



CHARMED CIRCLE

Get involved in local community

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MSc (IT & CA) - 3rd Sem

A Project Report on



DEVELOPED BY

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SUBMITTED TO

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AFFILIATED TO

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Rajkot.

PROJECT GUIDE

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I. Preface

- A community has been defined as a group of interacting people living in a common location. The word is often used to refer to a group that is organized around common values and is attributed with social cohesion within a shared geographical location.
- A sense of community refers to people's perception of interconnection and interdependence, shared responsibility, and common goals.
- Currently Internet has made the world smaller and we can interact with people that are far from us, different geography, different culture, different values, but many times, it is important to collaborate with people that are within our locality (city, village).
- This project is to encourage collaboration, better communication, problem solving and support from other members within the local community.
- This mobile application allows users to create new communities, join the local communities based on the GeoLocation.
- It also allows community members to collaborate by posting various feeds, asking questions and providing answers to other questions and chat facility that will help community members to discuss on some topic and get to a strong conclusion.

II. Acknowledgement

- Every work that completes successfully stands on the constant encouragement, goodwill and support of the people. Through this, I would like to express my gratitude to all those who have contributed to accomplish our project successfully.
- It is a pleasure to acknowledge my debt to all the people involved, directly or indirectly, in the development of this project, undertaken at Computer Science Department. This experience will definitely help us in our future endeavors of work.
- I would also like to thank Miss. Vaishali Vaghela and all other faculties of our department for being a constant source of inspiration right from seeking project to the successful completion of project and also guiding us throughout project.

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1. Project Profile

Project Name	Charmed Circle
Objective	Local Community
Front End	Ionic 5
Backend	Google Firebase
Database	Google Firestore
Editor	Microsoft Visual Studio Code
Documentation Tool	Microsoft Word 2007, Lucid Chart
Operating System	Windows 7
Supported Device	Mobile / Tablet with Android KitKat and above
Hardware Requirements	Good Internet connection, At least 2 GB RAM

1.1 Scope of project

- Charmed Circle is an Ionic based Hybrid mobile application in which a user can create local communities, join other communities and collaborate with other community members.
- A community member can post the feeds, ask questions and provide answers to other questions and can start and get into the discussion.

2. Programming Technologies

- In the development of Charmed-Circle Mobile Application, I have used Ionic framework with Angular and Google Firebase as the backend for authentication, database and storage.
- I have used Microsoft Visual Studio Code as a development tool and Google Chrome browser's Mobile Simulator for testing the application.
- Front-end Technologies:
 - Ionic
 - Angular
- Back-end Technology:
 - Google Firebase
- Database:
 - Google Firestore

2.1 Front-end Technologies

- The front-end is everything involved with what the user sees. That involves designing the User Interface and defining how the user will interact with various components that is User Experience.
- In this application everything that user will see and interact is built with Ionic and Angular, which are the frameworks developed in JavaScript language.

2.1.1 Angular

- Angular (commonly referred to as "Angular 2+" or "Angular v2 and above") is a TypeScript-based open-source web application framework led by the Angular Team at Google and by a community of individuals and corporations.
- Angular is a complete rewrite from the same team that built AngularJS (version 1.x of Angular was named AngularJS).
- Angular is a JavaScript framework which makes you able to create reactive Single Page Applications (SPAs).
- Angular is a cross platform language. It supports multiple platforms. We can build different types of apps by using Angular:
 - **Mobile applications:** we can build mobile apps by using Angular with strategies from Cordova, Ionic, or NativeScript.
 - **Progressive web application:** Progressive web applications are the most common apps which are built with Angular. Angular provides modern web platform capabilities to deliver high performance, offline, and zero-step installation apps.
 - **Desktop applications:** Angular facilitates to create desktop apps on different types of operating systems i.e. Windows, Mac or Linux by using the same Angular methods which are used for creating web and native apps with frameworks like Electron.

Features of Angular:

- The framework is built on the famous concept of *MVC (Model View Controller)*. This pattern is based on splitting the business logic layer, the data layer, and presentation layer into separate sections. The division into different sections is done so that each one could be managed more easily.
- We don't need to write special code to bind data to the HTML components. Angular provides *two-way data-binding*.
- When carrying out *DOM manipulation* a lot of JavaScript was required to be written to design any application. But with Angular, you will be amazed with the lesser amount of code we need to write for DOM manipulation.
- Right from the beginning, AngularJS became extremely popular among engineers. A *strong community* provided enough training materials, discussions, and third-party tools to embark on using AngularJS as well as find a solution to nearly every arising issue.
- In this Charmed Circle app Angular 8.1.2 is used with Ionic Angular is responsible for making all the communication to the server and handling the user interactions.

2.1.2 Ionic

- Ionic is a complete open-source SDK for *hybrid mobile app development* created by Max Lynch, Ben Sperry, and Adam Bradley of Drifty Co. in 2013.
- The original version was released in 2013 and built on top of AngularJS and Apache Cordova. However, The latest release was re-built as a set of Web Components, allowing the user to choose any user interface framework, such as Angular, React or Vue.js.
- Ionic provides tools and services for developing hybrid mobile, desktop, and Progressive Web Apps based on modern web development

technologies and practices, using Web technologies like HTML5, CSS, JavaScript, and Sass.

- Ionic uses *Cordova* and, more recently, Capacitor plugins to gain access to host operating systems features such as Camera, GPS, Flashlight, etc.
- Users can build their apps, and they can then be customized for Android, iOS, Windows, Desktop (with Electron framework), or modern browsers.

Features:

- With the *Ionic CLI tool*, we can quickly manage development tasks such as previewing the app in a browser, emulating the app, or deploying an app to a connected device. It helps with setting up and starting a project as well.
 - With Ionic, we can create the *look and feel* that's like the native apps, making it easier for the users to use the app.
 - The user interface *components* have been carefully designed to implement native style guidelines, but also allow for easy customization of any visual aspect of the app.
 - The *performance* with Ionic is comparable to a native app; the better the app performs, the happier app users will be.
 - The *Ionic community is very active* on the forums, with code contributions, and in sharing tips and tricks about the platform. The open source spirit is alive and well within the project.
-
- In this Charmed Circle app Ionic 5 is used with Angular base. All the components that are displayed to the user are Ionic components.

2.2 Back-end Technologies

- The back-end, or the "server-side", is basically how the site or application works, updates and changes. This refers to everything the user can't see in the browser, like databases and servers.

2.2.1 Google Firebase

- Firebase is a Backend-as-a-Service (BaaS) that is a next-generation app-development platform on Google Cloud Platform (GCP).
- Firebase is a mobile and web application development platform developed by Firebase, Inc. in 2011, then acquired by Google in 2014.
- Firebase frees developers to focus crafting fantastic user experiences. Means we don't need to manage servers, we don't need to write the APIs.
- Firebase provides developers a plethora of tools and services to help them develop high-quality apps, some of them are:
 - **Realtime database and Firestore:** a cloud-hosted NoSQL database that lets us store and sync between the users in real time.
 - **Authentication:** provides backend services, easy-to-use SDKs, and ready-made UI libraries to authenticate users to the app. This also allows using third-party single-sign on facilities like Google, Facebook, Twitter, etc.
 - **Cloud functions:** Cloud Functions for Firebase let us automatically run backend code in response to events triggered by Firebase features and HTTPS requests. The code is stored in Google's cloud and runs in a managed environment.
 - **Cloud Storage:** this is a powerful, simple, and cost-effective object storage service built for Google scale. We can use our SDKs to store images, audio, video, or other user-generated content.

- **Hosting:** Firebase Hosting provides fast and secure hosting for the web app, static and dynamic content, and microservices.
- etc.

2.2.2 Google Cloud Firestore

- Cloud Firestore is a flexible, scalable NoSQL database for mobile, web, and server development from Firebase and Google Cloud Platform.
- It keeps data in sync across client apps through real time listeners and offers offline support for mobile and web so we can build responsive apps that work regardless of network latency or Internet connectivity.
- Cloud Firestore also offers seamless integration with other Firebase and Google Cloud Platform products, including Cloud Functions.

Features:

- The Cloud Firestore data model supports flexible, *hierarchical data structures*. We can store data in documents, organized into collections. Documents can contain complex nested objects in addition to subcollections.
- We can also use queries to retrieve individual, specific documents or to retrieve all the documents in a collection that match the query parameters. It can also include chained filters and combine filtering and sorting.
- It uses data synchronization to update data on any connected device.
- It also caches data that app is actively using, so the app can write, read, listen to, and query data even if the device is offline. When the device comes back online, Cloud Firestore synchronizes any local changes back to Cloud Firestore.

3. System Analysis

- Analysis is an iterative activity. The process steps will likely be repeated several times, with consultation between customers, end users and developers during each iteration and communication through the steps.
- The true analysis part of requirement analysis locates places where requirements are unclear, incomplete or ambiguous. Requirements analysts work with customer representatives to resolve these issues, sometimes preparing tradeoff studies to compare alternatives.
- The purpose of the analysis activity is to transform candidate technical requirements into formal requirements by ensuring that they express the needs of the customer.

3.1 Study of the current system

- A typical local community consists of business operators, public agency staff and residents, and their interactions can include the sharing of resources, information and assistance, as well as the establishment of commercial relationships between community members.
- But there are always problems in establishing these communities, gathering all the interested people at one place and take decisions.
- And these locality related problems are sometimes related to the specific geographic location only therefore it might not be of any relevance to a person who is not in that locality. So it is good to find a person nearby with whom to discuss and get the guidance.
- These local communities can improve the social life of all the members and can also improve the quality of decisions.

3.2 Problem and weaknesses of the current system

- Creating a community of local people in a city or village is not always as easy, because it involves gathering of people of the same interest and agree on certain decisions.
- After establishment of the community, to share the thoughts, to ask questions or give answers they all to meet at a place, which is not always feasible to all the valued members.
- There are also problems in sharing thoughts and resources among the community members. They have to meet at a place to discuss something and reach a strong decision.
- So this process is slow and has many flaws in that, which makes it difficult for fast and easy reach to interested group.

3.3 Requirements of new system

- The work product of this phase is the SRS (System Requirement Specification) document, in which we mention all the requirements that must be fulfilled by the application going to be created.
- I developed this Hybrid mobile application to solve the above-mentioned problems. The concrete requirements of the application are as below:
 - Account management.
 - Users should be able to create new communities and join or leave communities based on locality (GeoLocation).
 - Users should be able to post the feeds in community and view the latest posts.
 - Ask questions and give answers to the questions of others.
 - Open a new discussion and chat with other members and close the discussion.

3.4 Information Sources

- Different strategies evolved by the analysts (i.e. developers) to gather information are:
 - Interacting with users of the current system.
 - Procedure manuals and available literature rulebooks, which specify how various activities, are carried out in the organization
 - Computer Software's of this type available in the market/from Internet
 - Various sources on the Internet

3.5 Feasibility Study

- Feasibility study is the likelihood the system will be useful to organization or general public. After studying the requirements, whether the proposed project is feasible or not, is determined by checking the various feasibilities.

3.5.1 Technical Feasibility

Technical feasibility corresponds to the determination of whether it is technically feasible to develop the software.

- Necessary technology exists to do what is suggested and required by the organization.
- The proposed equipment has the technical capacity to hold the data required to use the new system.
- The hardware needed to develop and implement the system is adequate.
- As this app is a Hybrid Mobile app development is possible with simple software (like VSCode, browser, emulator) and deployment is also simple using Firebase.

3.5.2 Operational Feasibility

Operational feasibility focuses on whether the system will work when it is deployed and installed. Operationally this system is feasible because:

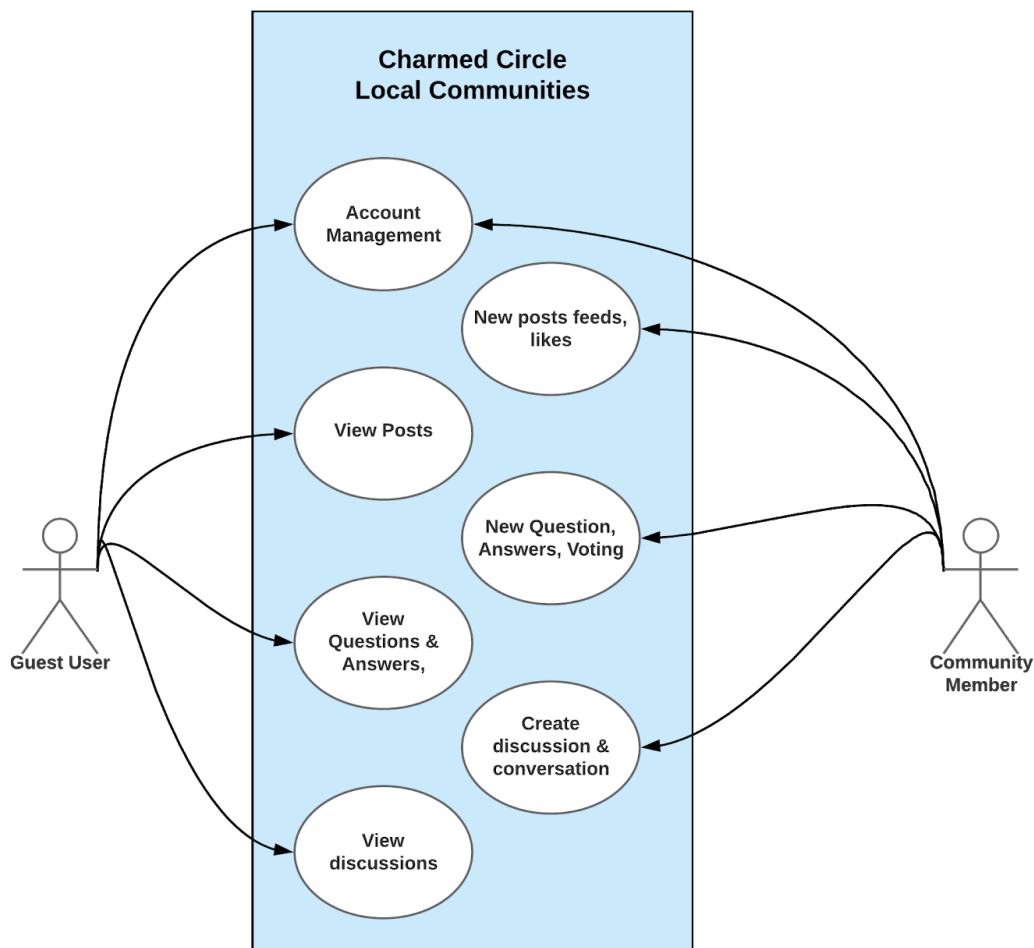
- The proposed system will not cost any harm to the existing system and its users.
- No special training required for the user as it has a self-explanatory interface.
- This application will give added benefits of better communication and collaboration so this will make the whole process easy, fast and involve more members in the process.
- The decision making process will be faster and community members can take much more strong decisions.

4. System Design

- System design is the process of defining the elements of a system such as the architecture, modules and components, the different interfaces of those components and the data that goes through that system.
- Systems design could be seen as the application of systems theory to product development.
- Nowadays Object-oriented analysis and design methods are becoming the most widely used methods for computer systems design. The UML has become the standard language in object-oriented analysis and design.

4.1 Use Case Diagram (UCD)

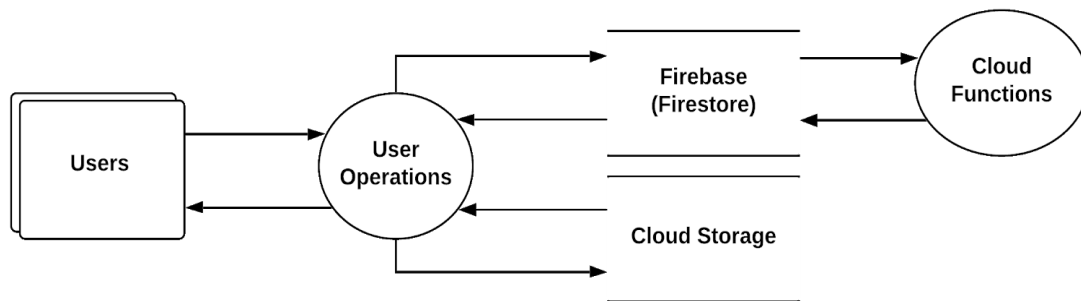
- A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved.



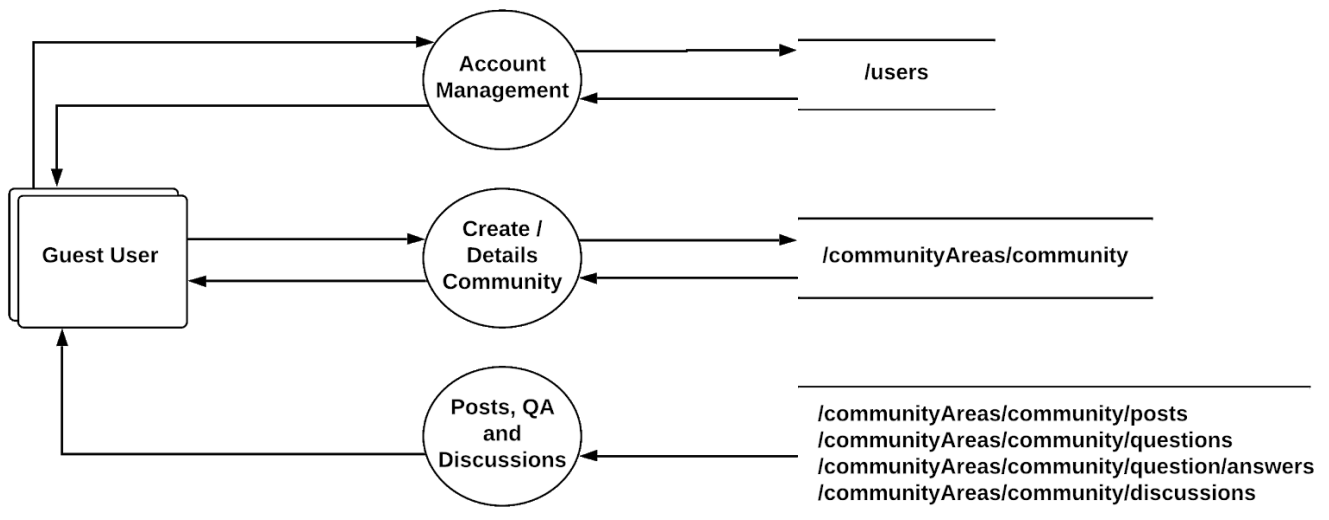
- In the above UCD, it is illustrated that the Guest User (not a community member) will be able to see the posts, QA and discussions but not be able to interact with that.
- On the other hand a community member will be able to send new posts, post questions, give answers and start discussion and do the conversation in that etc.

4.2 Data Flow Diagram

- A data flow diagram (DFD) maps out the flow of information for any process or system.
- A data flow diagram can dive into progressively more detail by using levels and layers, zeroing in on a particular piece. DFD levels are numbered 0, 1 or 2, and occasionally go to even Level 3 or beyond.

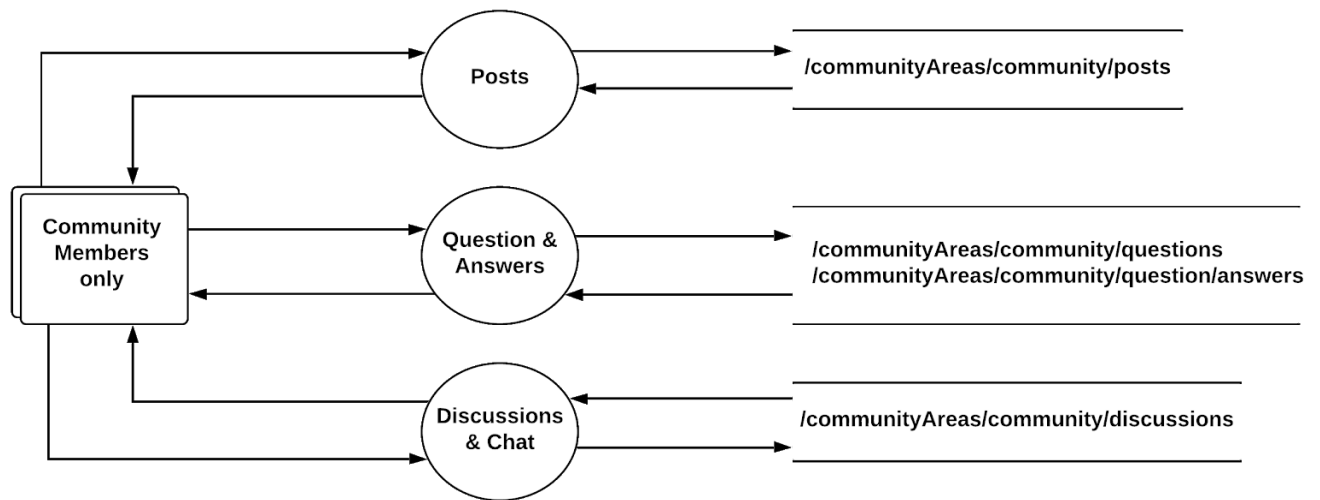


0-Level DFD



Guest User DFD

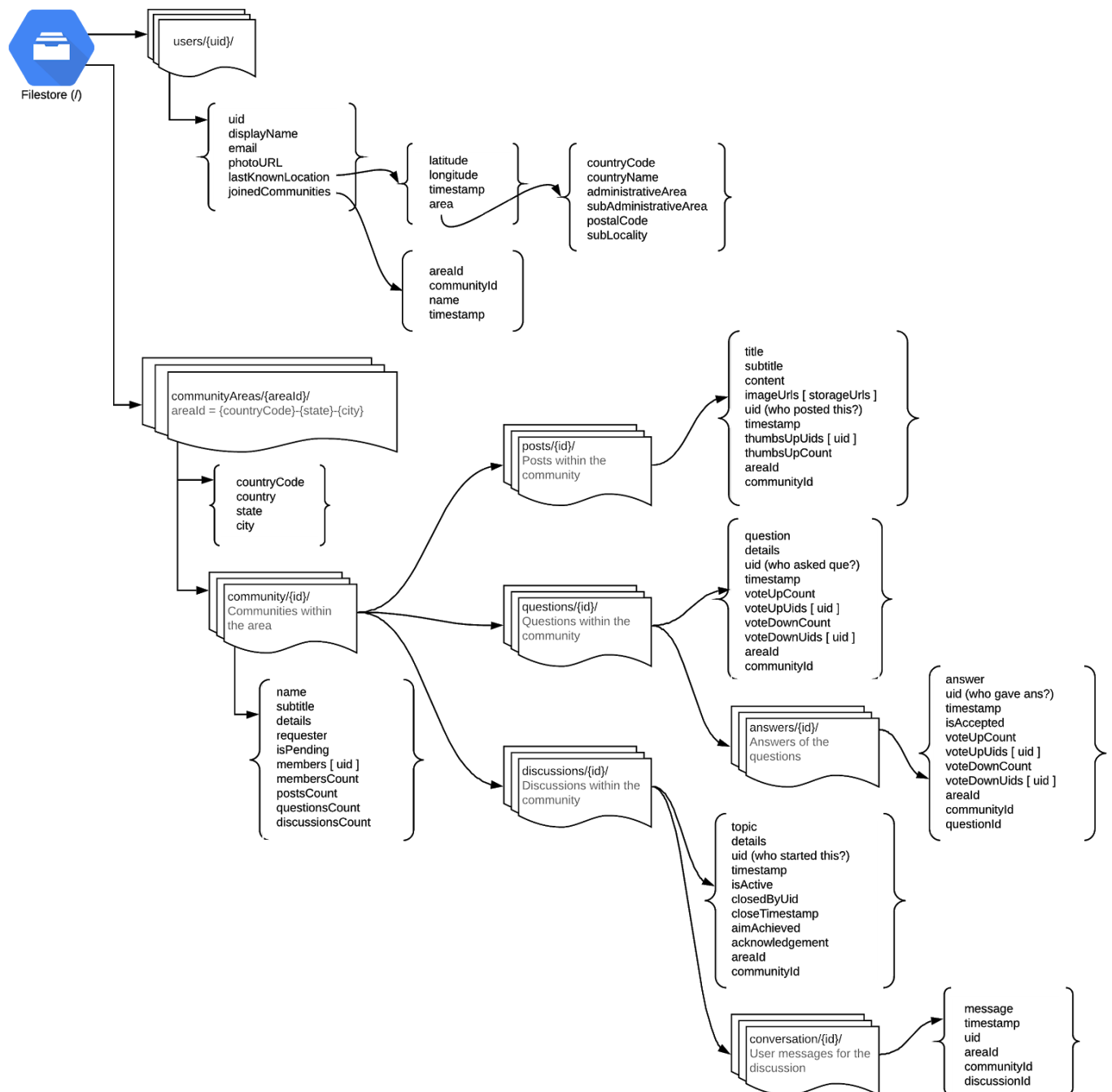
The above diagram shows that a Guest user can create an account, and authenticated users can create communities, view content but they can not interact in a community until they don't join that community.



Community Members DFD

The above diagram shows that a community member can see the content and can also post and interact.

4.3 Database ERD (Entity Relationship Diagram)



This app is using Google Firestore as the database which is a NoSQL, real-time database. It includes collections of documents having flexible schema.

4.4 Data Dictionary

- A data dictionary is a collection of descriptions of the data objects or items in a data model for the benefit of programmers and others who need to refer to them.
- The database used in this app is NoSQL database, so data objects are represented as collections of documents, which are as below:

/users/ (collection)

- | - uid/ (auto-generated document ID)
 - | - uid (type: string, details: user ID)
 - | - email (type: string)
 - | - displayName (type: string)
 - | - photoURL (type: string, details: User profile picture URL)
 - | - lastKnownLocation (type: map)
 - | | - latitude (type: number)
 - | | - longitude (type: number)
 - | | - timestamp (type: number, details: time of location)
 - | | - area (type: map, details: reverse GeoCoding area)
 - | | - countryCode (type: string, details: e.g. 'IN' for India)
 - | | - countryName (type: string)
 - | | - administrativeArea (type: string, details: state)
 - | | - subAdministrativeArea (type: string, details: city)
 - | | - postalCode (type: string)
- | - joinedCommunities (type: array)
 - | | - areald (type: string, details: areald of joined community)
 - | | - communityId (type: string)
 - | | - name (type: string, details: community name)
 - | | - timestamp (type: number, details: time when user joined)

/communityAreas/ (collection)

- | - communityAreaId (docId in form {countryCode}-{state}-{city})
 - | - countryCode (type: string)
 - | - countryName (type: string)
 - | - state (type: string, details: same as administrativeArea)
 - | - city (type:string, details: same as subAdministrativeArea)
 - | - communities (collection)

/communityAreas/{communityAreaId}/communities (collection)

- | - communityId (document ID which is slug of community name)
 - | - name (type: string, details: name of community)
 - | - subtitle (type: string, details: one-line description of community)
 - | - details (type: string)
 - | - requester (type: map, details: info about the user who created)
 - | - uid (type: string, details: user id of creator)
 - | - timestamp (type: number, details: when created?)
 - | - isPending (type: boolean, details: community is active or not)
 - | - members (type: array, details: uids of joined users)
 - | - membersCount (type: number)
 - | - posts (collection)
 - | - postsCount (type: number)
 - | - questions (collection)
 - | - questionsCount (type: number)
 - | - discussions (collection)
 - | - discussionsCount (type: number)

/communityAreas/{communityAreaId}/communities/{communityId}/posts/

- | - postId (auto-generated document ID)
- | - title (type: string)
- | - subtitle (type: string)
- | - content (type: string, details: post content)
- | - imageUrls (type: array<string>, details: user posted images)
- | - uid (type: string, details: who posted this?)
- | - timestamp (type: number, details: when posted?)
- | - thumbsUpUids (type: array<string>)
- | - thumbsUpCount (type: number)
- | - areaId (type: string, details: communityAreaId)
- | - communityId (type: string)

/communityAreas/{communityAreaId}/communities/{communityId}/
questions/ (collection)

- | - questionId (auto-generated document ID)
- | - question (type: string)
- | - details (type: string)
- | - uid (type: string, details: who asked this question?)
- | - timestamp (type: number, details: when the question is asked?)
- | - voteUpUids (type: array<string>)
- | - voteUpCount (type: number)
- | - voteDownUids (type: array<string>)
- | - voteDownCount (type: number)
- | - answers (collection)
- | - areaId (type: string, details: communityAreaId)
- | - communityId (type: string)

/communityAreas/{communityAreaId}/communities/{communityId}/
questions/{questionId}/answers/ (collection)

- | - answerId (auto-generated document ID)
 - | - answer (type: string)
 - | - uid (type: string, details: who gave this answer?)
 - | - timestamp (type: number, details: when the ans is given?)
 - | - isAccepted (type: boolean, details: ans accepted by who asked or not)
 - | - voteUpUids (type: array<string>)
 - | - voteUpCount (type: number)
 - | - voteDownUids (type: array<string>)
 - | - voteDownCount (type: number)
 - | - areaId (type: string, details: communityAreaId)
 - | - communityId (type: string)
 - | - questionId (type: string)

/communityAreas/{communityAreaId}/communities/{communityId}/
discussions/ (collection)

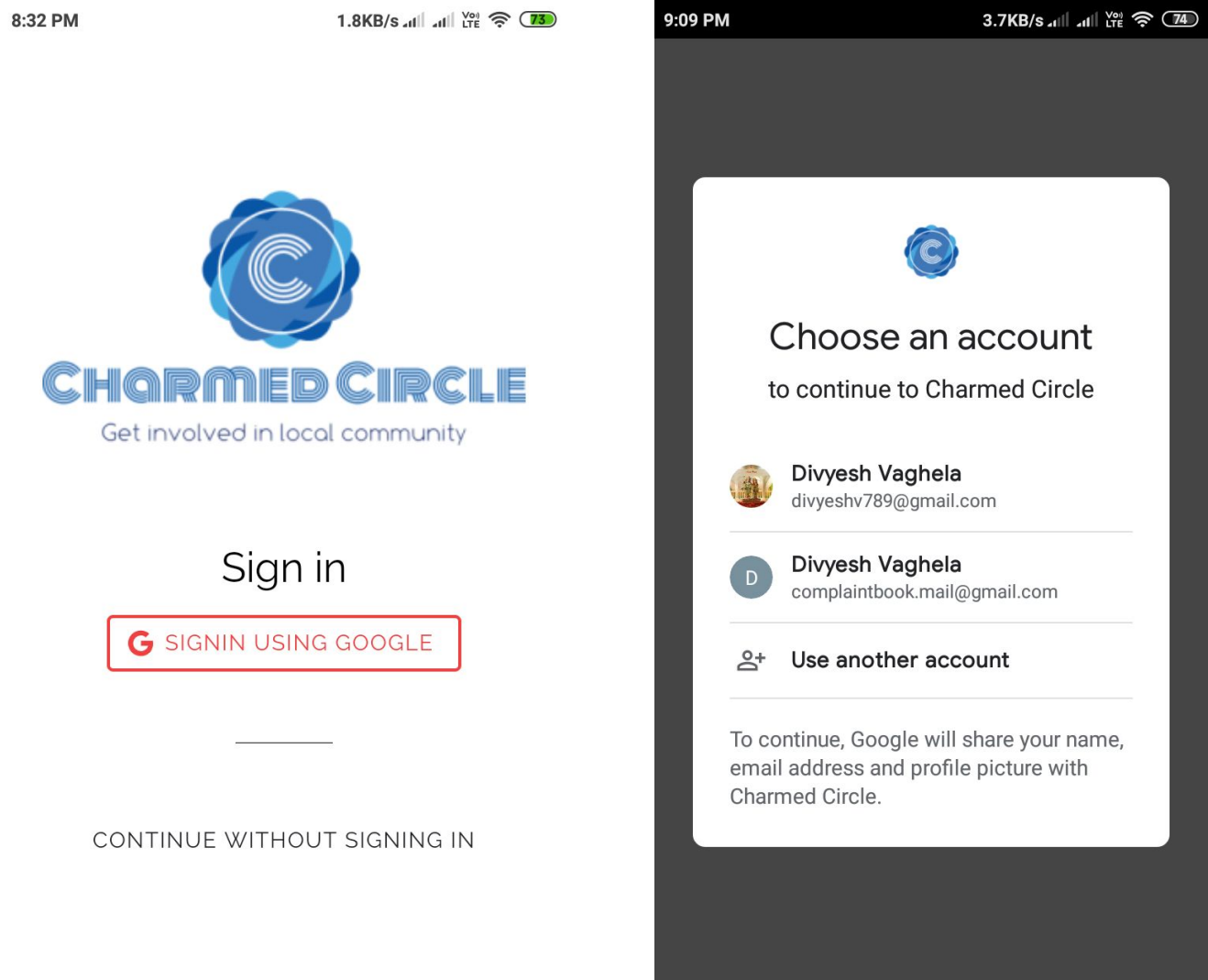
- | - discussionId (auto-generated document ID)
 - | - topic (type: string, details: topic of discussion)
 - | - details (type: string)
 - | - uid (type: string, details: who started this discussion?)
 - | - timestamp (type: string, details: when the discussion is started?)
 - | - conversation (collection, user messages)
 - | - isActive (type: boolean, details: discussion is closed or not)
 - | - closedByUid (type: string, details: User id who closed the discussion)
 - | - closeTimestamp (type: number, details: when closed?)
 - | - aimAchieved (type: boolean, details: user closing feedback)
 - | - acknowledgement (type: string, details: user closing feedback)
 - | - areaId (type: string, details: communityAreaId)
 - | - communityId (type: string)

/communityAreas/{communityAreaId}/communities/{communityId}/
discussions/{discussionId}/conversation/ (collection)

- | - messageId (auto generate document ID)
 - | - message (type: string)
 - | - uid (type: string, details: user id who sent the message)
 - | - timestamp (type: number, details: when the message is sent?)
 - | - areaId (type: string, details: communityAreaId)
 - | - communityId (type: string)
 - | - discussionId (type: string)

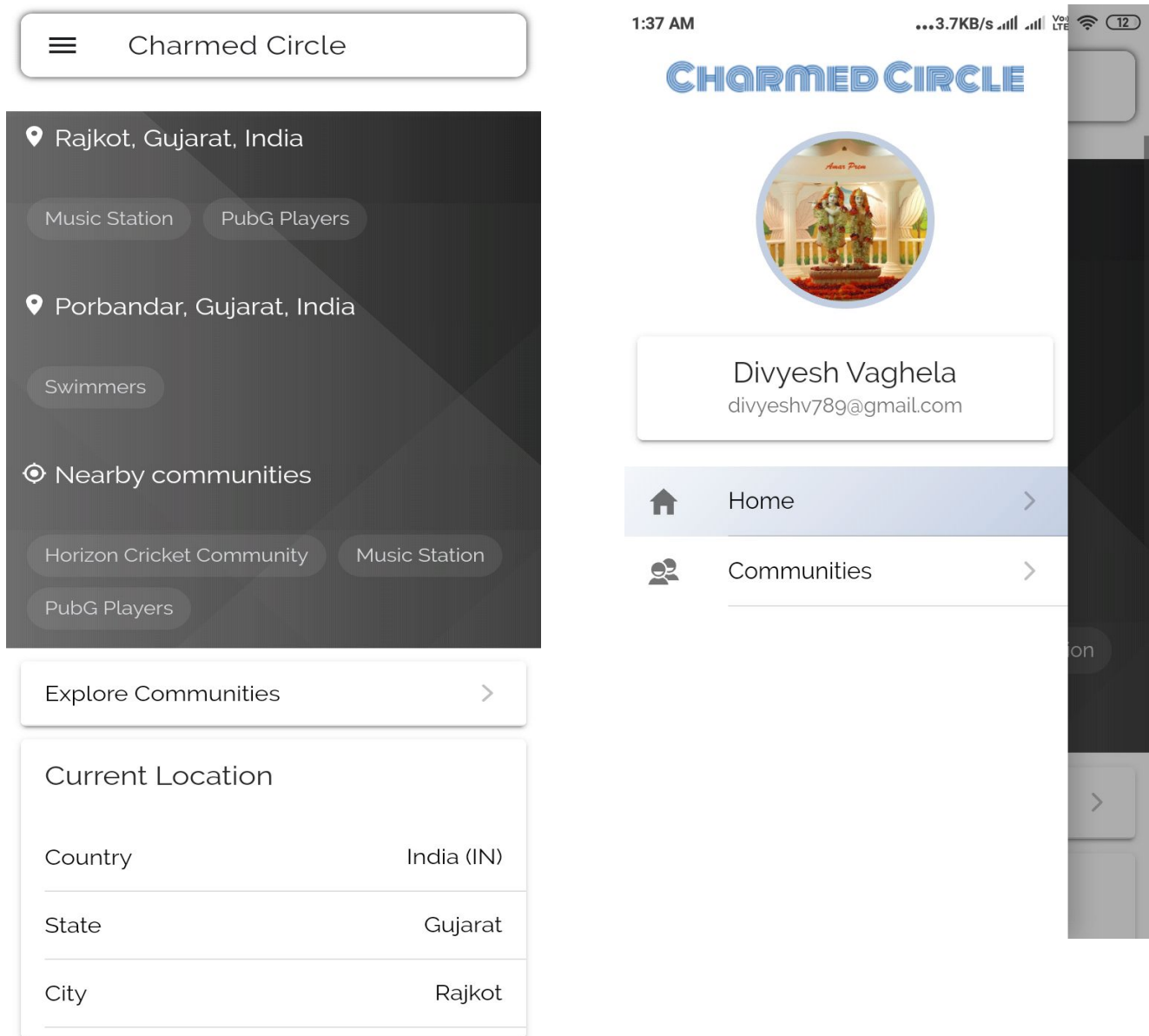
5. Screenshots

Sign In Screen



This Screens show the Sign In functionality. User can sign in using their Google Account or they can continue without sign in. If the user does not sign in, then he/she won't be able to interact in any community but they can only view the things.

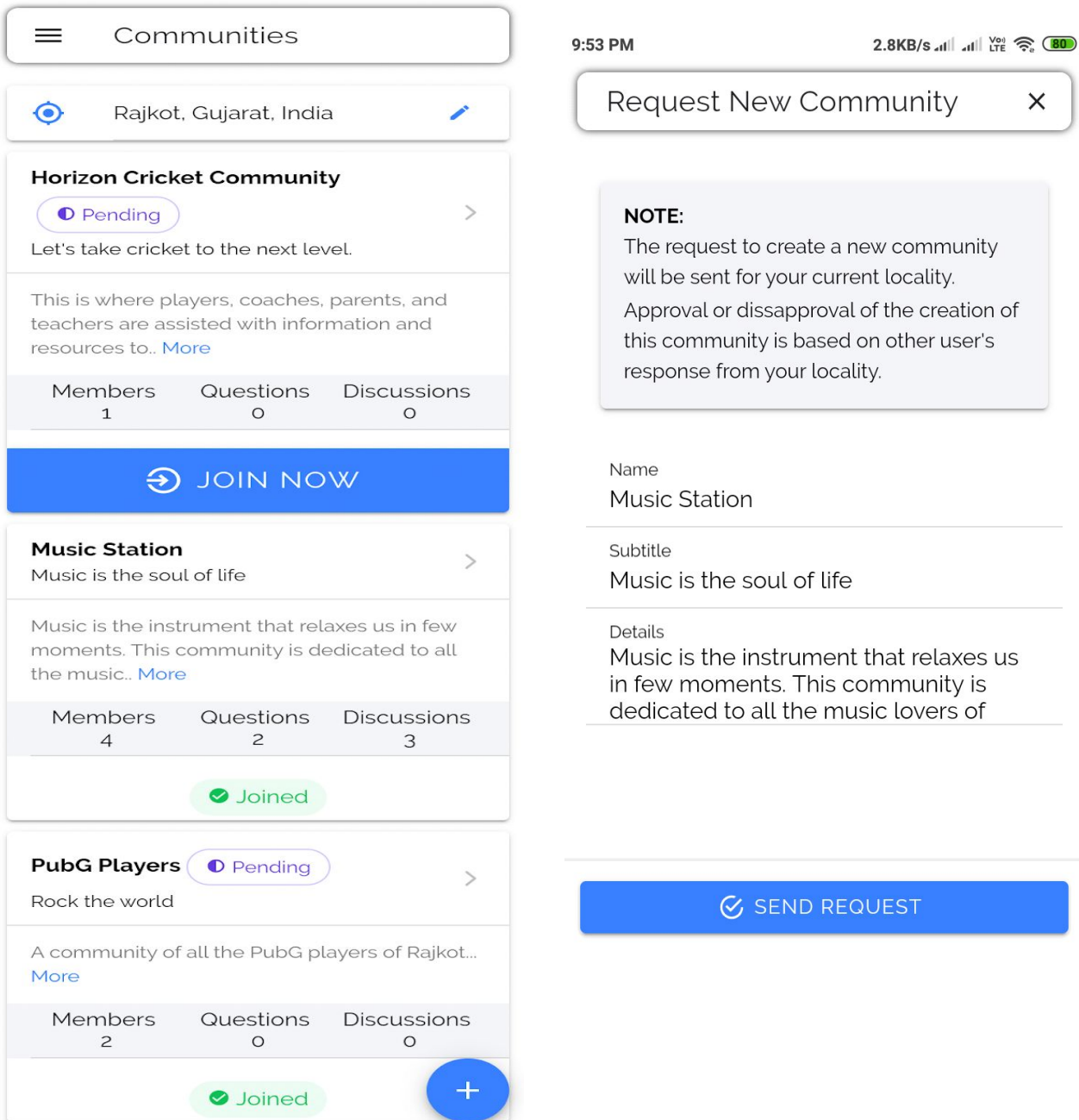
Home and side menu



Home page lists the communities joined by the user and nearby communities also (based on location).

Side menu of the app provides quick navigation to other parts of the app.

Communities



The first screen lists all the communities in the selected locality. By default it will display the communities based on location but we can select a locality by using edit icon.

Users can also send a request for new community as shown in second screen.

Music Station

Divyesh Vaghela

Aug 18, 2019, 1:29:01 PM

Music making inspiration

Find the inspiration for music around you

In this post, I'm going to share some ways that you can find inspiration for your music. Some of the.. [More](#)

1

Divyesh Vaghela

Aug 18, 2019, 1:21:13 PM

Greatest Gujarati Songs of all the time

List of Gujarati songs

Gujarati cinema is changing and growing at its peak. The tracks in Gujarati songs playlist are ever .. [More](#)

1

Divyesh Vaghela

Aug 18, 2019, 1:15:40 PM

Gujarati Folk music

Great Gujarati traditional music is still alive

Gujarat, a western state of India, is known for music traditions of both folk and classical music. .. [More](#)

1

This screen shows posts from a community and we can also add new posts using the form.

Questions

Music Station

Whis is a best music mixer application?

I want to go in field of Music mixes, creating fusions and all. so I want a good application for mus.. [More](#)

1

ANSWERS
0

Divyesh Vaghela

Aug 22, 2019, 12:17:36 PM

How to start career in the music industry?

I want to start my career in music industry. I am currently pursuing my graduation and interested in.. [More](#)

1

ANSWERS
1

Divyesh Vaghela

Aug 22, 2019, 12:34:27 AM

Posts

Q&A

Discussions

8:12 PM
...3.2KB/s
VoLTE
74

Ask a Question

How to start career in the music industry

I want to start my career in music industry. I am currently pursuing my graduation and interested in music. So how can I make my career?

This Screens show the Questions asked in a community. Community members can also vote the question and can also ask a new Question.

Answers

← How to start career in the ...

8:13 PM

...3.6KB/s 74

X

Answer

✓

How to start career in the music industry?

I want to start my career in music industry. I am currently pursuing my graduation and interested in music. So how can I make my career?



1



ANSWER NOW >



Aug 22, 2019, 12:34:27 AM



Divyesh Vaghela
complaintbook.mail@gmail.com >

Answers

1

First of all you should decide that whether you want to go in Singing or Music.

If you want to go in singing then you should start rehearsal for that and participate in some reality show.

If you want to go in music then you should decide on one particular instrument like guitar or flute and be proficient in that.



1



✓ Accepted



Aug 22, 2019, 11:15:24 AM



Divyesh Vaghela
divyeshv789@gmail.com >



Posts



Q&A



Discussions

How to start career in the music industry?

First of all you should decide that whether you want to go in Singing or Music.

If you want to go in singing then you should start rehearsal for that and participate in some reality show.

If you want to go in music then you

This Screens show the Answers of a question. Community members can vote the question and answer and they can also submit their answer by the given form.

Discussions

Music Station

Guidance for learning Flute

I am eager to learn Flute but not able to find any good source. I'll be thankful if somebody can guide me through a quick start. I am also ready to join any good class in Rajkot.

Active [JUMP INTO DISCUSSION >](#)

Divyesh Vaghela

divyeshv789@gmail.com

Aug 20, 2019, 7:29:31 PM

Started

Expanding the reach of Gujarati songs

Today the new generation don't know the richness of Gujarati poems, bhajans and songs. So this discussion.. [More](#)

Closed [VIEW DISCUSSION >](#)

Divyesh Vaghela

complaintbook.mail@gmail.com

Aug 21, 2019, 9:54:17 AM

Started

Aug 21, 2019, 10:30:50 AM

Closed

Discussion was successful

Closer feedback: The aim is achieved. This was a very good discussion thanks to

Posts

Q&A

Discussions

8:18 PM

...2.0KB/s

73

Start New Discussion

Guidance for learning Flute

I am eager to learn Flute but not able to find any good source. I'll be thankful if somebody can guide me through a quick start. I am also ready to join any good class in Rajkot.

This Screens show the Discussions within a community. Community members can participate in the discussion and send messages.

They can also start a new discussion by the given form.

Conversation in Discussion

←

Guidance for learning Flute

8:47 PM

2.2KB/s

✕

Close discussion

✓

8/20/19, 7:29 PM

I am eager to learn Flute but not able to find any good source. I'll be thankful if somebody can guide me through a quick start. I am also ready to join any good class in Rajkot.

g

8/24/19, 9:26 PM

Hello.. Rajkot academy is a very good academy.. near Raiya road, check it out..

hope this will help..

9/7/19, 8:35 PM

Okay, thanks Dhaval, I'll check it out..

D

9/7/19, 8:39 PM

I suggest you to first check some good tutorials in YouTube. There are so many tutorials and it will give you a good start..

Okay I'll check that also.]

➤

Posts

Q&A

Discussions

Are you satisfied with this discussion... Is the aim achieved?

This discussion will prove very helpful to me, thanks to all for your guidance.

Are you sure want to close this (*Guidance for learning Flute*) discussion?

Once the it's is closed, no one will be able to interact in this discussion.

This Screens show the conversation (chat) of a discussion. Community members can view and send their own thoughts on the discussion.

Member who started the discussion can close the discussion by submitting the feedback form.

6. Testing

“Software testing is a process of executing a program or application with the intent of finding software bugs.”

- It can also be stated as the process of validating and verifying that a software program or application or product:
 - Meets the business and technical requirements that guided its design and development,
 - Works as expected
 - Can be implemented with the same characteristics.

6.1 White-box testing

- White-box testing (also known as clear box testing, glass box testing, transparent box testing, and structural testing) is a method of testing software that tests internal structures or workings of an application, as opposed to its functionality (i.e. black-box testing).
- In white-box testing an internal perspective of the system, as well as programming skills, are used to design test cases. The tester chooses inputs to exercise paths through the code and determine the appropriate outputs.
- White-box testing can be applied at the unit, integration and system levels of the software testing process.
- **In this project:**
 - I have tried this technique to test this application. I have analyzed the data flow, control flow, information flow, coding practices, and error and exception handling within the system to test the intended and unintended software behavior.

- I have used this technique to confirm that all code implementation follows the intended design.
- I have mostly used white box testing as the unit level testing to rectify the mistakes in the early phases.
- As this is a Hybrid application most of white box testing as Unit level is done this Google Chrome browser's Mobile Device Emulator and module level testing with the actual android device.

6.2 Black-box testing

- Black-box testing is a method of software testing that examines the functionality of an application without peering into its internal structures or workings.
- This method of test can be applied to virtually every level of software testing: Unit, Integration, and System.
- In this test, Test cases are built around specifications and requirements, i.e., what the application is supposed to do. Test cases are generally derived from external descriptions of the software, including specifications, requirements and design parameters.
- The test designer selects both valid and invalid inputs and determines the correct output.
- **In this project:**
 - I have also tried this technique to test the app. I have tried with both valid and invalid data.
 - All the validations are working perfectly fine and user is given proper error message also, so that they can rectify them.
 - Most of the validation are done through the Angular only, but also user authentication and authorization related rules are set in the Firestore itself.

- Geographical location is the most important element in this app, so I have tested this app in various devices from different vendors and also in different locations.
- I have also tested this project against the users that will be the direct users of this app in future to ensure that it is enough robust to work properly in the real world.

6.3 Gray-box testing

- Gray box testing, also called gray box analysis, is a strategy for software debugging in which the tester has limited knowledge of the internal details of the program.
- A gray box can be thought of as a program or system whose workings are partially understood.
- With respect to internal processes, gray box testing treats a program as a black box that must be analyzed from the outside. During a gray box test, the person may know how the system components interact but do not have detailed knowledge about internal program functions and operations.
- **In this project:**
 - I have also tried this technique to test the android app. I have discussed all the possible scenarios and decision principals, to get the right idea about the right flow.
 - By doing gray box testing I focused well on making our Data Flow the most efficient and also made the end-to-end process accurate and robust.
 - For efficient processing, data handling and consistency in the database, some of the things are moved to Cloud functions (whenever possible and efficient). So all the cloud functions are also well tested.

7. Conclusion

- Charmed-Circle, Hybrid Mobile application for a better interaction between local people, works satisfactorily. And almost all the aspects are well implemented and easy to use.
- The user can login and view their profile, they can see the communities around them and also create new communities for their locality.
- Community members can view the posts, like others posts and also they can post new feeds. For Question-Answers also members can ask new questions, give answer to the question. They can also vote the questions and answers. They can also view the discussion of other members and also can start a new discussion.
- The main aim of this application is to make better communication between local people of same interest or same background by creating a community and allowing them to share thoughts.
- The local communities can contribute to the society by having communities that solve the problems of that locality and create a better environment.
- Geographical location matters the most in this application, so the user will be able to create, join and contribute to the communities based on that.

8. Bibliography

This section describes the documents and other sources from where the information was gathered.

Reference books:

- Angular In Action by Jeremy Wilken (Manning Publications Co.)
- Pro Angular 6 - Third Edition by Adam Freeman (Apress)
- Ionic In Action by Jeremy Wilken (Manning Publications Co.)
- Mobile App Development with Ionic by Chris Griffith (O'Reilly)

Websites:

- Ionic Framework Documentation: <https://ionicframework.com/docs>
- <https://www.youtube.com>
- <https://stackoverflow.com>

Future Enhancements:

- As of now only local city or village level community can be created, it is not possible to create communities at a more abstract level like state or country level, which could be useful in some cases.
- Community members can only add descriptive question-answers, but choice based question is also a good idea. In addition to that opinion count and ratings based questions can be added.
- Improper content can be added by some community members which are not relevant to the community, we can give the option to flag the content as inappropriate or not relevant.
- Local community members Meet Up planning is also an added feature.