' when needed.

3. **props :** The second data type is props. It is immutable. It can be used to pass the data to the different components. It makes a connection between container component and presentation component. Container component is where all of the states and functionalities are handled, whereas presentation component is

where View present it is a passive area. Initialization of the state and update of the state are handled in container component. The result will be passed to the presentation component to display the view by using the props.

4. **Style :** The most important thing in web or mobile app is styling. It makes application attractive. We don't need any special language or syntax for styling. You can style your application by using the javascript object. All components accept the props style. We can pass the style by changing the CSS properties like 'backgroundcolor- backgroundColor'. We can also use inline style but it's not a good practice. The best way to create styleSheet object is by using Inline style or by using stylesheet.

5. **Flex layout :** Flex Layout is provided to give a clean layout to the component. Children of a component layout are specified using the Flexbox. Using the flexDirection, alignItems, and justifyContent properties we can archive the right layout.

- **flexDirection :** This property decides the main axis of the layout. Component's child elements should be organized generally horizontally or vertically.

- **justifyContent :** JustifyContent determines the distribution of children in primary axis.

  **Values:** (flex-start, center, flex-end, space-around)

- **alignItems :** alignItems regulates alignment of child elements in secondary axis.

   **Values :** (flex-start, center, flex-end, stretch) flex-start aligns at start, center aligns at center, flex-end aligns at end and stretch stretches to fill area.

6. **Handling text input :** The basic component TextInput is used to get text input from the user. It has props onChangeText, onSubmitEditing. onChangeText function is called whenever the text is changed. onSubmitEditing is invoked when the text is submitted.

7. **ScrollView :** ScrollView is used to render a large list or large content in view with a scrollbar. It helps to view the large content.

8. **ListView :** It is used to display the vertically scrolling list of changing data. It renders the dataSource array value to the view.

   - dataSource is a model to listView.

   - renderRow is used to fetch the data from dataSource and render it to the screen.

   - rowHasChanged it determines any change in row.

9. **Navigators :** Navigators are used change the scene in the app. Most of the apps are built with more than one scene. So, we navigate the user to multiple scenes. We do this by using navigators. React Native has several built-in components for

navigation. But Navigator is a basic built in javascript component. It supports both Android and iOS.

- **InitialRoute :** Specifies which component (or scene) should be displayed or rendered when the application is started.

10. **Networking :** Most of the apps need to fetch data from remote URL. You maybe want to make POST a request or simply fetch the data from another server. React provides fetch function to make an HTTP request to another server. Catch the error throw by fetch otherwise dropped by silently.

- fetch(URL) is used to fetch content from URL and then store response in a variable.

**In React Native, DOM is used and here is the difference:**

| Real DOM | Virtual DOM |
|---|---|
| 1. It updates slow. | 1. It updates faster. |
| 2. Can directly update HTML. | 2. Can't directly update HTML. |
| 3. Creates a new DOM if element updates. | 3. Updates the JSX if element updates. |
| 4. DOM manipulation is very expensive. | 4. DOM manipulation is very easy. |
| 5. Too much of memory wastage. | 5. No memory wastage. |

**The steps to create and run a new React Native app include:**

- Installation of required dependencies such as JDK, Node and Python using package manager such as Chocolatey.

- Installation of React Native CLI using npm or npx

- Create new react native app using command:

react-native init HimIPH

- Install Android Studio and/or Xcode and then run following commands:

cd HimIPH

react-native run-android

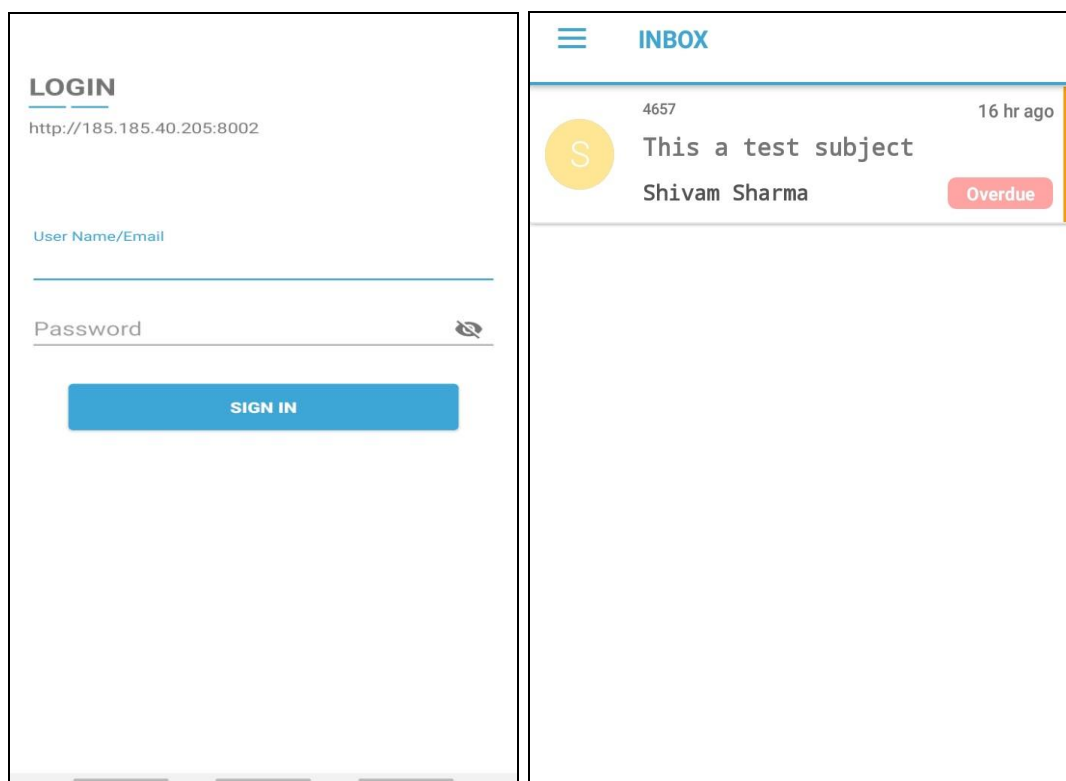Here are some screenshots of HimIPH react native app:



**Fig 20. Login and Inbox screen**

The user/engineer/adminstartor can login using username and password and then in Inbox screen, they can see any tickets/complaints and also replies for ticket. He/she can also reply using HimIPH app.
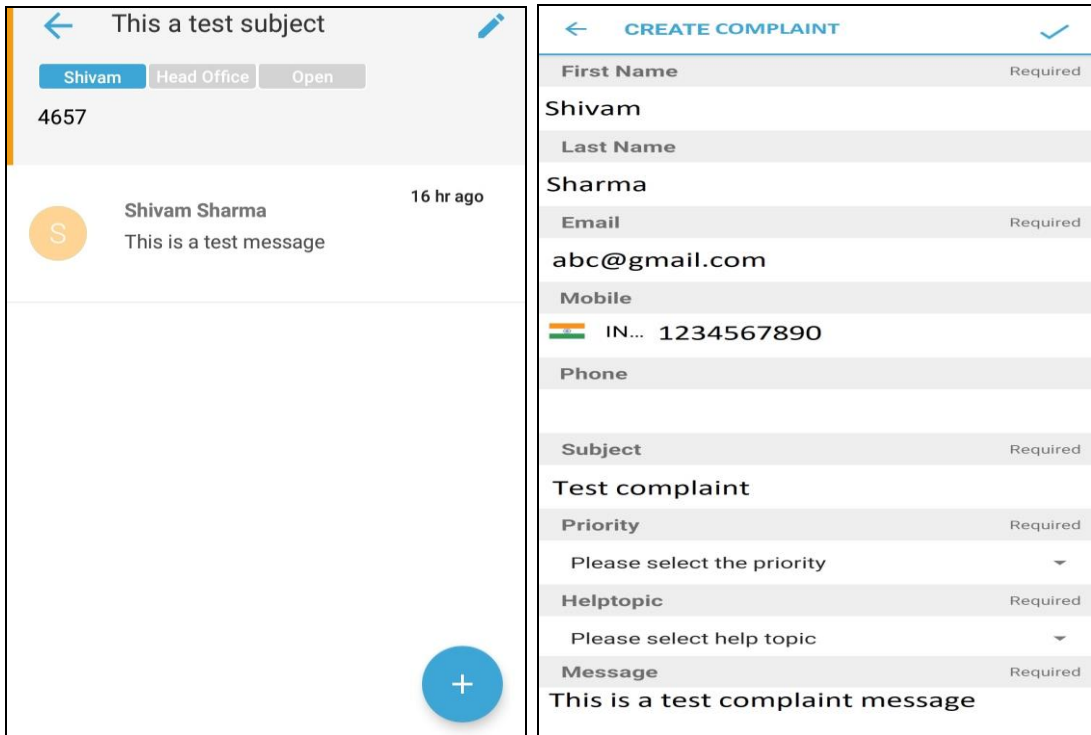
**Fig 21. Complaint body and Create New Complaint screen**

They can check complaints in Inbox and also create new complaints.
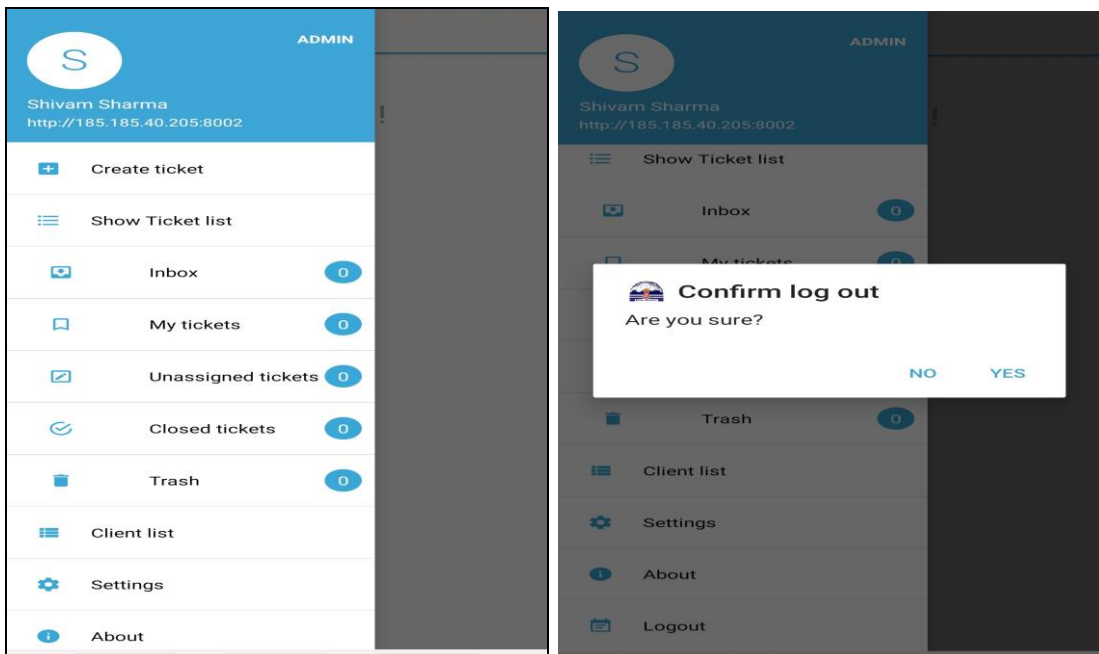


**Fig 22. Navigation and Logout screen**

In navigation menu, various options are available such as user list, create new ticket, tickets list, about and logout.

**Now here is the Entity Relationship diagram for HimIPH react native app:**
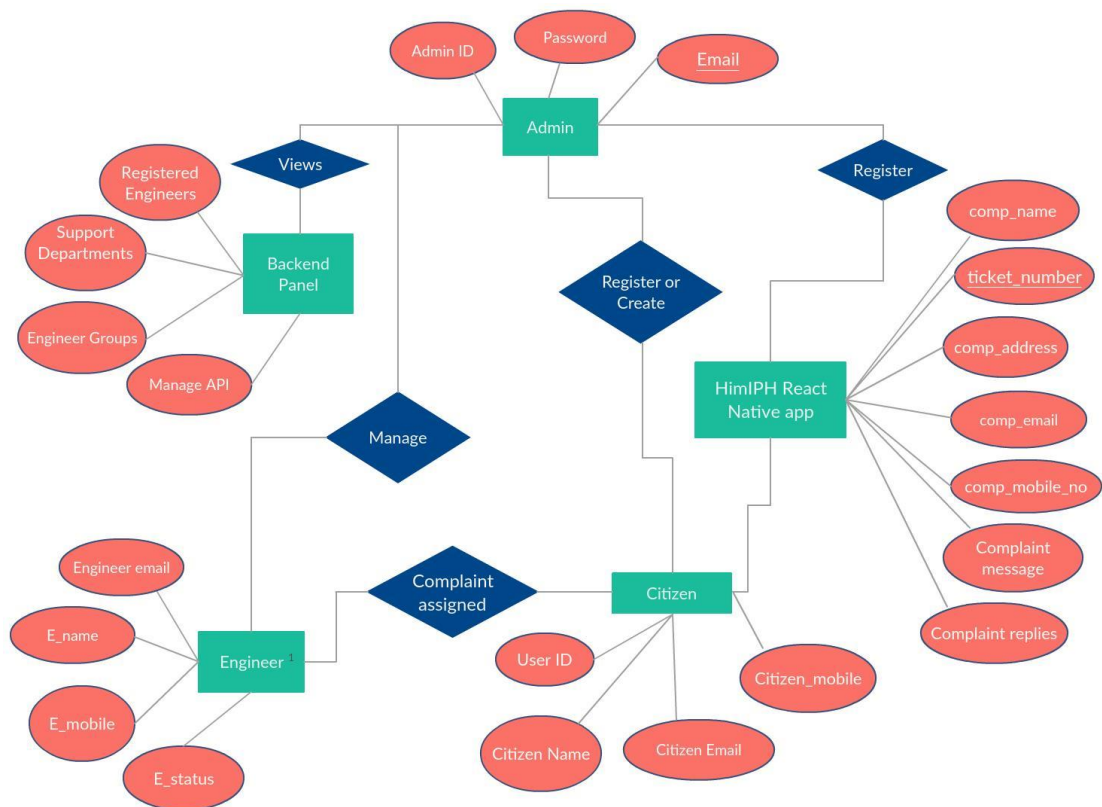


**Fig 23. ER Diagram for complete complaint management system app**

- The various attributes of Admin object/entity are: admin_id, admin_email, admin_password

- The various attributes of Engineer object/entity are: engineer_email, engineer_name, engineer_mobile, engineer_status, engineer_password

- The various attributes of Citizen object/entity are: user_id, citizen_email, citizen_name, citizen_mobile

- The various attributes of ticket object/entity are: ticket_id, comp_email, comp_name, comp_mobile, comp_address, comp_message

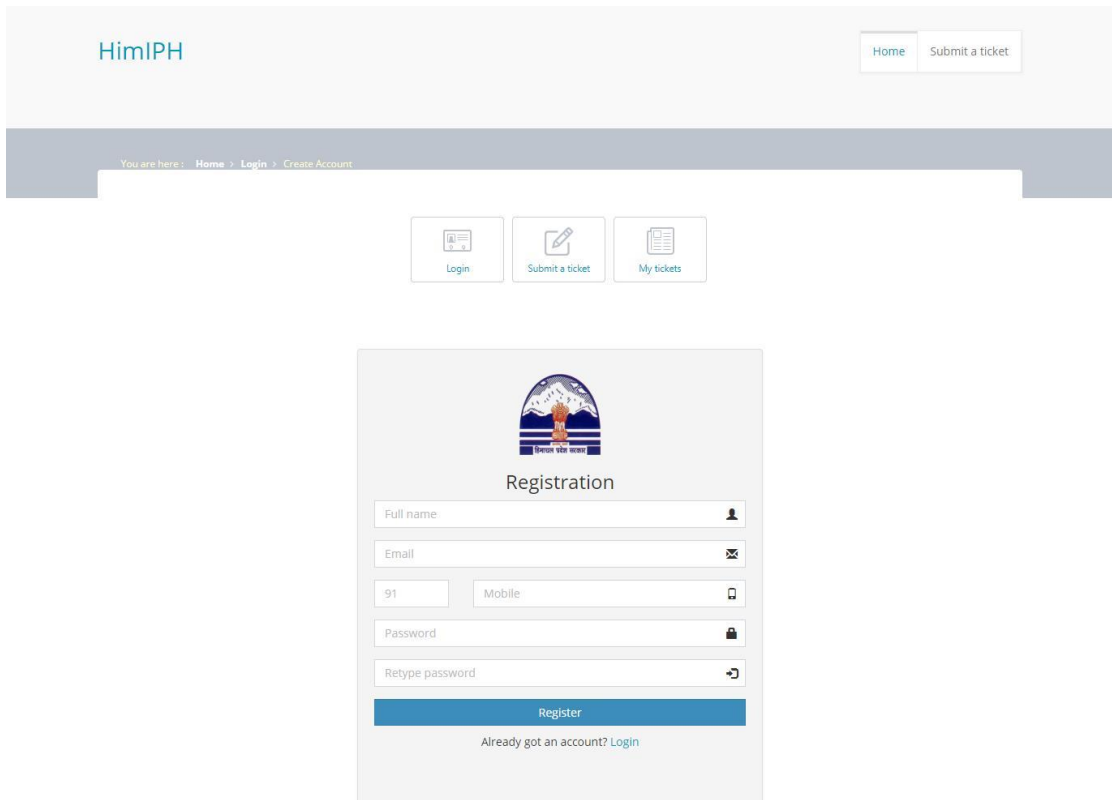**Now here is the Data Flow diagram for HimIPH react native app:**
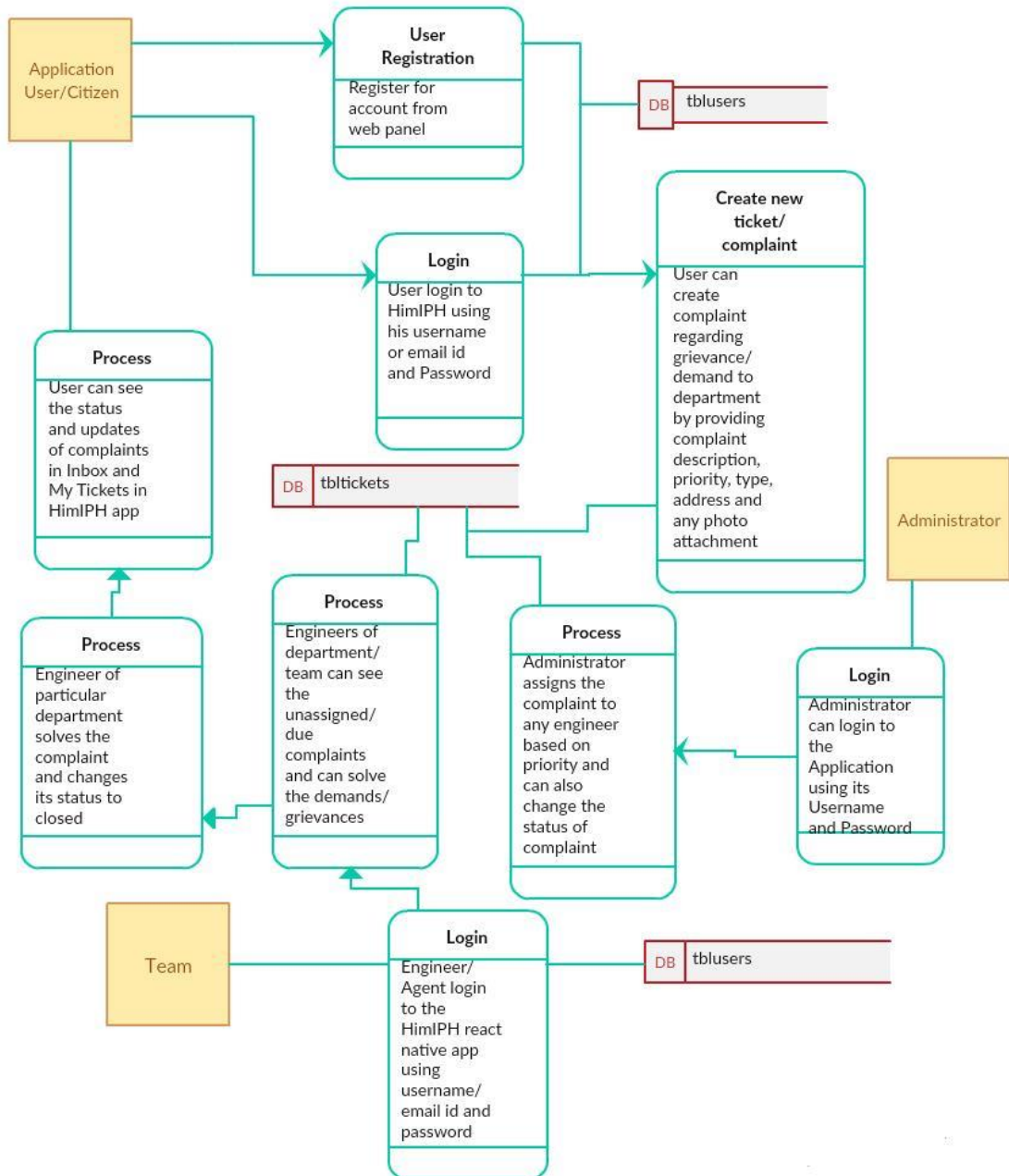


**Fig 24 Data Flow Diagram for complaint management system HimIPH app**

**Working of HimIPH app:**

The frontend or the React Native application is the platform from where the user/citizen can register complaints and check its status and replies. The backend is in Laravel (PHP framework). For security reasons, the user has to register account from web panel only.



Then a mail containing password is sent using SMTP. Then the user can login to mobile app using the username/email id and password.

After login, the user can see the complaints and any replies/actions taken in Inbox and/or My tickets screen. The user can also create complaint by pressing "Create New Complaint" option from navigation menu. Then he/she needs to fill details such as complainant name, complainant address, complainant mobile number, complaint type (Grievance/Demand), complaint priority, complaint subject and its description. Then after pressing "Submit" option, complaint is created and a four-digit random ticket number is generated for it.
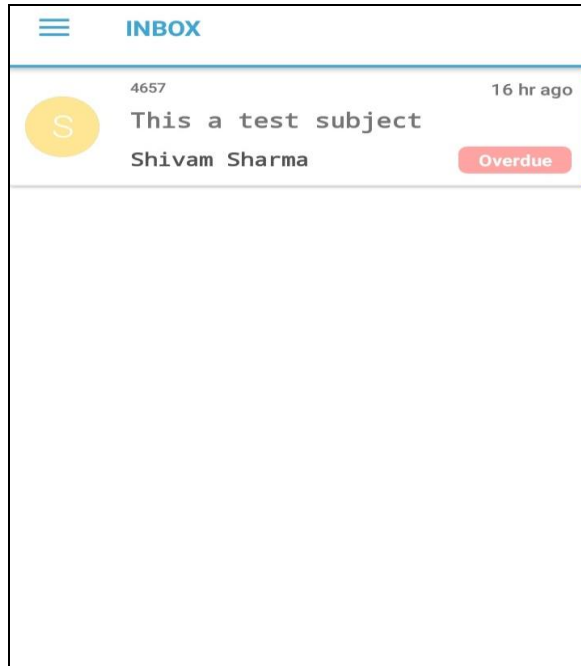
Then administrator/senior engineers can assign the ticket to other engineers based on the priority of complaint. The administrator/engineers can also login using HimIPH app and manage tickets/complaints from there. The administrator can also manage the users/citizen accounts, details and passwords.

# CHAPTER 5

# CONCLUSION & FUTURE SCOPE

To conclude, it can be said that the cross-platform development continually improving. The best suggestion for programmer is actually understand technical requirements and to maintain oneself up-to-date of those modifications in the tech and contemplating each instrument utilizing the instrument contrast. Within this water complaint redressal system react native app, later more features like client chat with engineers, SMS verification can be added.

# REFERENCES

- AllianceTek. Comparison chart for mobile applications development, 2011 http://www.alliancetek.com/downloads/article/comparison-chart-for-mobile- app.pdf, April 2012.

- Comparison: App inventor, droiddraw, rhomobile, phonegap, appcel- erator, webview, and aml http://www.amlcode.com/2010/07/16/comparison-appinventor-rhomobile-phonegap-appcelerator-webview-and-aml/, May 2012.

- eWeek. Xamarin delivers monotouch 5.2 for iphone and ipad application development http://www.eweek.com/c/a/Application-Development/Xamarin-Delivers-MonoTouch-52-for-iPhone-and-iPad-App-Development-366462/, April 2012.

- Forbes. Mobile web app vs. native app? it´s complicated http://www.forbes.com/sites/fredcavazza/2011/09/27/mobile-web-app-vs- native-app-its-complicated/, April 2012.

- J. Dixon J. Dehlinger.Mobile application software engineering:Challenges and research directions http://www.mobileseworkshop.org/papers/7- Dehlinger Dixon.pdf, April 2012.

- Richard L Kerns John E Andereson, Paul H Schwager. The drivers for acceptance of tablet pcs by faculty in a college of business. Journal of Information Systems Education, 17(4):429, Winter 2006.

- PhoneGap. How phonegap works http://phonegap.com/about, April 2012.

- refulz web developer´s blog.Build cross platform phone applications with phonegap http://php.refulz.com/build-cross-platform-phone-applications- with-phonegap-1/, April 2012.

- Adobe Systems. Adobe air 3 http://demand.assets.adobe.com/en/downloads/guides/6408.guide. Mobile April 2012.

- Technoholik. Titanium: an app making tool for web develop- ers http://technoholik.com/news/mobile/apps/titanium-an-app-making-tool- for-web-developers/80, April 2012.

- Appcelerator Titanium. Api documentation http://docs.appcelerator.com/titanium/2.0/index.html#/api, April2012.

- Dunka, Bakwa & Emmanuel, Edim & Oyerinde, Yinka. (2017). HYBRID MOBILE APPLICATION BASED ON IONIC FRAMEWORK TECHNOLOGIES. International Journal of Recent Advances in Multidisciplinary Research. 04. 3121-3130.

- "React Native · A framework for building native apps using React," React Native Blog ATOM. [Online]. Available: https://facebook.github.io/react-native/. [Accessed: 28-Apr-2019].

- H. Brito, A. Gomes and Á. S. e. J. Bernardino, "JavaScript in mobile applications: React native vs ionic vs NativeScript vs native development," 2018 13th Iberian Conference on Information Systems and Technologies (CISTI), Caceres, 2018, pp. 1-6.

- Vladimir Novick. 2017. React Native - Building Mobile Apps with Javascript. Packt Publishing.