Bilkent University

Department of Computer Engineering

Senior Design Project

Project short-name: Charin

High Level Design Report

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1 Introduction

On different continents of the world conditions of different societies, groups of people or even animals might be in poor conditions. Benevolent people helps to those who are in need or in a bad condition. Donating or in other words helping who are in need can be tiring process and would need more organized, transparent way. Moreover, people can not always trust to 3rd person therefore we are proposing mobile app called "Charin" to solve discussed issues. Charin is a mobile application where people can help others and socialize while supporting them. We tried to make the process of benefiting others more fun and appealing for users. While arranging events to help others, users will have a chance to meet with people from different backgrounds and make new friends. Nonetheless, the main purpose of Charin is finding a solution to problems we are able to solve such as providing necessary needs of people in need. Although there are some websites, foundations which serve the same purpose, we tried to reach a clearer approach where the users can clearly see where their donation goes. To be able to reach our goal, we used blockchain. Blockchain is becoming famous technology nowadays. It was introduced in October 2008. First application of blockchain was bitcoin [1]. Blockchain technology allows to monitor transaction of money according to hash codes of the transacted money. It gives possibility of transparency at the payments. If we consider different social events that contains claims for donations to different people or places, transparency becomes crucial thing. Nowadays there are a lot of social awareness acts which people generally share these acts and give comments about these acts. However, in donation cases, there are a lot of frauds which you cannot know in which account your money combined. In Charin application, developers tried to solve this problem for society. The purpose of Charin application is to use Blockchain technology in social charity application. With the help of this application people can share the event and get support from their followers. In this application, people become famous with the help of their donations.

1.1 Purpose of the System

Charin is mobile app that has social media side which will let users to follow, unfollow other users. Moreover they will be able to participate in events and even to create events. Users will be able to donate to events and donation system will be implemented by blockchain technology to trace the donations and provide transparency. Users will also be able to create groups to handle the events better, to gather people with same interests, location, background into the same place. Groups will allow people to see the events they are interested in. Goal of the system is to create a system that lets users help in a transparent system and socialize while doing that.

1.2 Design Goals

1.2.1 Performance

- The system should respond to the user in a short time (less than 1 second).
- When a crash happens, there should not be any data loss.

1.2.2 Transparency

- System should be transparent and provide information about events.
- System will use blockchain technology to provide transparency in donation system.

1.2.3 Usability

- Since system will be implemented as mobile app it should be user-friendly for smartphone users.
- The application should provide information about how to donate.

1.2.4 Security

- System will use sensitive information in credit card payments while donation therefore it should be secure for users.
- The application will not share any information about belonging to the user with a third party.
- Data will not be corrupted and it will be stored safely.
- User will be able to manage sharing properties in settings and the system will apply the privacy accordingly.

1.2.5 Reliability

- System should be reliable enough that people use this mobile app and donate through this app.
- The system should be able to handle large number of users at the same time.

1.2.6 Privacy

- Since system will hold information about the people who needs help, it should not violate their privacy.

1.3 Definitions,acronyms,and abbreviations

Following abbreviations are used throughout the report.

- **HTTP:** Hyper-Text Transfer protocol
- **API:** Application programming interface
- **JSON:** JavaScript Object Nation
- **TCP:** Transmission Control Protocol

1.4 Overview

Charin offers ideal solution to the problems in donation processes. Users can create their own events and others can participate in this event. Also, users will be able to donate in terms of money, or special cards(cards that can be spent on only 1 website) to specific events.

On the other hand, Charin has a social media side. It allows users to follow and to be followed. Users will be to join groups. Users will be able to comment, like to the posts that is shared by his/her followers.

Since we discussed briefly about system, this report discusses the high-level design of the system.

2 Current Software Architecture

In this chapter, the existing systems which are similar with Charin will be presented. At the end of the chapter, the features that offered by Charin different than the other existing systems will be explained.

2.1 Similar apps and platforms

2.1.1 Donate A Photo

Donate A Photo is one of the most popular and successful charity application today. This app developed by Johnson&Johnson.

- Available only on mobile and only for Iphone. Web platform is not supported.
- User can upload one photo for each day.
- Win-win situations. Your photos inspire others all around the world
- Johnson&Johnson will donate 1 dollar for each photo

2.1.2 Alice

Alice social tech startup has launched a blockchain technology that will show those donating to charity the impact their money is making. Alice is a London-based platform running the first appeal using St Mungo's homeless charity technology.

- Not yet available because it is startup.
- Blockchain will supply transparency of app
- Transparency will encourage people do donations.
- Blockchain technology has benefited charities so much. For instance, some charities are accepting donations via blockchain.
- Alice is going further by using blockchain technology, especially its smart contracts function to track donations and ensure it makes an impact or cancels it if it didn't make an impact as proposed.

2.1.3 ShareTheMeal

The app is an extension of the ShareTheMeal non-profit initiative run by the World Food Programme (WFP) – the world's largest humanitarian agency combating hunger globally and providing food aid to an estimated 80 million people each year. The UN WFP is 100 percent voluntarily funded, so every contribution counts.

- Available both for mobile and web. IOS and Android both supported.
- This app is available in 9 languages, including English, Spanish, French, German, Italian, Portuguese, Russian, Korean, and Japanese.
- This iOS app gives you a direct channel to fund UN efforts in supporting children in need, on the go, with just a tap on your phone
- It costs you US $0.50 to feed one hungry child a day
- You can track where the meals are distributed and the impact.

2.1.4 Pinkcoin

This is the era of cryptocurrencies and interesting new coins are being developed every day, meaning there is a promising future for cryptos. Pinkcoin is a cryptocurrency developed to make donation easy. The coin also rewards users through unique staking technologies.

- Available only for web. Mobile version is not released.
- Pink coin provides a secure network that disrupts the charity models that are not transparent.
- It focuses not only on the peer-to-peer transaction as you can also make profits by owning a coin.
- In Pinkcoin, you can receive interest by putting your coins in your wallet called Staking.
- If user hold the coins for some time, you'll get profit because you are helping in the building of the blockchain.
- The algorithm randomly selects someone with the correct block; such person will receive a reward.
- If user also donate to the Breast Cancer Charity Drive that the Pinkcoin is running, you can get a reward.

2.2 Charin

In Charin donator can see who need help and can donate that person. Other app provide donation on base of randomly algorithm in Charity that is not issue user can choose. User can track their donation. Our app will be available for web and mobile. In the first step we will develop for android.

3 Proposed Software architecture

3.1 Overview

Charin's system decomposition aims to present the structure of the application in detail. In this section, subsystem decomposition of the system is discussed. Afterwards, hardware and software mapping of the system is shown and explained. In this part of the report, data management of Charin is also explained in details. Controlling the access and security of a system is a crucial part and the process how Charin handles it is included in this section. Global software software and boundary conditions can also be found in the report.
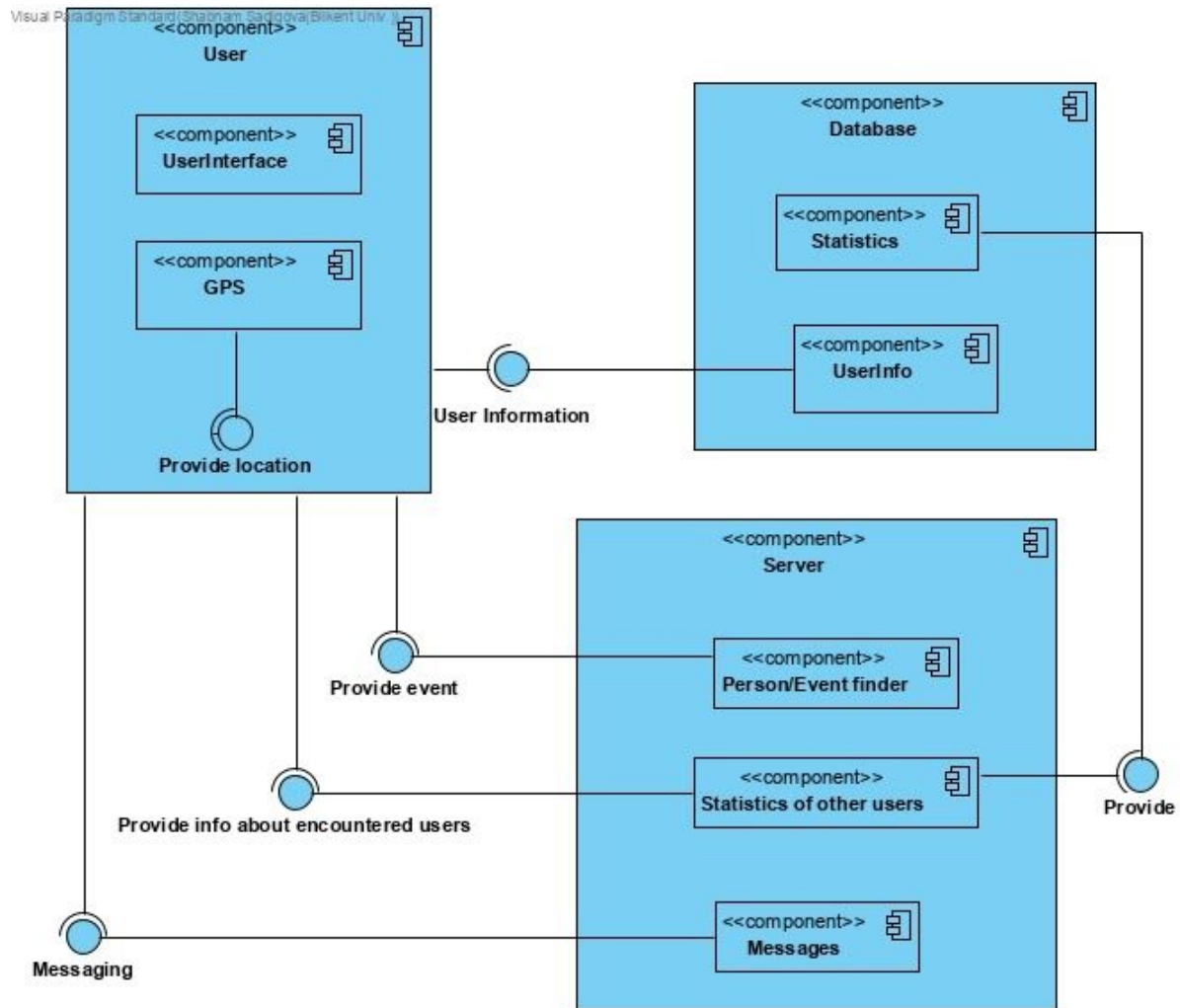
3.2 Subsystem decomposition

Figure 1. Subsystem Decomposition Diagram

A client-server architecture is chosen to design the system since it is suitable for the design goals of the project. The subsystems are User, Server and Data Management. The first subsystem, User, responsible for user interaction and will provide locational information. Data Management layer is responsible for the databases. Server component responsible for user interaction between other users and events.
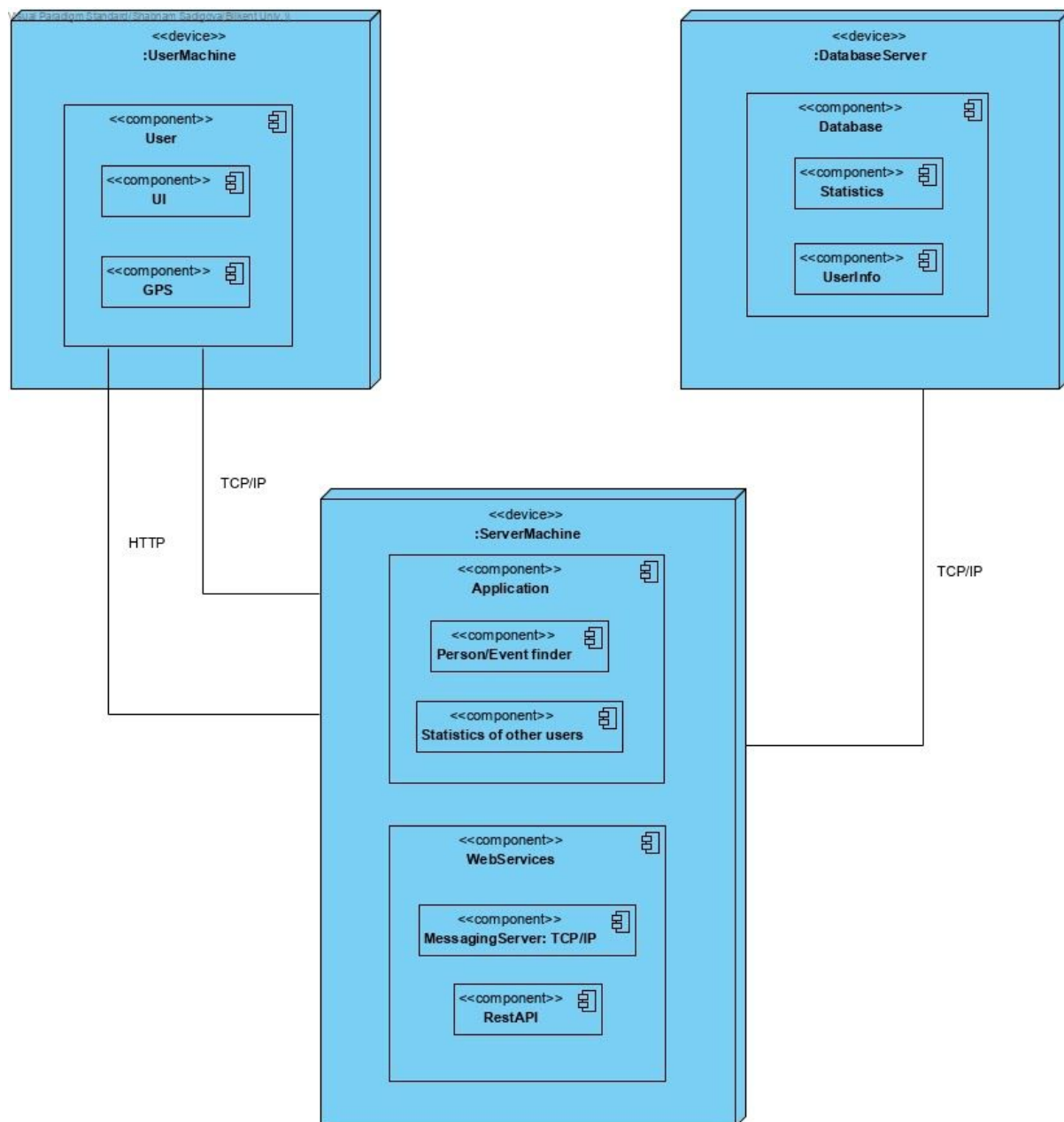
3.3 Hardware/software mapping

Figure 2. Hardware/Software Mapping Diagram

Device of the user can be smartphones(Android/IOS) or PC. User will show him/her GPS location. User and server will communicate with TCP/IP and HTTP. Communication between server and database server will be handled with TCP/IP. Server Machine contains Web Services and Application related components. Web Services contain Messaging Server for communication between users and REST API for communication between User, Server Machine and Database Server.

3.4 Persistent Data Management

Since Charin is not only donation app, and it has social media side, system will store personal data about users, groups, and posts. We are going to use MongoDB[2] which is a NOSQL cross-platform database program. In database system will store information about users, groups, posts and events. On the other hand, all crucial information about donations which should be shared among other users in a transparent way will be stored in blockchain. In a blockchain we are going to hold which transactions made between users. We are going to implement blockchain with Hyperledger [3] which is modular blockchain framework.

3.5 Access Control and Security

System is going to store important data about users (name, email, password). Therefore we should provide control and security to the system, to do so we should use encryption technique for the database. In system we are going to use bcrypt[4] to encrypt crucial information.

Bcrypt is the adaptive password hashing function which is also flexible and is implemented in different languages but we are going to use it in Nodejs. Due to it is usability it is very well known hashing function.

On the other hand, users will have to enter their email and password to enter the system and modify their data.

3.6 Global software control

Charin is a client-server application. When a user tries to log in, the given information will be checked and the user will be allowed to log in if the information is valid. According to user's permission, he/she login info will be saved on the device. The login information will be encrypted for the sake of privacy.

After logging in, the user will be able to change his/her personal information. He/she will be able to search event/person in need and can see the status of person or event. All requests coming from the user will be handled on server and relevant output will be generated.

3.7 Boundary conditions

In the system of Charin, there are three main boundary conditions which are initialization, termination and failure of the system. Each boundary condition is explained in detail in the sections below.

3.7.1 Initialization of the System

For the user to be able to use Charin, he/she needs to have an internet connection. The application will not proceed without internet. The user also needs to have an account in the system in order to use the application. If the user does not have an account, he/she has to create an account. The user needs to allow the application to use his/her GPS location to be able to find nearby events.

3.7.2 Termination of the System

The user can log out from Charin whenever they wish to, by simply tapping on the logout button placed. To be able to use the application again, the user needs to login to the system. If the user does not log out the system, he/she will be able to open the application directly. The system will count the user as logged in all the time. By clearing the cache of the application, the user can also terminate the application.

3.7.3 Failure of the System

If the user's phone is not connected to the internet, the application will fail to proceed. In the case of internet connection failure, the application will only be able to present the cached data only.

4 Subsystem services

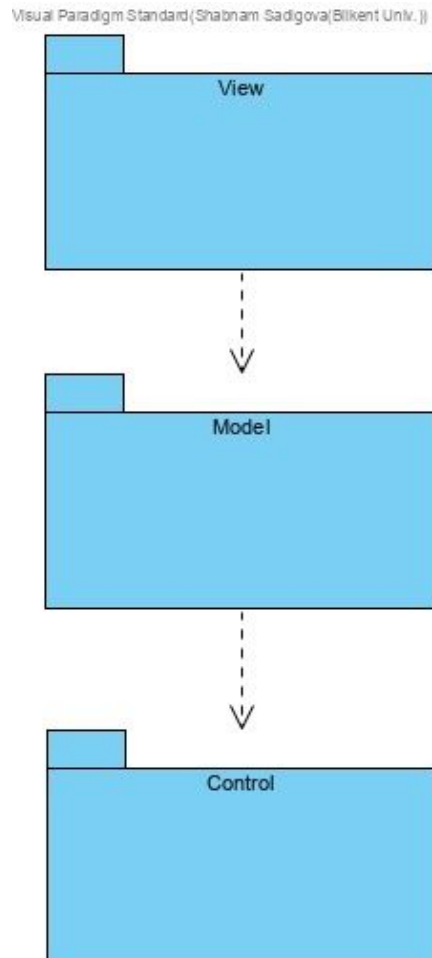The subsystems of the system of Charin is explained in this section with details.

Figure 3. Subsystem Diagram

4.1 View Subsystem

View subsystem is used for the user interface of Charin. All the classes related to user interface of the program is placed in the View subsystem.
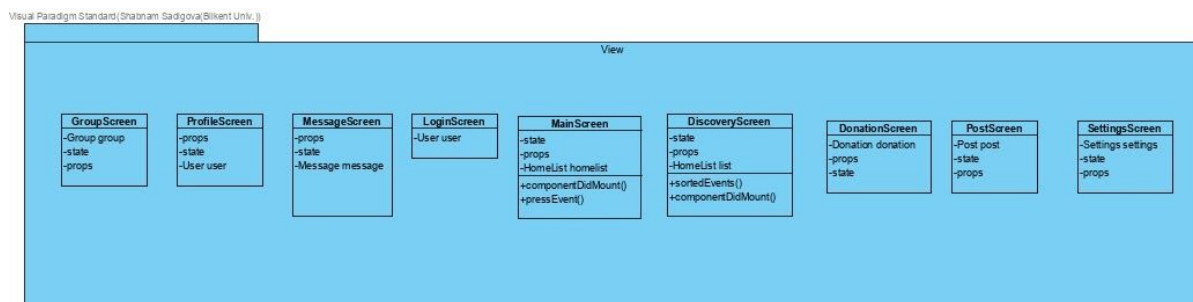

Figure 4. View Subsystem Diagram

- **GroupScreen:** This class is for displaying the groups of Charin.
- **ProfileScreen:** This class handles the representation of user profile.
- **MessageScreen:** This class is for handling the view of messaging.
- **LoginScreen:** The LoginScreen manages the view of the login page.
- **MainScreen:** The MainScreen class is for displaying the home screen of the program.
- **DiscoveryScreen:** Charin allows the users to discover nearby events, groups, search for users. The DiscoveryScreen is for displaying the search screen.
- **DonationScreen:** Charin is a program to handle donations and and it has a separate page to manage the donations. DonationScreen is for displaying the page for donations.
- **PostScreen:** This class is for displaying posts posted by other users.
- **SettingsScreen:** The users will be able to customize the settings of the application as they wish to and this page handles that operation.
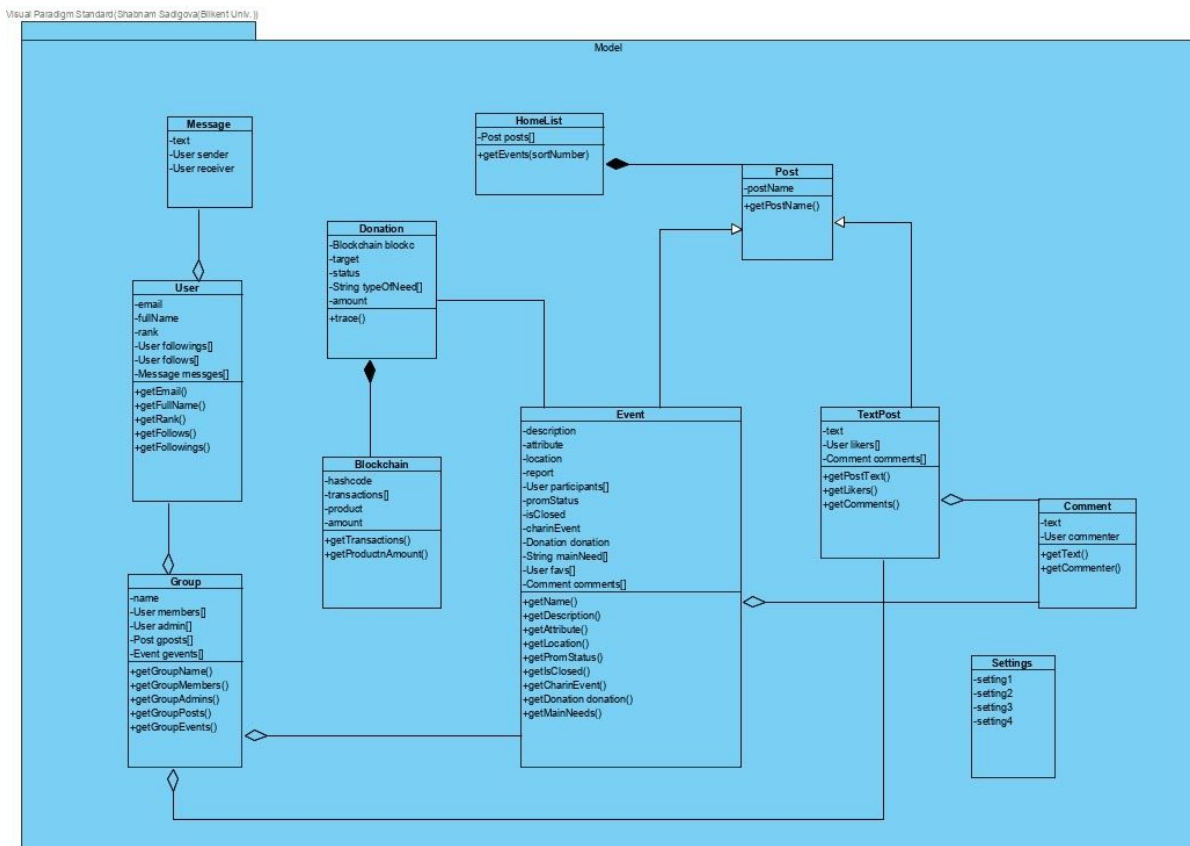
4.2 Model Subsystem

Figure 5. Model Subsystem Diagram

- **Message:** This class handles the backend of the MessageScreen class.
- **User:** The User class is for handling the user profile and information.
- **Donation:** This class is for handling the backend of the DonationScreen class.
- **Blockchain:** The Blockchain class is for handling the donations made by using blockchain.
- **Group:** This class is for handling the management of the groups.
- **HomeList:** The home screen of the application is managed by the HomeList class.
- **Event:** This class handles the management of the events of Charin.
- **Post:** The Post class is used to allow the user to post what they want in the application.
- **TextPost:** This class is used to keep track of likes and comments of a post.
- **Comment:** The Comment class is used to handle the comments on a post. It allows the users to comment.
- **Settings:** The Settings class is for handling the settings of the application according to user's choice.
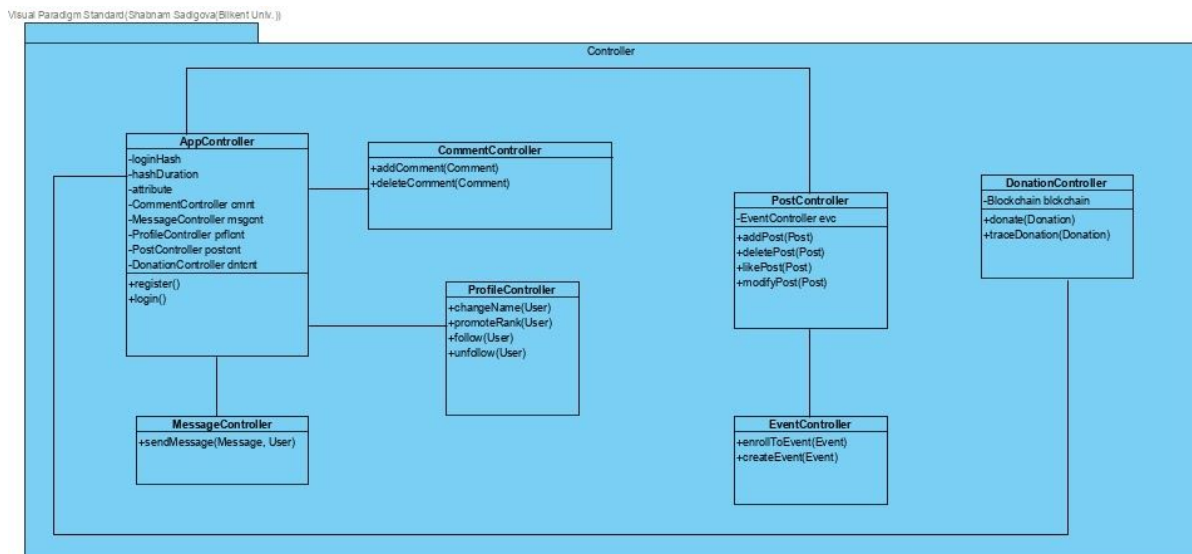
4.3 Controller Subsystem

Figure 6. Controller Subsystem Diagram

- **AppController:** This class controls the overall working of the application.
- **MessageController:** This class controls the messages.
- **ProfileController:** This class controls the profile of the users.
- **CommentController:** This class controls the commenting feature of the application.
- **PostController:** This class controls the posting feature of the application.

- **EventController:** The EventController class controls the events of Charin.
- **DonationController:** The DonationController is used to handle the donations in Charin.

5 New Knowledge Acquired and Learning Strategies Used

Blockchain:

There are a lot of sources on the internet related to blockchain. But only few of them reliable and few of them have are made by professionals. As a team we bought online course from Coursera and Udemy. We got skills about blockchain and bitcoin. From Coursera we followed this syllabus

- In the first week, we learn structure and operational aspects of Bitcoin blockchain, and compare different types of blockchains
- In the second and third week we learned algorithms and techniques for blockchain then we discuss the concept of asymmetric key encryption, define the concept of hashing, and try to understand techniques that use algorithms to manage the integrity of transactions and blocks in blockchain.
- Also we bought a course about smart contract in semester break our team try to finish this course.

Machine Learning:

Machine Learning is another hot topic of today. There are plenty number of sources on the internet and some of them are well structured,some of them not. There are a lot of apps which uses machine learning but actually they do not need. In the first month of this semester we spend our majority time to discussion and research. Because it is meaningless to use machine learning if app do not require. After well organized plan we decide that our app need some machine learning techniques. We bought udemy course for learning machine learning techniques. Three members of team learned ML from this course another team member are taking ML course in Bilkent now. Every week when we meet for project we discuss our knowledge try to improve our techniques.

6 References

[1] Iansiti Marco and Karim R. Lakhani. "The truth about blockchain" Harvard Business Review. https://enterprisersproject.com/sites/default/files/the_truth_about_blockchain.pdf. [Accessed: Oct 25, 2019]

[2] "Managed MongoDB Hosting | Database-as-a-Service", MongoDB, 2019. [Online]. Available: https://www.mongodb.com/cloud/atlas. [Accessed: 21- Dec- 2019].

[3] "Hyperledger - Open source blockchain for business - IBM Blockchain", Ibm.com, 2019. [Online]. Available: https://www.ibm.com/blockchain/hyperledger. [Accessed: 21- Dec- 2019].

[4] "bcrypt", npm, 2019. [Online]. Available: https://www.npmjs.com/package/bcrypt. [Accessed: 21- Dec- 2019].