Health Monitoring

Group #1

Report 1

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Customer Statement and Requirements (CSR)

Problem Statement

It's general knowledge that a person's chosen living environment will have some impact on a their health. Occasionally a study will appear claiming that a person exposed to some condition is more or less likely to suffer from some physical ailment. When these claims are definitively proven drastic steps are taken to improve the state of being. Some intuitive examples of this would be exposure to pollution or hazardous build materials. Cities and homes are now designed in such a way to avoid health hazards due to these findings however these are now obvious hazards. Perhaps a more worrying concern is what has not been found or proven to be hazardous yet for conditions that are not as obvious.

So it's possible to come up with a whole new set of questions but collecting data on a person's daily living situation and fitting their habits to a generic category of well known issues does not really give insight on a better living style. Instead an effort should be made to try to find new ways of proving what may be abnormal in a person's health. For example it may be interesting to know the rate cancer appears in people that live in a close proximity to a power plant against the normal rate but there is no reason to limit this to power plants. Analysis can be done on long term exposure to high pollution. Living in areas with high or low atmospheric pressure can be found to lead to irregular heart beat. Not only does this allow for long term health recording but it also informs the user how their environment could potentially harm them.

Thanks to the developing of technology, it's now possible to use a mount of sensors and applications in smart phones to monitor the data of our health. For example, the PPG sensor monitors a person's heart rate. This can be considered one of the most basic index of health. The temperature transducer can be used to detect skin temperature. Another emerging trend is to use a phone's inbuilt gyroscope sensor to track how many steps the user has taken today. Once all this data is logged in a single database a number of methods can be applied to manipulate data in such a way that an simple mobile application will be able to tell a user more about their health on demand. To keep up with a user's standards and emerging market trends there's a dire need to have smarter feedback that moves most of the work away from a user. Many mobile users are not willing to dive deep into a topic and instead want a simplified summary of what they're looking for.

In general, feedback regarding our health is given through three major source. The first and most reliable option would be a visit to the doctor's office. Since a doctor's office is properly equipped to perform a patient checkout this is without a doubt the preferred method but these visits are infrequent. It's also impossible for your doctor to know about your lifestyle habits from a simple checkup. The next major source would be a word of mouth advice. Many people seem to want to cross check what their doctor might of told them with a friend or family member. This is a fair response however everyone will need to validate these responses moving to the final

source of webpage documents. There's a few trusted sites that can help validate this information however it's alway left to the user's discretion and not always easy to find. The new proposed method is to instead collect basic vitality signs and health indicators from a user's mobile device and return a simple feedback on how well their health is.The idea is to not only collect information on how healthy the user is but also information that would help determine health risks with the user. The value of this information includes a large user base for ad revenue, keeping a consistent record of vitality factors for research and development, and a very useful indicator for health insurance companies to possibly provide discounts to lower risk users.This indicates that a domain of possibilities may be overlooked from a simple doctor's visit. In the future it may even be possible to tell more about a person's health than a visit to a doctor provided the platform evolves with emerging technology.

The first major requirement is to establish a way to collect user health information from their mobile device. The application will need to be simple to use so information can be obtained on people of all ages which consequently extends our user base. It should also keep user information private. It's very easy for someone to feel hesitant that they're health is being monitored so it's important that they feel the application can be trusted. No one will want to download an application that does not give them something in return so it's important that they get active and fun feedback about their health. It's very import that the average person feels like the application is helping them make better health decisions and not just collecting information on them. It's also very important to get this done as soon as possible. The earlier data is collected the easier it will be to strike a balance between the software functionality and time to develop. Overall it's important to find a use for all the information that's being collected on the user and in return be able to give better insight on their health.

The next step is to to figure out the data can be related to user's health condition. External data sources can be used to map back to health data. For example a lookup of locations nearby that can negatively impact their health or the pollution level of the region might reveal interesting facts about the user. By knowing how often a user is exposed to these conditions it's possible yield more logical conclusions. It will be very helpful to notify a user that they are say for example spending 60% of their time near a long term health hazard. It would also be very helpful for researchers to possibly verify or debunk some of the general beliefs about these so called hazards. Overtime this data can be anonymously shared for medical research to validate or come up with new conclusions. It's also important to come up with simple and generalized conclusions based on the data being collected alone. By collecting some initial information like the user's age and gender it's easier to categorize the user base. Some other initial user information that may be helpful is if the user has a pre-existing health condition however it may be possible to cross check this information from a medical system in the future as the application evolves. Over time it should be possible to find what may be normal conditions for a person's health for that particular group.

Finally, it's important to come to a conclusion regarding the user's health through some generalized health index and relaying that information in a simplified form back to the user. The main challenge of this part is finding a index that is easy to measure but also a reliable judge of a user's health. One of the simplest measures that can be a good indicator of user health is possibly heart rate. It may be possible as more data is collected to figure out a trend between a user with a healthy heart versus a user with an unhealthy heart. This builds off the first major requirement in the sense that the earlier data is collected the better. Basically a smarter decision can be made by getting a head start on finding health irregularities from these measurements. By building up reliable algorithms predictions will be made, tested and verified. Only then can a reliable conclusion be made.

Contemporary, some existing personal health monitoring application collect user data via a smartwatch or other external devices that are not available to the majority. For most cases, those apps cannot work without a Bluetooth connection to external devices. Since the smartphone consists of many different kinds of sensors with the networking functionality, it could be used in monitoring user's health conditions. It will definitely be of great convenience to the user. Additionally, it will be quite easy to link the internet using smartphone rather than wearable devices for collecting data. Especially for uploading and analyzing those data. This makes the data a lot more shareable and casts a larger net on the possible number of users the application covers.

In order to generate more conclusive results without intuitive data, connecting different types of data together is a great approach. For example, location information from mapping service providers will play an important role in this project. By mapping the location info to different databases, such as income, pollution and altitude, additional data will be found and analyzed. So overall the data we're collecting needs to be able to easily link back to pre-existing information possibly collected by another company.

Some additional social network functions can be a good way for applying the sense of competition into this app. For example, users can share their exercising status on facebook. An intuitive UI design may courage people to download the same application and achieving a great health condition with friends can be a strong motivator for customers to improve their own health. What's more, the system will apply different strategies to analysis data collected. For instance, the application could count the time which user marks as "going to the gym" for "strenuous exercise" and other activity time for "mild exercise" such as walking or doing housework. Then the total activity condition will be generated based on those two main kind of activity status.

After adopting machine learning method, the application can give users some advice. At this time, using some external links, actual examples and pictures can help users understand better. Then users can easily combine application's advice and information on the Internet to make a plan which is suitable to the users themselves. And this way can help users relieve pressure, they do not need to follow the application.

System Requirements

Functional Requirements

Identifier	Priority Weight	Requirement
Req-1	5	The system will insert sensor measurements to a remote database.
Req-2	1	Hold sensor data on mobile phone when no network connection if present.
Req-3	1	Upload sensor data upon connection reestablishment.
Req-4	2	History log will be presented when there is a requirement
Req-5	2	Send periodic user health feedback based on the environment.
Req-6	3	Send user general health feedback based on heart rate.
Req-7	4	Send user energy consumption feedback based on quantity of motion.
Req-8	2	System should give out advice about user's daily activity.
Req-9	1	Allow user to give out feedbacks to developer.
Req-10	3	Use GPS sensors to get the data about location, velocity and moving distance.
Req-11	3	Use map information and location data from GPS to analyze which places users stay in.
Req-12	2	Provide pollution level based on map location.
Req-13	3	Use PGG sensors to get user's current heart rate.
Req-14	3	Use temperature transducer to get the skin temperature.
Req-15	2	The data analysis should be processed in the cloud system.
Req-16	3	Analyze the places users stay in and the data from acceleration sensor and speculate the action of users.

Req-17	3	Use gyroscope to get data of level, orientation, velocity and accelerated velocity.
Req-18	4	Using vibration sensor to detect user's spontaneous physical actions during sleep.
Req-19	3	Use heart rate to estimate the mental health condition of the user.
Req-20	2	The application should require minimum number of user's inputs.
Req-21	2	The system should be easy to use. For example, feedback should be got within 3 clicks.
Req-22	1	The administrator should be able to access user's data and make changes.
Req-23	2	The system should be robust. Malfunction of several sensors will not break down the whole system.
Req-24	4	All user data should be encrypted for privacy security.
Req-25	3	The application should keep working in the background.
Req-26	1	Every icon must be clickable, otherwise it should become a grey one.
Req-27	2	Allow users share their location.
Req-28	1	Landscape mode should be available.

Non-Functional Requirements

Identifier	Priority Weight	Requirement
Req-1	3	Allow user to select which sensors to report on to allow additional privacy and power efficiency.
Req-2	2	Option to only upload data when on WiFi to avoid extra mobile charges.
Req-3	2	Allow user to share health condition with friends.
Req-4	2	The system should require little maintenance.

Req-5	2	The system should provide with a straightforward UI showing the conditions of user's parts of body.
Req-6	1	The feature of UI can change based on different seasons and festivals.
Req-7	2	The system should provide link about professional nouns.
Req-8	1	Some tips related to weather condition are posted to users.
Req-9	4	Users' data should be saved in their cell phone when transmission is termination.
Req-10	1	Apply larger icons and limit the number of items in each menu for better visual experience.

Glossary of Terms

Accelerometer: An accelerometer is a device that measures proper acceleration. In the system it can be used in detecting the vibration and user's abrupt actions. Function: measure acceleration, tilt and vibration

PPG sensor: Measure the bio-potential generated by electrical signals that control the expansion and contraction of heart chambers.

Gyroscope: Used to detect orientation. Typically used to detect motion.

Temperature sensor : Detect the temperature change, and pass into data.

Light sensor: A light sensor is a device that detects light or other electromagnetic energy. In this system it detect light conditions to show the sleeping status.

User Interface (UI):The goal of user interface design is to produce a user interface which makes it easy (self-explanatory), efficient, and enjoyable (user-friendly) to operate a machine in the way which produces the desired result.

Compass: An instrument containing a magnetized pointer that shows the direction of magnetic north and bearings from it.

Displacement sensor: An instrument to measure travel range between where an object is and a reference position.

Atmospheric pressure sensor: A a scientific instrument used in meteorology to measure atmospheric pressure. Pressure tendency can forecast short term changes in the weather.
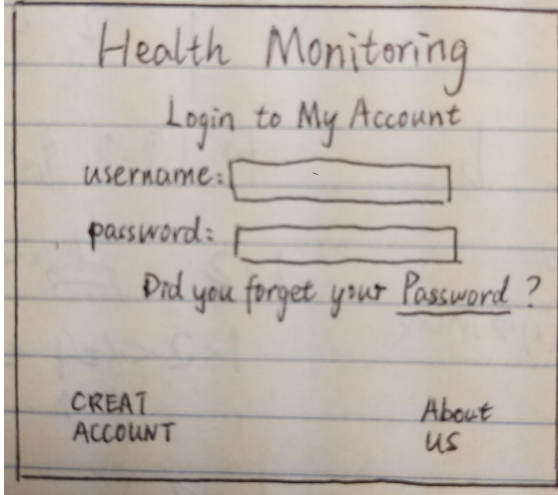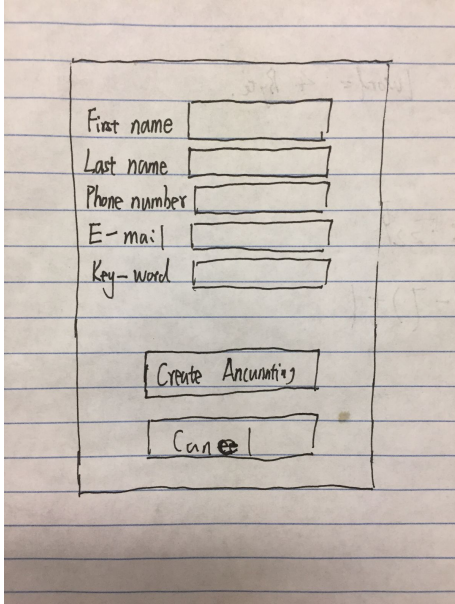
Tile Server: A program running on a remote machine that returns mapped location images for a set of coordinates.
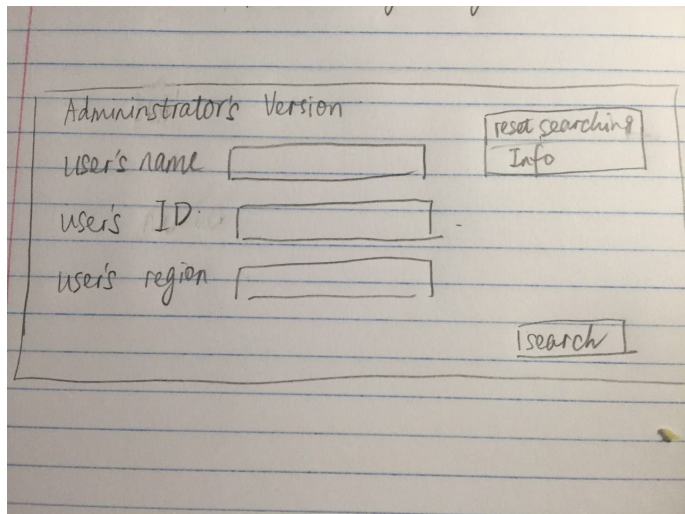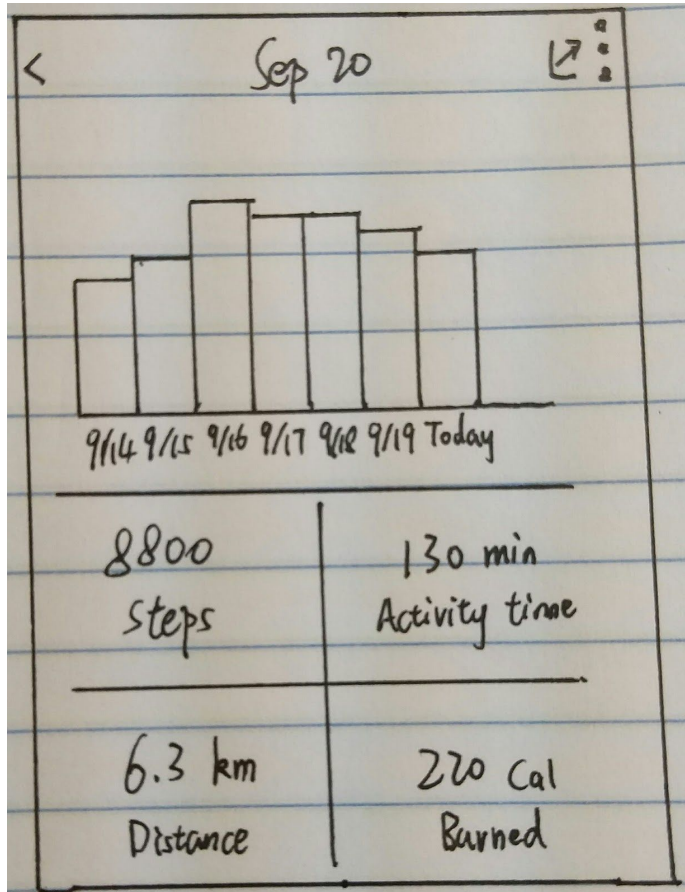
Android (operating system): Android is a mobile operating system developed by Google, based on the Linux kernel and designed primarily for touchscreen mobile devices such as smartphones and tablets.
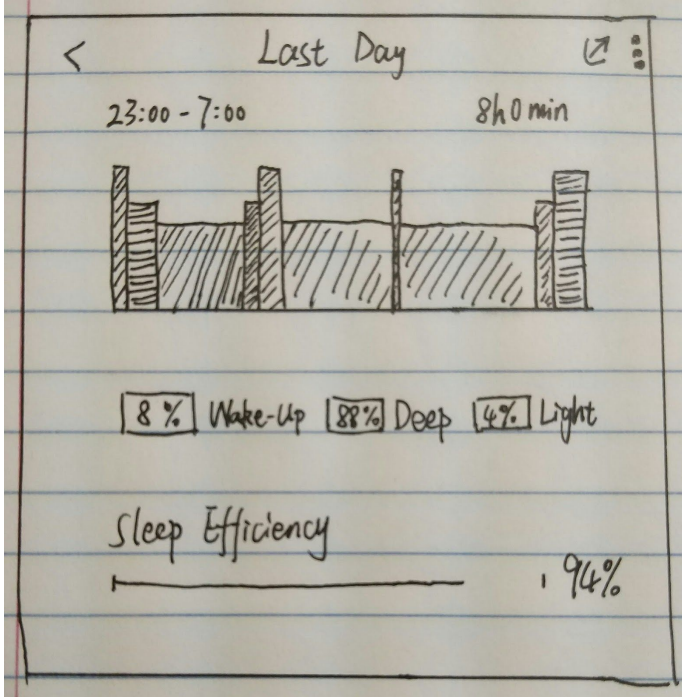
GIS: Geographic Information System, a system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data.
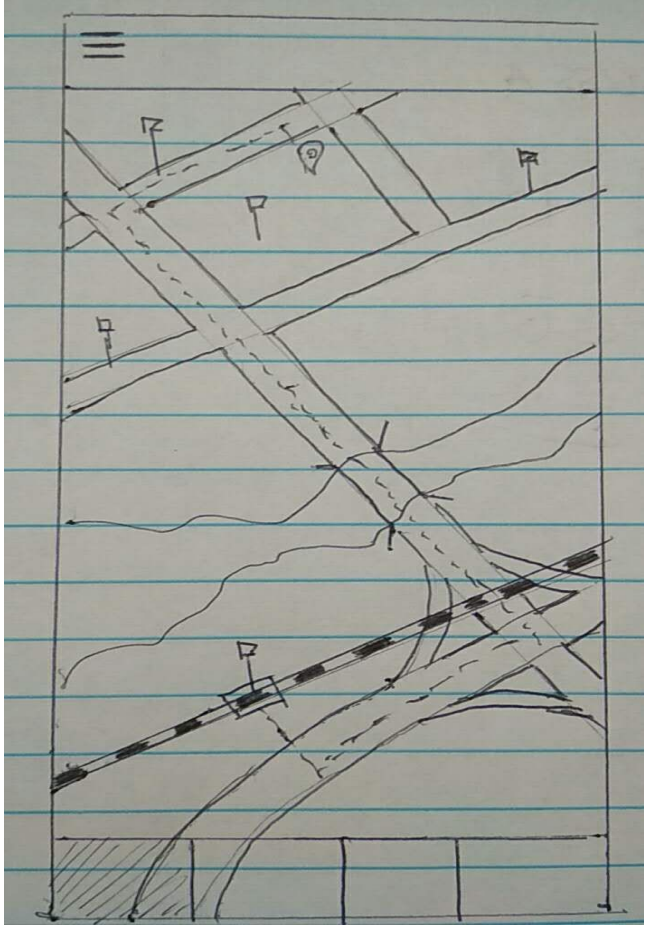
User Base: Established group of users for a particular computer program.
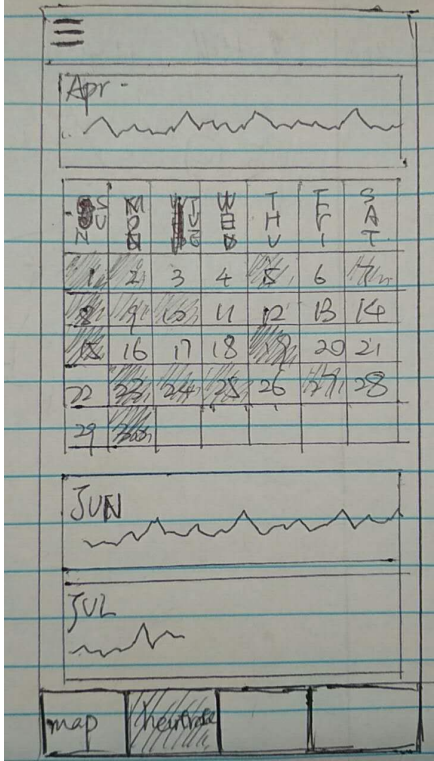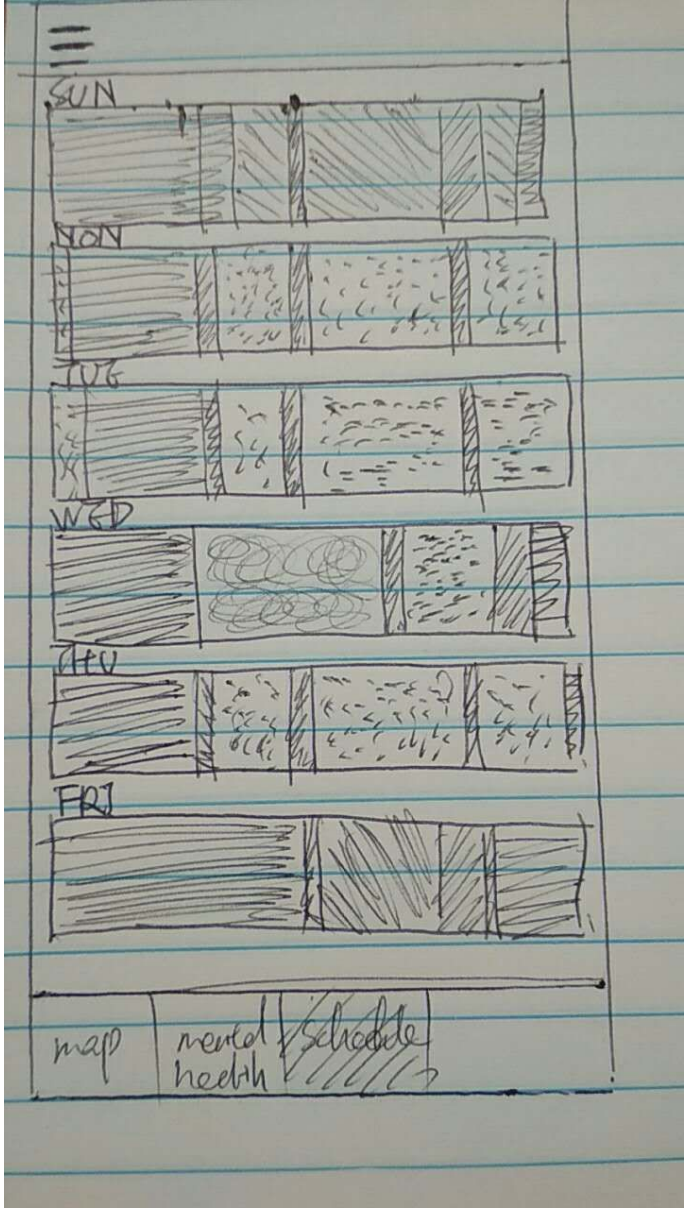
On-Screen Appearance

Identifier	Priority Weight	Requirements
Req-1	4	Users should have a secure login and register interface. Health Monitoring Login to My Account username: password: Did you forget your Password? CREAT ACCOUNT About us
Req-2	4	As a new customer, I want to create a new account if I have not registered. First name Last name Phone number E-mail Key-word Create Accounting Cancel
Req-3	1	As a manager, I can access user's data and make changes.
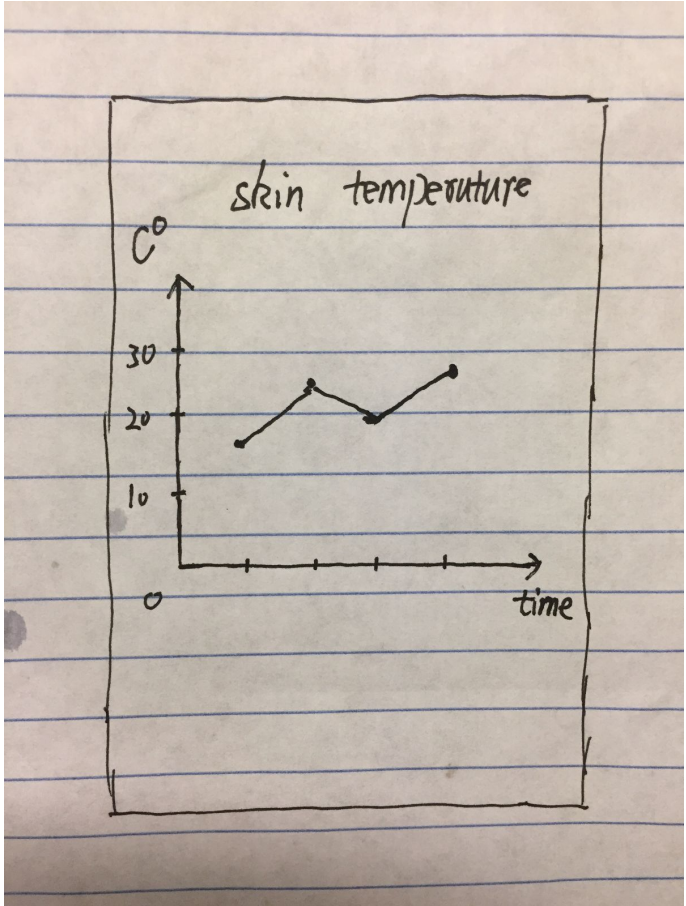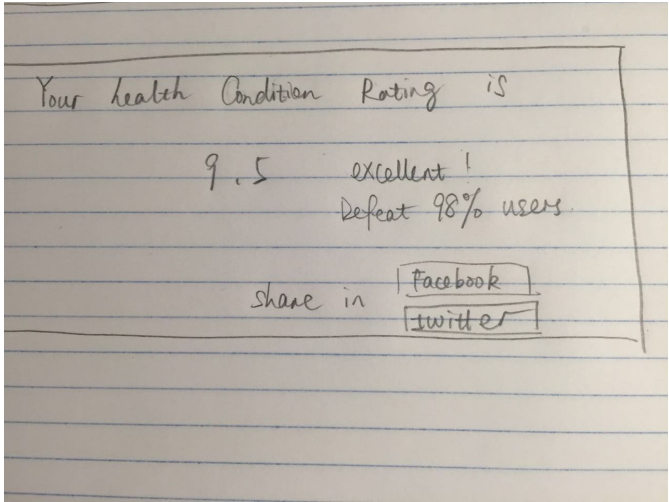
		Administrator's Version user's name [ ] reset searching Info user's ID [ ] user's region [ ] [search]
4		User's daily activities (for example walking) data and history data. Sep 20 9/14 9/15 9/16 9/17 9/18 9/19 Today 8800 Steps 130 min Activity time 6.3 km Distance 220 Cal Burned
5		Sleeping status of last night, 7 days in the past and more history data.
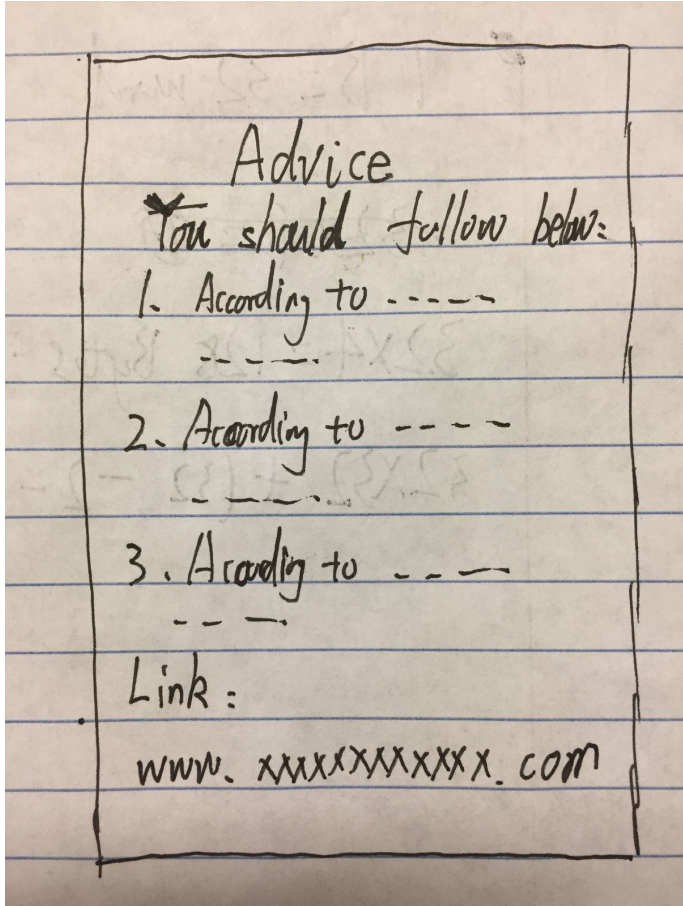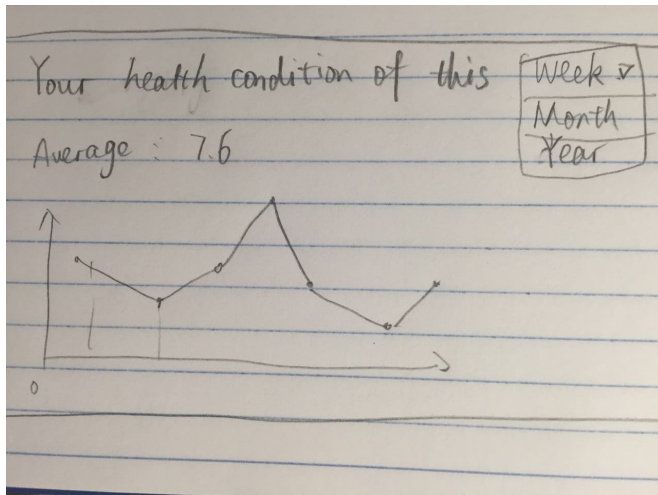
Req-6	4	To show map information and data collected by GPS sensor.
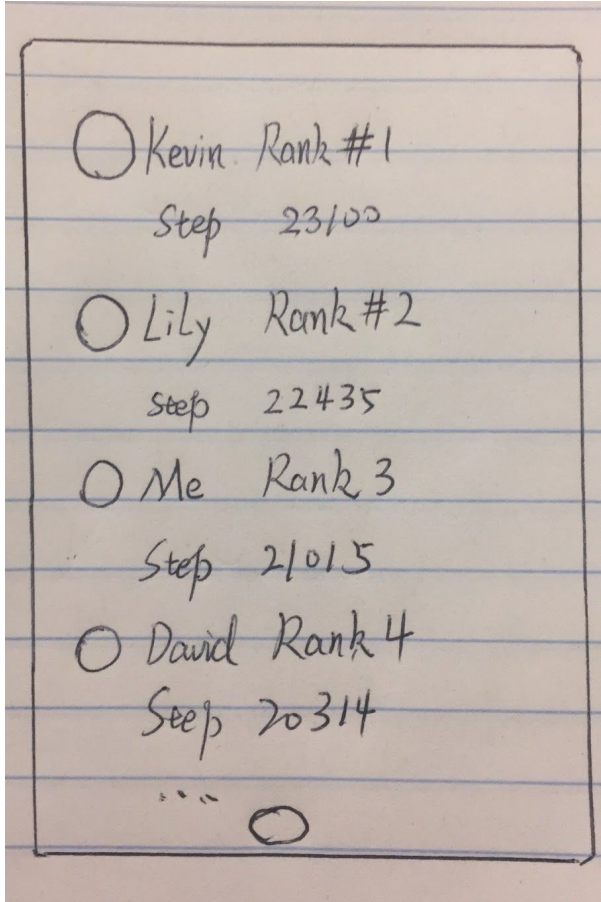
Req-7	4	To show the heart rate data as calendar and use different colours to show the level of mental health.

| Req-Y8 | 4 | Show the probable schedule of the user estimated by data analysis. |

Req-9	3	To show the temperature data as line chart.

Req-10	2	Users are able to share their health condition to social communication app.
Req-11	3	After analyzing, the application can give users advice and some links.

Advice
You should follow below:
1. According to - - - - -
- - - - -.
2. According to - - - -
- - - -.
3. According to - - - -
- - - -.
Link :
www. xxxxxxxxxx.com

Req-12	3	System should provide history log and real time chart of their health condition.
Req-13	2	Step ranking list.

Your health condition of this Week ✓ Month Year
Average : 7.6

Req-14	2	Pollution map of America: yellow area is most polluted area, and red needle is the location of user.

Project Management

- The group has scheduled a weekly meeting time on Tuesday 6:00 pm.
- We will hold online meetings based on requirements.
- Our primary channels for productivity have been GroupMe and Google Drive. Within our shared Google Drive folder, we all have access to our reports and additional resources that may be useful to the team. All of our reports have and will be edited in parallel by all group members.
- The team also has BitBucket and GitHub accounts that will be used to host code in the near future.
- No team leader has been officially decided.
- Data Collection (Hongyuan Shen, Guanjiang Yang)
  - Collect data from different sensors
  - Collect data from mapping software
  - Integrate different data types into database

- Data Reduction (Kai Guo, Ziqi Ai)
  - Simple linear regression on base health index
  - Multiple linear regression on compound data types
  - Provide Pearson product-moment correlation coefficient

- Data Analysis (Xiang Xing, Kevin Pielacki)
  - Machine learning approach
  - User's interface and straightforward data display
  - Dashboard to display aggregated data

Functional Requirements Specification

Stakeholders

- **Customer**
- **Developers and Maintenance Team**
- **Business Companies**

Actors and Goals

- **User**
  - **Primary Initiating Actor**
  - **Attempting to monitor and improve health**
- **Administor**

- - ○ **Supporting Actor**
    - ○ **Keeps track of user accounts and system maintenance**
  - **Database: Cloud**
    - ○ **Offstage Actor**
    - ○ **Keeps record of user data for analysis and summary results**
  - **Sub-database: Smart-Phone**
    - ○ **Offstage Actor**
    - ○ **Keeps temporary record of user data until ready to upload to cloud**
  - **System**
    - ○ **Offstage Actor**
    - ○ **Inner working of web server, database, and analyzer**
  - **Health Insurance Agent**
    - ○ **Initiating Actor**
    - ○ **Attempting to better categorize users**

Actor	Actor's Goal	Use Case Name
User	Begin tracking their personal health.	Registration (UC-1)
User	View current account.	Login (UC-1)
Administrator	Track and modify user accounts.	AdminPortal (UC-1)
Database	Log sensor data to remote server.	DataCollection (UC-2, UC-3)
Sub-Database	Temporarily hold sensor data until ready to upload with steady network connection.	TempData (UC-3)
User	View logged health status and history.	HealthDashboard (UC-2)
User	View a quick summary of overall health.	HealthScore (UC-3)
GPS Data	Provide list of nearby environmental hazards.	GISAnalysis (UC-3)

Heart Rate Data	Provide prediction of better or declining health.	HeartRateAnalysis (UC-3)
User	Get suggestions on how to improve health.	HealthFeedback (UC-4)
User	Share overall health status with friends.	SocialPlugin (UC-5)
Insurance Agent	View a new applicant's health condition.	UserPublicSummary (UC-3, UC-6)

Use Cases

Casual Descriptions

UC-1: Registration and Sign In

User A creates an account through the login in page. User A provides his/her personal information on the login page. After server confirmation, User A can login with email and password.

UC-2: Data Display

User A wants to check his/her health data in a diagram or chart. User A select year/month/week then heart rate/walking distance/etc and the corresponding chart will be displayed.

UC-3: Data Analysis and Estimation

User can get ratings based on the data set selected.User can also get an overall score of their health condition.

UC-4: Getting Advice

If User wants to get some advice to improve their health condition, Click get advice button and advice will be displayed based on their health index.

UC-5: Sharing Health Conditions

User A can share his/her health condition to social communication Software.

UC-6: Business Summary

A health insurance company wants can use a summary of a person's health status to offer more competitive rates to the user.

Use Case Diagram
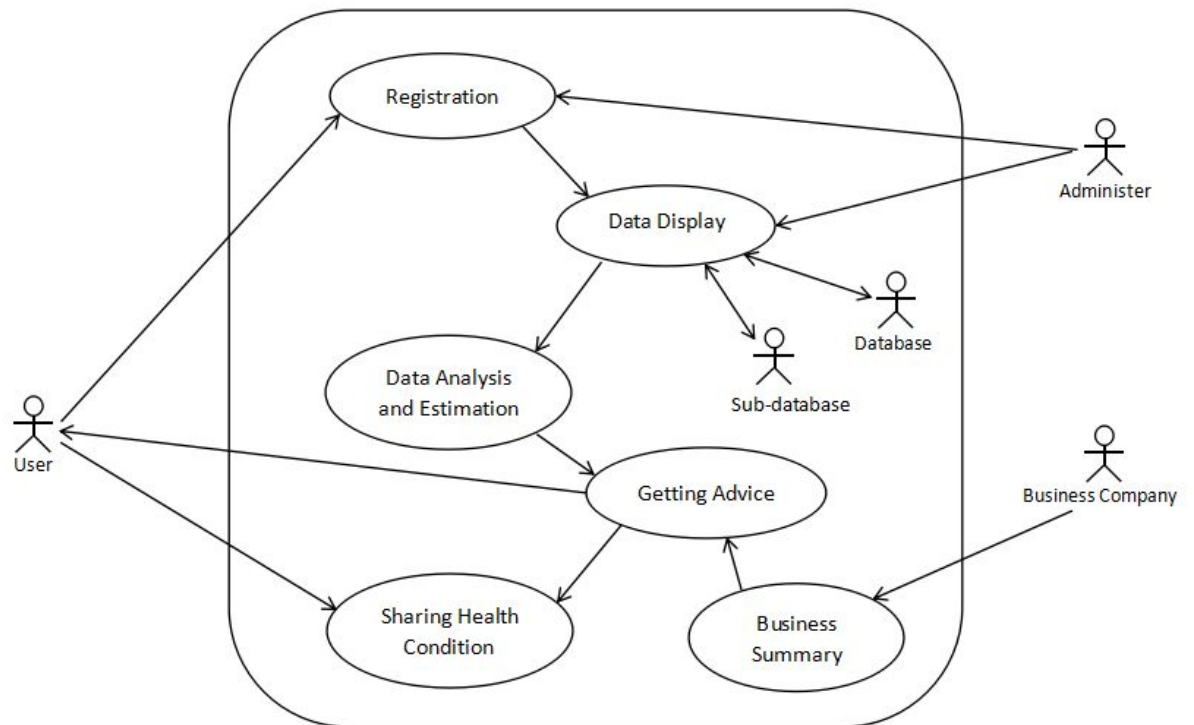
Traceability Matrix

Requirements	Priority Weight	UC-1	UC-2	UC-3	UC-4	UC-5	UC-6
F-Req-1	5		x				x
F-Req-2	1		x				
F-Req-3	1	x					
F-Req-4	2	x					
F-Req-5	2				x		
F-Req-6	3		x		x		
F-Req-7	4		x		x		
F-Req-8	2				x		

F-Req-9	1						
F-Req-10	3		x				
F-Req-11	3		x	x			
F-Req-12	2			x			x
F-Req-13	3		x				
F-Req-14	3		x				
F-Req-15	2			x			x
F-Req-16	3			x			
F-Req-17	3		x				
F-Req-18	4						
F-Req-19	3			x			x
F-Req-20	2						
F-Req-21	2						
F-Req-22	1						
F-Req-23	2						
F-Req-24	4						x
F-Req-25	3		x				
F-Req-26	1		x				
F-Req-27	2		x				
F-Req-28	1						
NF-Req-1	3						
NF-Req-2	2						
NF-Req-3	2					x	

NF-Req-4	2						
NF-Req-5	2						
NF-Req-6	1						
NF-Req-7	2						
NF-Req-8	1						
NF-Req-9	4	x					
NF-Req-10	1						

Full Dressed Descriptions

Use Case UC-1:	Registration and Sign In
Related Requirements:	F-Req-3, F- Req-4, NF-Req-9
Initiating Actor:	User, Administrator
Actor's Goal	To create an account on smart-phone which allows customer to make reservations and modify the personal and healthy information.
Participating Actors:	User Administor Database: cloud Sub-database: smart-phone System
Preconditions:	Users have to provide their right personal health information.
Postconditions:	User account information will be stored in the database and can be modified by the user at any time.
Flow of Events for main Success Scenario:	
→ 1 The user presses the "Create an account" button on login page.	

←	2	The App displays a form for the user to fill out. This form contains the First Name, Last Name, Email, Password, and Password Confirmation fields.
→	3	The user fills out the required information and presses "Submit."
←	4	The system verifies the information. This check ensures that the account does not already exist within the database of the users.
←	5	The system stores the user's information into a database and allows the user to log in with the username and password.

Use Case UC-2:	Data display
Related Requirements:	FReq1, FReq2, FReq 6, F-Req7, F-Req10, F-Req 11, F-Req 11, F-Req 13, F-Req 14, F-Req 17, F-Req 25, F-Req 26, F-Req 27
Initiating Actor:	System
Actor's Goal	To transmit the data from web server to user's smartphone and then display the data to user in the form of timetable or chart.
Participating Actors:	Database
Preconditions:	User logs in the application and start to upload data.
Postconditions:	User's health data will be stored in the database.
Flow of Events for main Success Scenario:→←	
←	1	The application is opened or activated(from background) by user .

→	2	The database transmit the health data from web servers to the smartphone, and the data is collected from GPS, gyroscope sensor, temperature transducer and PGG sensor.
→	3	The default page "TODAY" opens and present heart rate, present body temperature,today's step number and today's energy consumption show in this page.(This is a default page, so every time user activate this app this page shows to user.)
←	4	User presses the bottom button "CALENDAR".
→	4a	The page "CALENDAR" opens.
←	4b	User presses the any date he/she wants.
→	4c	It opens a page that shows average heart rate, average body temperature and step number and energy consumption in that page. In the other hand, show "ERROR" if there is no data for that date
←	5	User presses the bottom button "CHART".
→	5a	The page "CHART" opens.
←	5b	It opens a page that shows several charts of daily data in one month. The ordinate is respectively average heart rate, average body temperature and step number and energy consumption, and the abscissa are days in a month

Use Case UC-3:	Data Analyze and Estimation
Related Requirements:	F-Req-11,F-Req-12,F-Req-15,F-Req-16,F-Req-19
Initiating Actor:	Customer, Database
Actor's Goal	To get a conclusion of current health condition.
Participating Actors:	Analyzing System

Preconditions:	System access the database successfully and all the data needed for analyzing
Postconditions:	Conclusions about user's health condition will be posted and stored in the database

Flow of Events for main Success Scenario:		
→	1	The customer click "Get my health rating"
←	2	The system require data from database
→	3	Database transfer corresponding data to system
←	4	System analyze the data and provide conclusion to UI and store it in to database and history log

Use Case UC-4:	Getting Advice
Related Requirements:	F-Req-5, F-Req-6, F-Req-7, F-Req-8
Initiating Actor:	User
Actor's Goal:	User click the getting advice button.
Participating Actors:	System, Database
Preconditions:	Give user advice, which is based on user's health index, to improve their health condition.
Postconditions:	Professional advice will be displaced on the screen.

Flow of Events for main Success Scenario:		
→	1	The application get plenty of health data through sensor and cloud database.

←	2	User click the "Get advice icon".
→	3	System analyze the data and define a standard to determine whether user is health or not.
←	4	Based on user's health condition, system give the user professional advice.
←	5	The advice show on the screen.

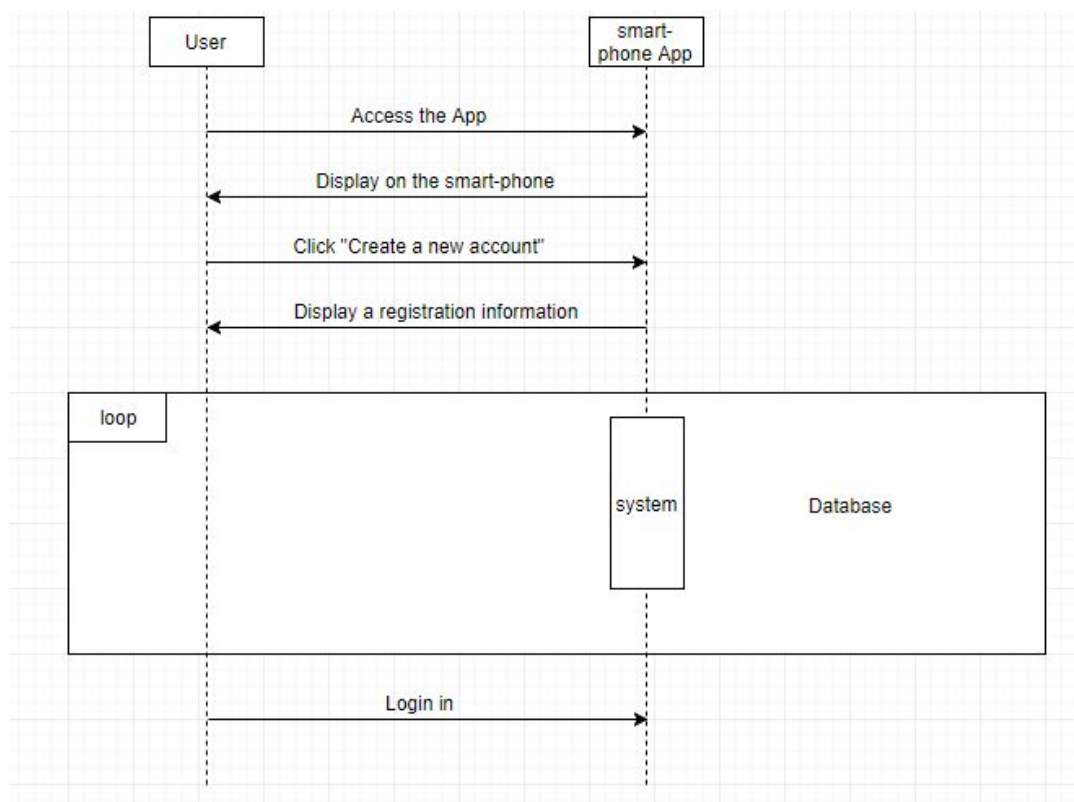| Use Case UC-5:	Sharing Health Conditions
Related Requirements:	F-REQ-4, F-REQ-5, F-REQ-6, F-REQ-7, F-REQ-8 NF-REQ-3
Initiating Actor:	User, Database: cloud, System
Actor's Goal	To share the health conditions result of a specific user with other users. Firstly, the system gets feedback from the cloud database and showing this user's general health status and his/her activity conditions. Then the user could share that information with their friends on their Facebook or Twitter. What's more, this user's status will be displayed as "running", "swimming" or other kinds of excise depended on the user's choice.
Participating Actors:	Other users
Preconditions:	The database on the cloud has conserved the user's data.
Postconditions:	The status of user will be taken into account for the strategy to analyze the daily activities of this user.
Flow of Events for main Success Scenario:	
→ 1	The user presses the "Share info" button on the main page or pages of other categories to choose which kind of data he/she wants to share with friends.

←	2	The system provides the user with some detail information, and ask the user to make sure that the information is exactly what he/she wants to share.
→	3	The user presses the "Yes, go on." button.
←	4	The system asks the user to choose a way that he/she wants to share the information on, such as "Facebook", "Twitter".
→	5	The user choose one way to share the information.
←	6	The system will show "Sharing successfully".
Flow of Events for Extensions (Alternate Scenarios):		
→	1B	The user presses the "Share activity" button on the main page to share excising activity he/she is doing with friends.

Use Case UC-6	Business Usage
Related Requirements:	F-Req-1, F-Req 12, F-Req 15, F-Req 19, F-Req 24
Initiating Actor:	Health Insurance Agent
Actor's Goal	To find more information about a someone applying for coverage to offer a better rate.
Participating Actors:	System Server, Database, Cloud
Preconditions:	The person applying for coverage must have an active account with the application.
Postconditions:	Return general user score and simple reasoning breakdown.
Flow of Events for main Success Scenario:	

|		
→	1	A health insurance company reaches an agreement with the application's owner to share data.

|		
←	2	An agent from the insurance company sees a new applicant has an active account.
→	3	The agent visits a web page that gives a simple risk and reward analysis.
←	4	The agent can categorize the applicant to a better suited group based on the information provided.
←	5	The agent is able to offer a better rate due to the health information provided by the application's owner.

System Sequence Diagrams

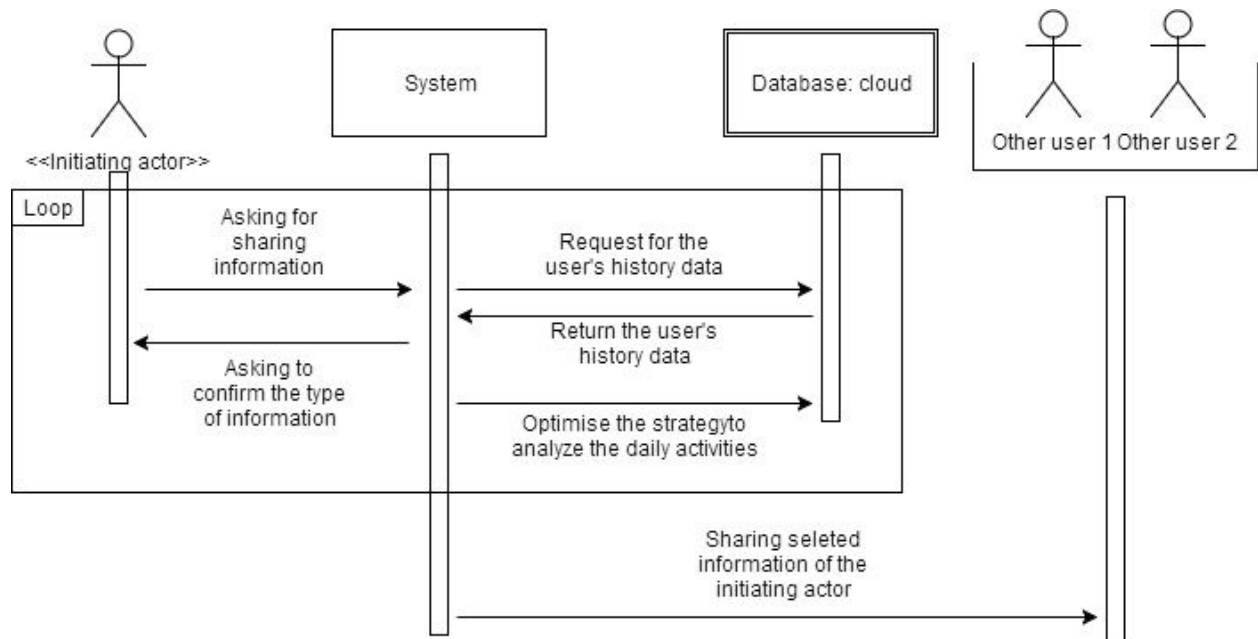## UC-1 Registration and Sign In
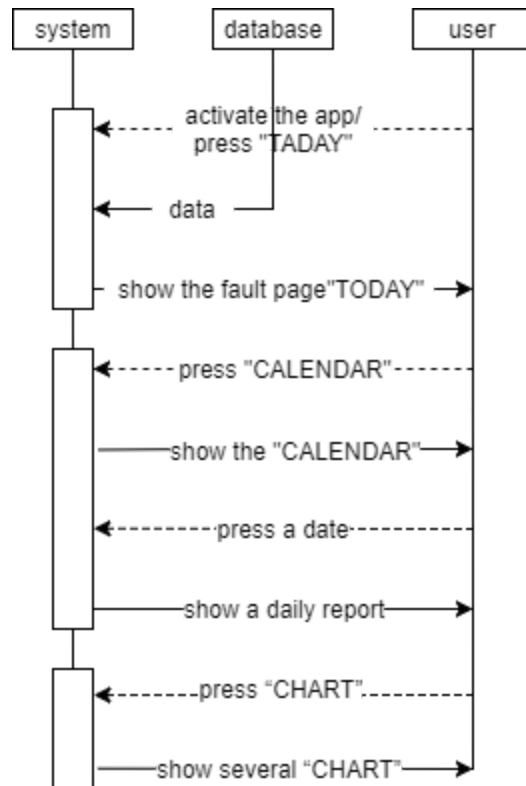
UC-2 Data display

UC-3 Data Analyze and Estimation
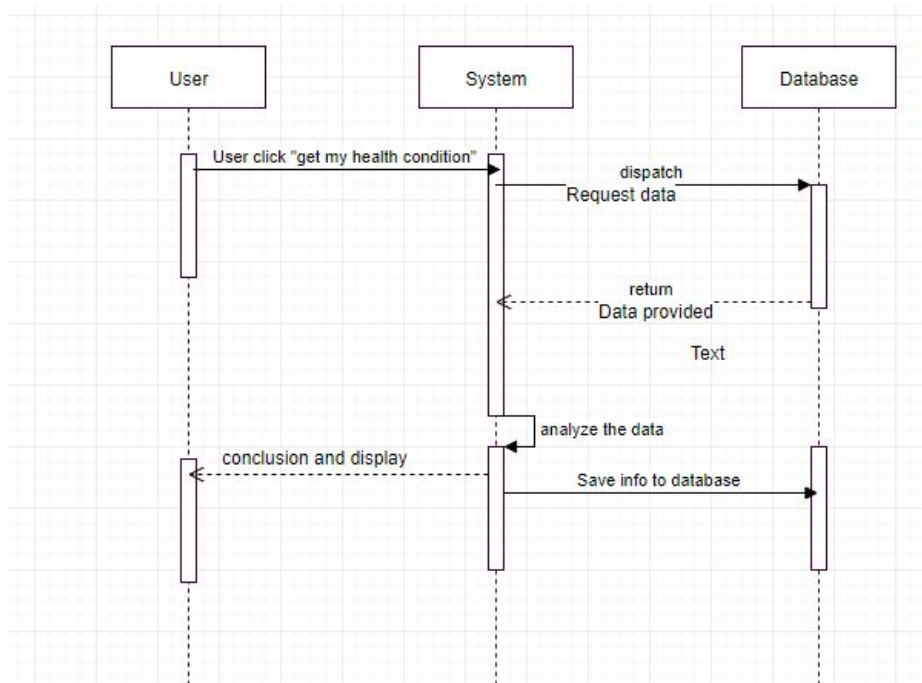
UC-4 Getting Advice
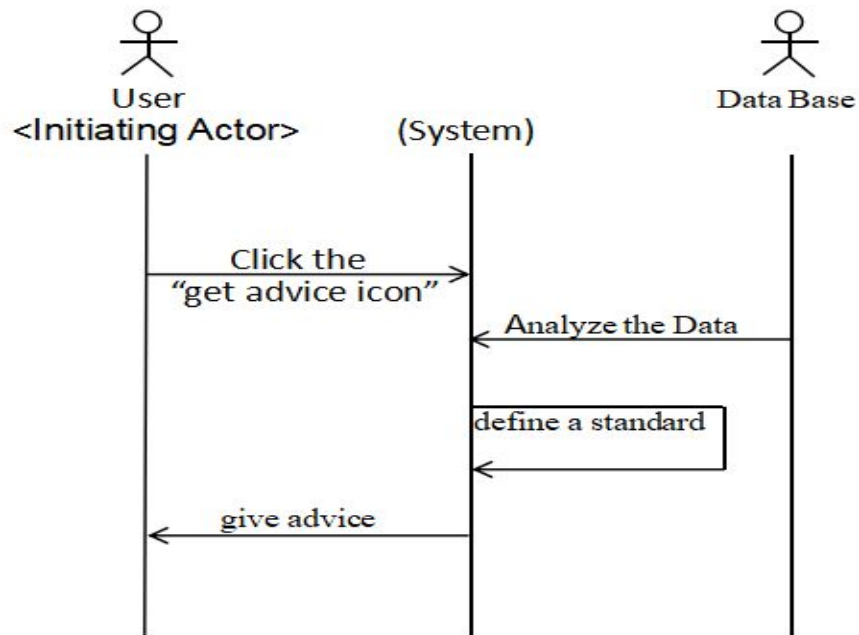
UC-5 Sharing Health Conditions

UC-6 Business Usage

User Interface Specification

Preliminary Design

UC-1 Registration and Sign In

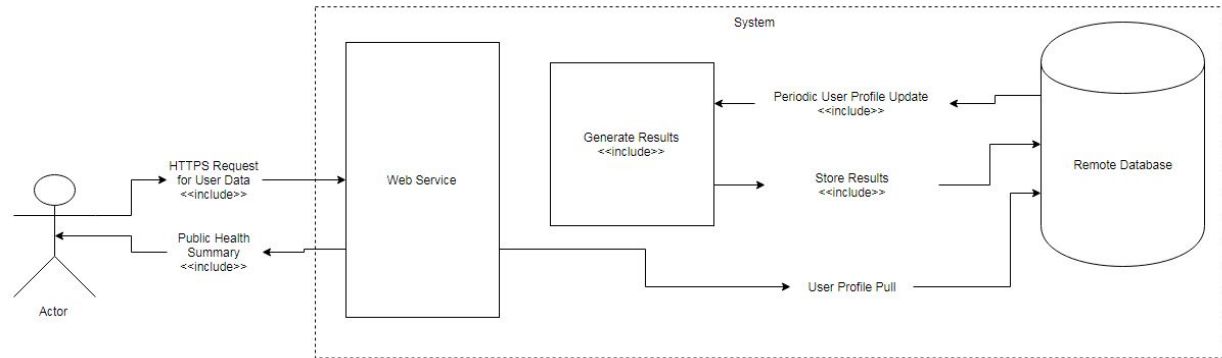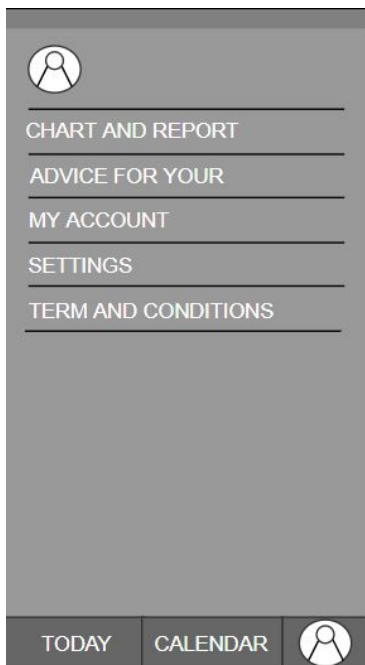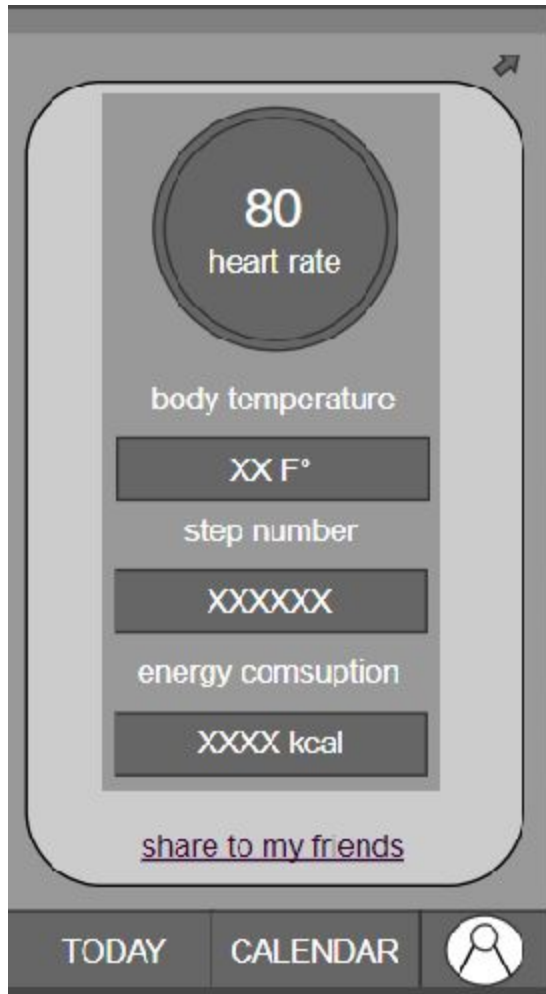## UC-2 Data Display
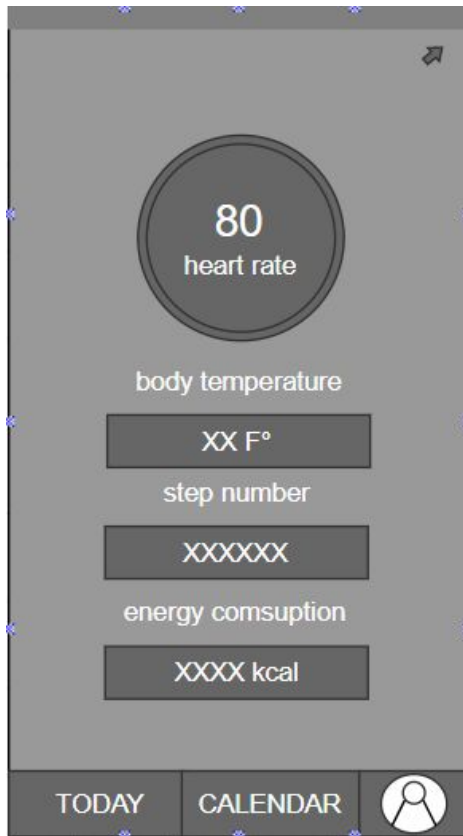
UC-3 Data Analyze and Estimation & UC-4 Getting Advice

UC-5 Sharing Health Conditions

UC-6 Business Usage

Health Monitoring

User Health Report

Email Address

User ID

Request Report

UC-1: Registration and Sign In

Assuming that the user is new to this system and did not have an account before.

NAVIGATION: total 2 presses
1. Press the "Create an account" button on login page.
2. After filling out the information, press the "Submit" button.
3. DATA ENTRY: total 5 fields to be filled out
4. Fill out the displayed form fields named "First name", "Last name", "Email", "Password", and "Password Confirmation".

UC-2: Data Display

Assuming that the user has already created an account and has logged in, and the user wants to see some health information.

NAVIGATION: total 4 presses
1. Open the application and the default page is "Today".
2. Press the "Calendar" button on "Today" page.
3. Press any of the date button.
4. Press the bottom button "Chart".
5. DATA ENTRY: none

UC-3: Data Analysis and Estimation

Assuming that the user has already in the default page.

NAVIGATION: total 1 press
1. Press the "Get my health rating" button on default page.
2. DATA ENTRY: none.

UC-4: Getting Advice

Assuming that the user is already in the default page.

NAVIGATION: total 1 press
1. Press the "Get advice icon" button on default page.
2. DATA ENTRY: none.

UC-5: Sharing Health Conditions

Assuming that the user is already in the default page and wants to share the health conditions with their friends on social media.

NAVIGATION: total 3 presses
1. Press the "Share info" button on the default page.
   a. Other cases: if the user is already in other detail displaying pages, there is also a "Share info" button on the page.
2. Press the "Yes, go on" button.
3. Choose the social media type by pressing one of those options on the displayed menu.
4. DATA ENTRY: none.

UC-6: Business Usage

Assuming the applicant already has an active account.

NAVIGATION: total 3 presses and single form field
1. Login with partnered account.
2. Visit page to request user health report.
3. Fill form with user ID information
4. Download or view in in browser report.

Project Management

- The group has scheduled a weekly meeting time on Tuesday 6:00 pm.
- We will hold online meetings based on requirements.
- Our primary channels for productivity have been GroupMe and Google Drive. Within our shared Google Drive folder, we all have access to our reports and additional resources that may be useful to the team. All of our reports have and will be edited in parallel by all group members.
- The team also has BitBucket and GitHub accounts that will be used to host code in the near future.
- No team leader has been officially decided.
- Data Collection (Hongyuan Shen, Guanjiang Yang)
  - Collect data from different sensors
  - Collect data from mapping software
  - Integrate different data types into database

- Data Reduction (Kai Guo, Ziqi Ai)
  - Simple linear regression on base health index
  - Multiple linear regression on compound data types
  - Provide Pearson product-moment correlation coefficient

- Data Analysis (Xiang Xing, Kevin Pielacki)
  - Machine learning approach
  - User's interface and straightforward data display
  - Dashboard to display aggregated data

Domain Analysis

Domain Model

UC-1: Registration and Sign In
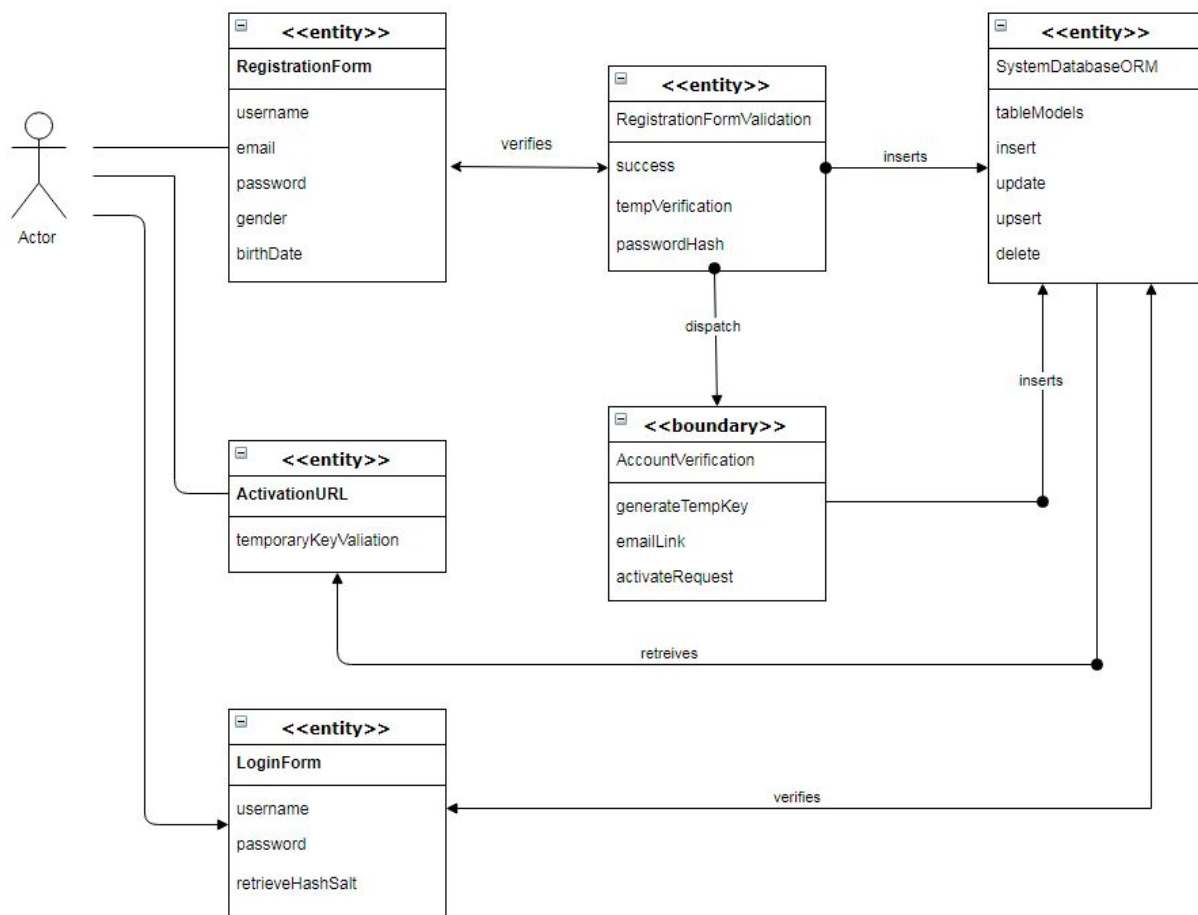
UC-2-4: Data Display and Getting Advice
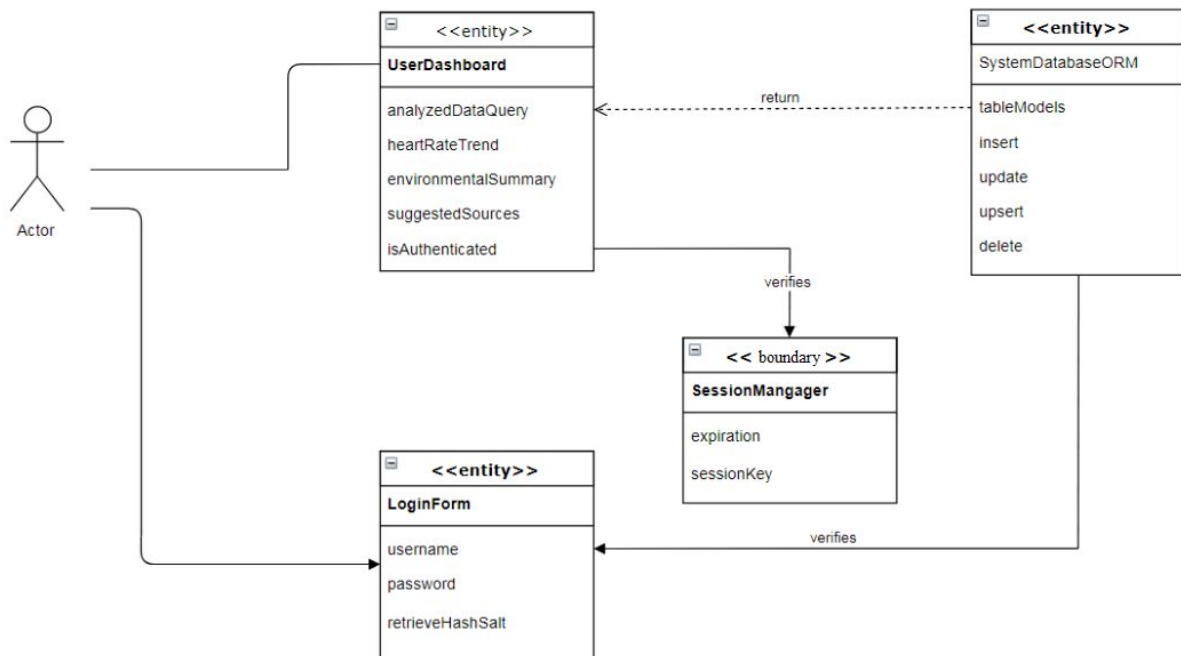
UC-3-: Data Analysis and Estimation
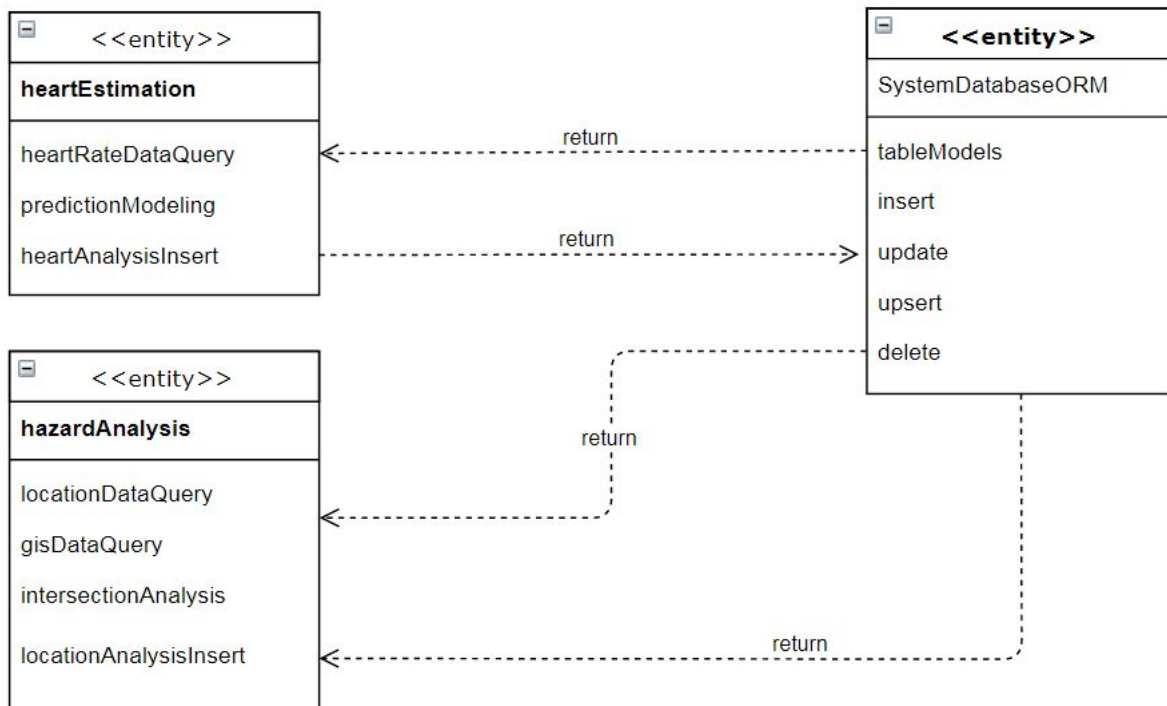
UC-5: Sharing Health Conditions
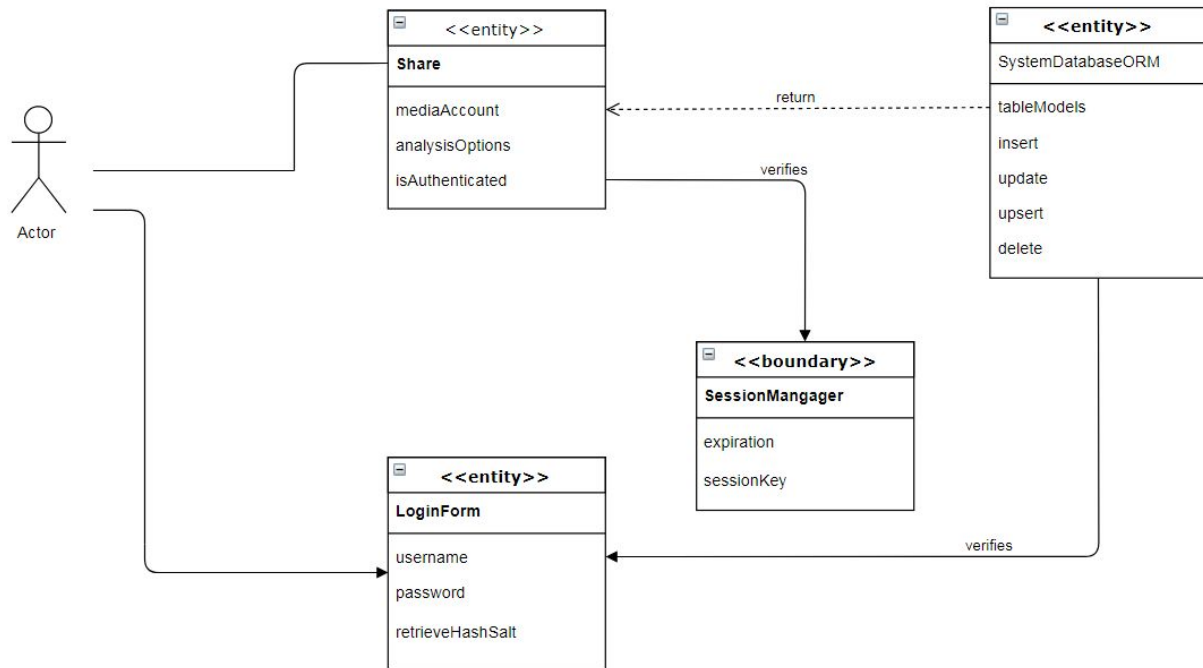
UC-6: Business Summary
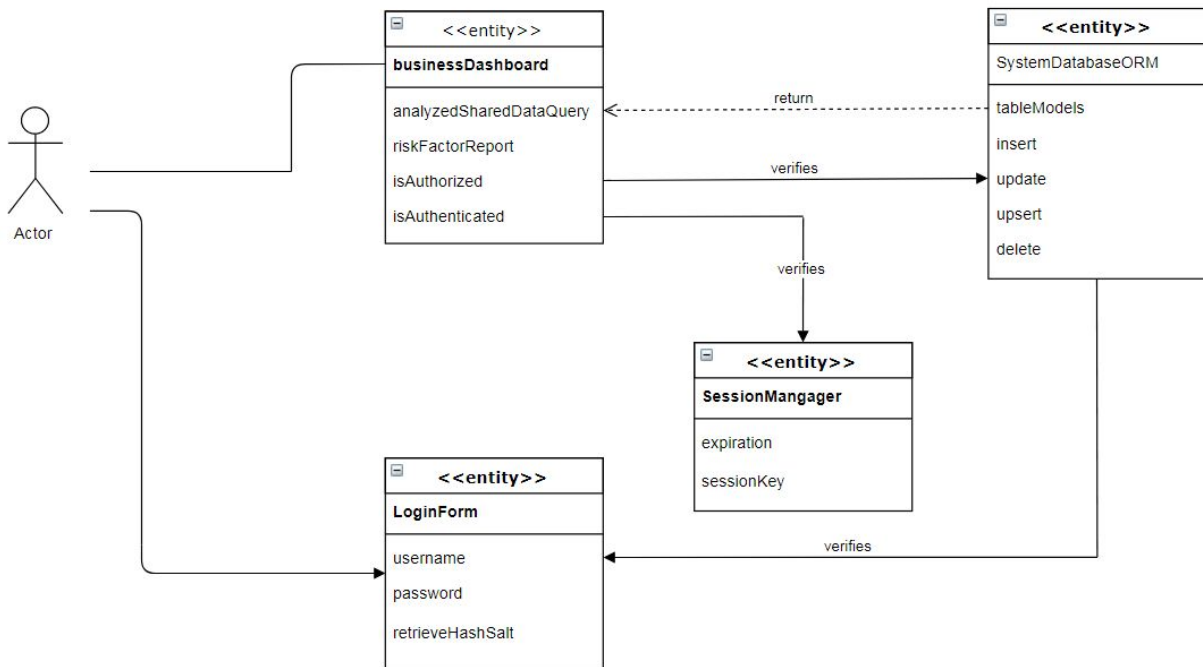
Traceability Matrix

		Domain Concepts			
		User Interface	System	Business Company	Database
Use Cases	UC-1 (Registration and Sign In)	X	X		
	UC-2 (Data Display)	X	X		X
	UC-3 (Data Analysis and Estimation)		X	X	X
	UC-4 (Getting Advice)	X	X	X	
	UC-5 (Sharing Health Conditions)	X	X		
	UC-6 (Business Summary)			X	

Concept Definitions

(D=Doing; K=Knowing; N=Neither)

Responsibility	Type	Concept
User creates account and inputs all of required personal information on the login page	D	User Interface
User can login the app using his/her account and password	K	User Interface
User can retrieve their password	K	User Interface
Transmits the data from web server to user's smartphone	D	System
Displays the data to user in the form of timetable or chart	D	System
Analyzes user's data and give useful advice to the user	D	System
Stores the data from user's smartphone	D	Database
User can download the previous data from the database	D	Database
Manages all users' health information	D	Manager Interface
Allows the App to use the location information and search around location information from the map	D	Internet Connection

server		
Links to the database	D	Internet Connection
Senses user's changes all the time.	D	Sensor
All part of this App should connect with each part.	D	Controller

Associative Definitions

Registration and Sign in And databases	User passes information through an interface like App. The information ranges from account info to making a reservation	Pass information to local database and upload to cloud database
Data Display and database	Database and Sub-database pass data to User Interface	Database Updated and pass Data to UI
Database and Data Analysis and Estimation	Database pass user's data to analysis and estimation system and system pass the conclusion back to database	Data analysis and storage
Advising System and Database	Database pass user's conclusion to system and system show the result to user	Conveys Information
Social communication system, database and UI	Pass the screenshot and user's info to the social communication app and share the status	Conveys User's information and health condition
Business Summary and database	Cloud database pass User's information to website	Conveys Business Info

Attribute Definitions

Concept	Attributes	Definition
User Interface	Registration form	User fills in the form and passes the user's info to the database

	Loginform	User fills in the form and submits for verification
	Analyze dashboard	Page to show the analyzed data such as energy consumption and average heart rate of the user
	Heart rate trend	A page shows the heart rate report based on the data analysis
	Environmental summary	A page shown the nearby environmental report based on the recent pollution conditions
	Suggested sources	A page shown the advice given by the health summary.
Database	Registration and validation	Check out the database and add user's info into the database. Create validation status to be confirmed
	Analyzing and estimation processes	Store the conclusion and link them to the corresponding user's information
	Updating and edit	Synchronize user's local database to System cloud database. Allow admin to edit user's info and data
	Userinfo	Contains the user information such as email, gender, date of birth and personal preferences.
	HistroyList	Contain user's health history, both in local database and system database
Analyzing System	Prediction model	A series of math models applied to estimate the health conditions through the collected data.
	Intersection analyze	Combine two or more different kinds of data together to analyze health condition.
Business Website	Risk factor report	A report includes the possible health risk for business analyzed from the health data
	Authorization	User can choose whether to authorize the

		report to business.
Social Communication applications	Social communication	use can touch the "arrow" icon, and then share the corresponding screenshot and health summary to other application.

System Operation Contracts

Operation	Registration and Sign In
Class Invariants	The user requires access to registration an account and sign in the application
Preconditions	❏ The user must fill in the necessary fields in the registration form. ❏ The user must enter a valid Email address. ❏ The user must enter a valid password.
Postconditions	➔ An account is created for the user and this information is stored in the database in a cloud server. ➔ The account information can be modified by the user at any time. ➔ The user can retrieve his/her password after finishing the registration.

Operation	Data Display
Class Invariants	Users can view their current health condition and history
Preconditions	❏ The user login the app ❏ The user should upload information or use the app for a period that will produce enough dataset..
Postconditions	➔ Graphs will be created based on the dataset and history ➔ Users are able to check their profile and make changes

Operation	Data Analyze and Estimation
Class Invariants	The system provides the user with his/her current health condition.
Preconditions	❏ Sub-database on the smartphone can keep user's data temporarily until the access to the cloud server is available ❏ all the data needed for analyzing are available. ❏ Getting conclusions about user's health condition
Postconditions	➔ The result will be posted and stored in the database ➔ Showing the result to users

Operation	Getting advice
Class Invariants	User can get advice from the cloud system.
Preconditions	❏ The cloud system can get data from user's smart phone, and then analyze the data. ❏ The user can obtain advice from system cloud.
Postconditions	➔ User can see the advice in their App. ➔ The App can show more information which is on the Internet for users.

Operation	Sharing Health Conditions
Class Invariants	To share the health conditions result of a specific user with other users.
Preconditions	❏ The database on the cloud has conserved the user's data. ❏ The system gets feedback from the cloud database and showing this user's general health status and his/her activity conditions. ❏ The user should choose which kind of information he/her wants to share with

	their friends.
Postconditions	➔ The user's status will be displayed as "running", "swimming" or other kinds of excise depended on the user's choice. ➔ The status of user will be taken into account for the further strategy to analyze the daily activities of this user. ➔ The system will show the message informing the share condition.

Operation	Business summary
Class Invariants	The system can estimate the potential health risk from the health condition report for business requirement.
Preconditions	❏ The user must fill in the necessary fields in the registration form. ❏ The user must access all the required data for a long period. ❏ The user must authorize the application to send the risk summary.
Postconditions	➔ A recent summary is created for the user and send it to specific company. ➔ The summary is private information and can only be used for the authorized business aim.

Plan of Work

ID	Task Name	Duration	6 Sep 2017	13 Sep 2017	20 Sep 2017	27 Sep 2017	4 Sep 2017	11 Dec 2017	19 Dec 2017	25 Dec 2017	1 Dec 2017	8 Dec 2017	15 Dec 2017	22 Dec 2017
1.0	Project management													
1.1	Project Understanding	10	██											
1.2	Project Planning	15	███											
2.0	Task Breakdown	10	███											
3.0	Interface Design	15					████							
4.0	Database Design	20							██████					
5.0	Controller Design	25						███████						
6.0	Simulation Design	15									██████			
7.0	Integration	25											████	
8.0	Testing	25											████	

Breakdown of Responsibilities

Group Member Name	Xiang Xing
Work Done So Far	Responsible for team organization and communication. I have been constructing the structure and breakdown of each report and submitting after organization.
Future Work	I will continue to facilitate the division of work to ensure that everyone contributes evenly and meets deadlines. Code wise, I will learn how machine learning work for our analyzing purpose.

Group Member Name	Kai GUO
Work Done So Far	Understanding and managing the project. Working with other team members to finish report 1, 2and 3.
Future Work	Programming part of the application. Working on data reduction and find the relation between user's daily data and their health condition

Group Member Name	Hongyuan Shen
Work Done So Far	Learn something about the data collection and finish all reports with other team members.
Future Work	Working on the part of data collection and machine learning.

Group Member Name	Ziqi Ai
Work Done So Far	Working with other team members to develop the design of system functions and finish each report.
Future Work	Working on the part of data analysis and sharing function.I will learn the application of machine learning method.

Group Member Name	Guanjiang Yang
Work Done So Far	Finish the chosen part of the report, and learn the database knowledge.
Future Work	Working on the part of data collection and machine learning.

Group Member Name	Kevin Pielacki
Work Done So Far	Remote virtual machine access, shared MySQL server,

	researching Java web and phone app frameworks.
Future Work	Working on post analyzer to enable periodic data updates.