

CS 5542 Project Increment 1

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Introduction

Nowadays, the technology is getting improved day after day and hour after hour. From this point, all the people start looking for new ideas and projects which help to simplify the daily issues for the people. Moreover, as we know the data in different types through different social media websites and applications are getting improved and increased every single second as well. Especially, when we talk about large amount of data and how to use this data in a sufficient way to serve us in a better way.

There are many majors and many different ways to get use of this data so that it would be sufficient for all the people in an easy, fast and simple way. For example, having an application for storing the patient's record is one of the best ideas, so that whenever something happens to this patient, all what the doctors have to do is checking in his last records about his health in the previous days and his previous illnesses. In this way, we used the data which we collected for all the patients in a better way and display it in a good application that is easy to be read.

In our project, we will do almost the same. We will use the technology (such as the smartphone or smartwatch) to get help and serve us in a better way in our daily life. Our project is about reading and monitoring some people's health parameters and make necessary assistance if necessary. Also, it can make life easy by recognizing and fetching the objects we want through controlling of smartwatch or smartphone. The smartphone and smartwatch will be paired, so the communication between the two can be easy and quite useful. We will do these through using big data tools such as spark which is a very good tool to deal with such data and analyse it.

In the next pages, we will discuss about the class and sequence diagrams for the project and we will explain the objectives of this project, APIs were used and the other tools and programming languages.

Project Goal and Objectives

- Overall goal(revised)

The main purpose of this project is to provide realistic assistance to adult, especially for seniors in 24/7 based. Such personal aid functions has become more critical in modern lives. Specifically, our “Baymax Duo” will provide very personalized health monitoring functions, which include body health monitoring, environmental safety and indoor objects identification functions such that to improve user’s life quality and safety.

- Specific objectives(problem statement)

Since we are focusing on application development for adults (especially for seniors). There are always issues related to unpredictable events, such as sudden illness, life threats that come from others. It is necessary to address those issues and develop certain applications to provide convenient assistant and reduce those potential threat in an urgent, precautious and effective manners.

- Specific features

By using health monitoring functions, if a user is experiencing potential health threat (such as heart attack, stroke, fall down, lost conscious etc), by matching real time data reading with the database to make assistance if necessary to increase patients’ surviving probabilities. At the same time, it can send out emergency signals to the user’s relatives, local police stations, hospitals etc. whenever it is necessary.

By utilizing image recognition function, the smartphone can capture human face characters and compare it with specific database to identify if this “unknown” person is a criminal or just his/her friends and send the analyzed results to the user.

Indoor objects identification ability is another feature that we are going to implement later on in our project. Since the Romo is part of user’s family, It must get familiar with its new home first. With that being said, it must start learning the basic objectives such as where is the wall, doors, general blueprint of the locations (in another word, robot should learn what a door, wall, or a cup should looks likes and what decisions should the robot make based on his previous learning experience-data/images etc). After recognizing these objects, by controlling of the smartphone or smartwatch, the Romo can fetch these objects for the user if they are wanted.

The smartwatch and smartphone are paired. In that case, the communication between the two devices could be easy. Notifications can be sent in two-way. The user can control the smartphone by just controlling the smartwatch, which would make life easy.

- Significance

With the development of modern civilization, people concern health, safety, and convenience much more than before. How to enjoy a life with high quality becomes a valuable question

considered by commercial market. We have four concerns according to the motivation. First, due to unawareness, some people suffer severely from sudden heart attack, which may even threaten the lives. In this case, Baymax Duo we propose could provide necessary assistance, such as bring medicine to these people and send text message to relevant people or hospital to save the lives. Second, criminal recognition is of great significance to protect home safety. Baymax Duo provides such function to identify criminals and friends to reinforce home safety. In that way, potential threaten to home could be eliminated as much as possible. Third, with the help of Baymax Duo, some easy work, such as fetching objects could be done by just making arm gestures. This will not only realize a more comfortable life, but also help improve the life quality of elderly people or disabled people. For example, if an old man wants to drink some water, he doesn't need to go to the kitchen to get it, the only thing he needs is to make the arm gestures with the smartwatch. The Romo on the other side will pick up the water for him. Also, the smartwatch and smartphone are paired. The two devices can communicate with each other easily. This will make life easy by taking advantages of the two and controlling one device through another one. Based on the four major functions, our Baymax Duo has the practical value and infinite market potentials without any doubts.

Project Plan

1) Schedule for the four different increments

A. Increment 1

List of work:

- a. Project design, including scenario, use case specification, and feature design.
- b. Design class diagram
- c. Design sequence diagram
- d. Design architecture diagram
- e. Manage sensors in both smartwatch and phone.
- f. Implement AlchemyAPI in phone app.

Scenario & use case specification & feature design & feature implementation:

Use case 1: send phone sensor information to smartwatch

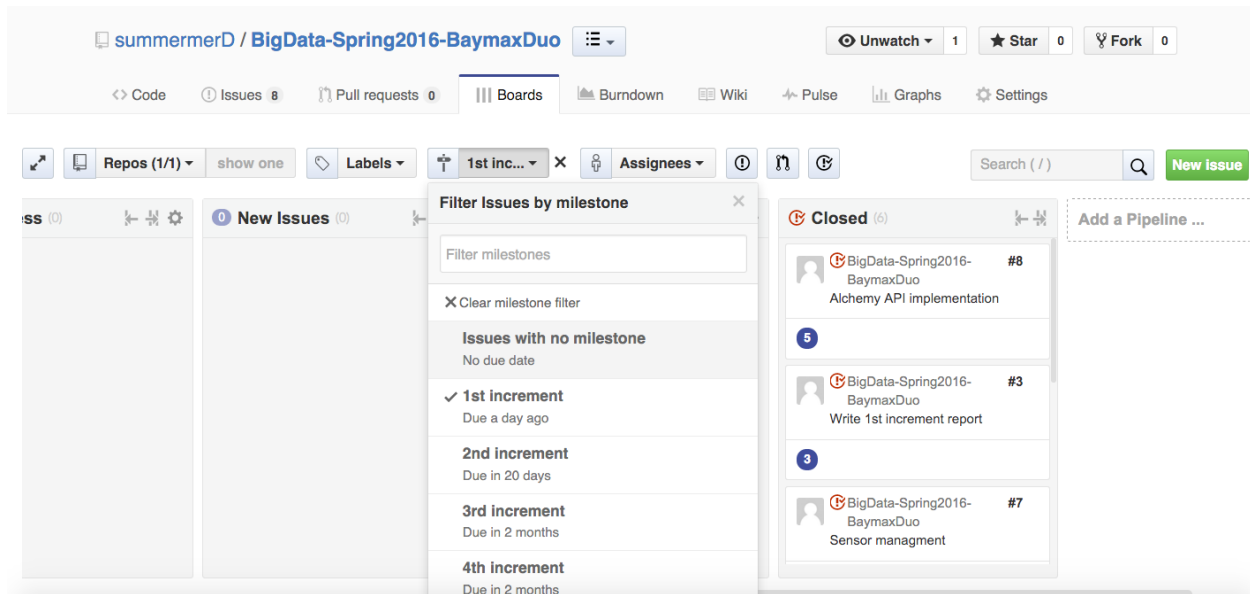
The phone has many sensors, such as accelerometer, light sensor, magnetic sensor, etc. The detected results can be sent to smartwatch by clicking the button on the phone. The user who wears the smartwatch can get the information.

We implement it by combining the sensor code with the notification code.

Use case 2: analyze image information by Alchemy API

We implement Alchemy API in android phone by using android Alchemy SDK. Alchemy API can provide image recognition as well as text analysis. So when a user chooses one image and clicks the button, the Alchemy API will analyze the image and give the category of the image it detects.

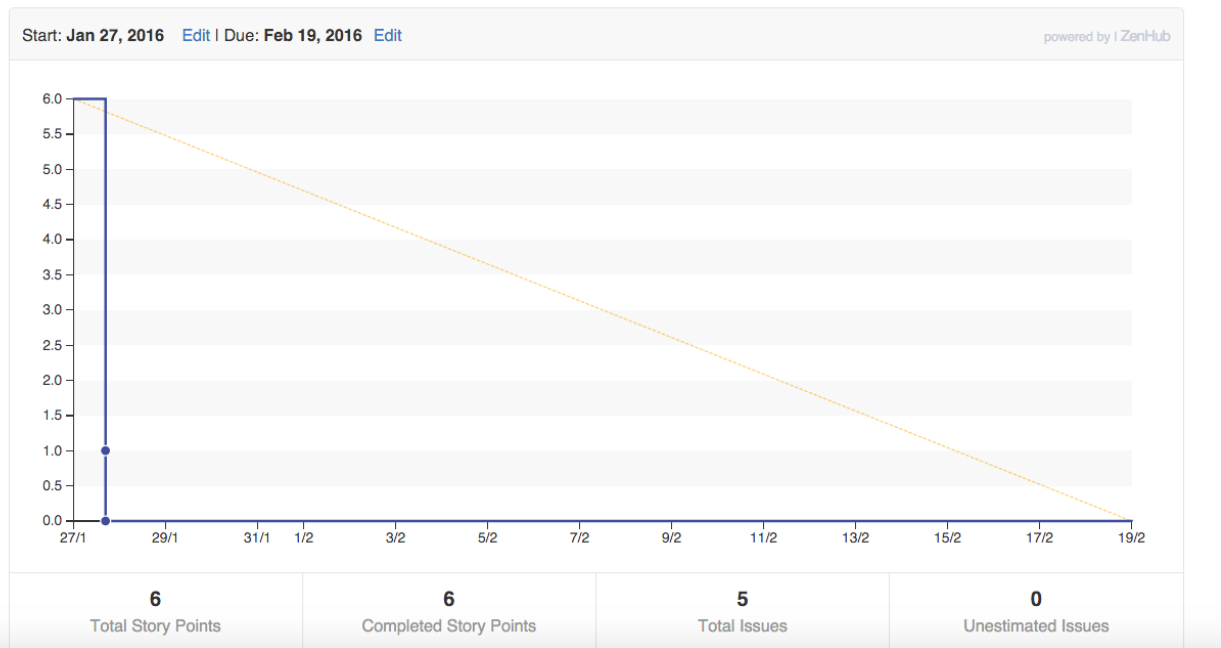
Boards:



Burndown chart:

1st increment

 Edit Milestone  Change Milestone ▾



B. Increment 2

List of work:

- Get training data from smartwatch
- Communicate between smartwatch and phone
- Use Spark to analyze training data sets obtained from smartwatch and phone.
- Implement movement of Romo

Scenario & use case specification & feature design & feature implementation:

Use case 1: We will measure the heart rate of the user and get lots of training data. Then figure out the normal range of the user. The training data can be sent to phone and analyzed by Spark.

Use case 2: We will let the Romo move by making gestures of smartwatch or touching the screen of phone. We will use object-C to code.

Boards:

summermerD / BigData-Spring2016-BaymaxDuo

<> Code 8 Issues 8 Pull requests 0 Boards Burndown Wiki Pulse

Repos (1/1) show one Labels 2nd inc... Assignees

16 Backlog (4)

- BigData-Spring2016-BaymaxDuo #9
Get training data from smartwatch
3
- BigData-Spring2016-BaymaxDuo #10
Communicate between smartwatch and phone
3
- BigData-Spring2016-BaymaxDuo #11
Use Spark to analyze training

0 To Do (0)

Filter Issues by milestone

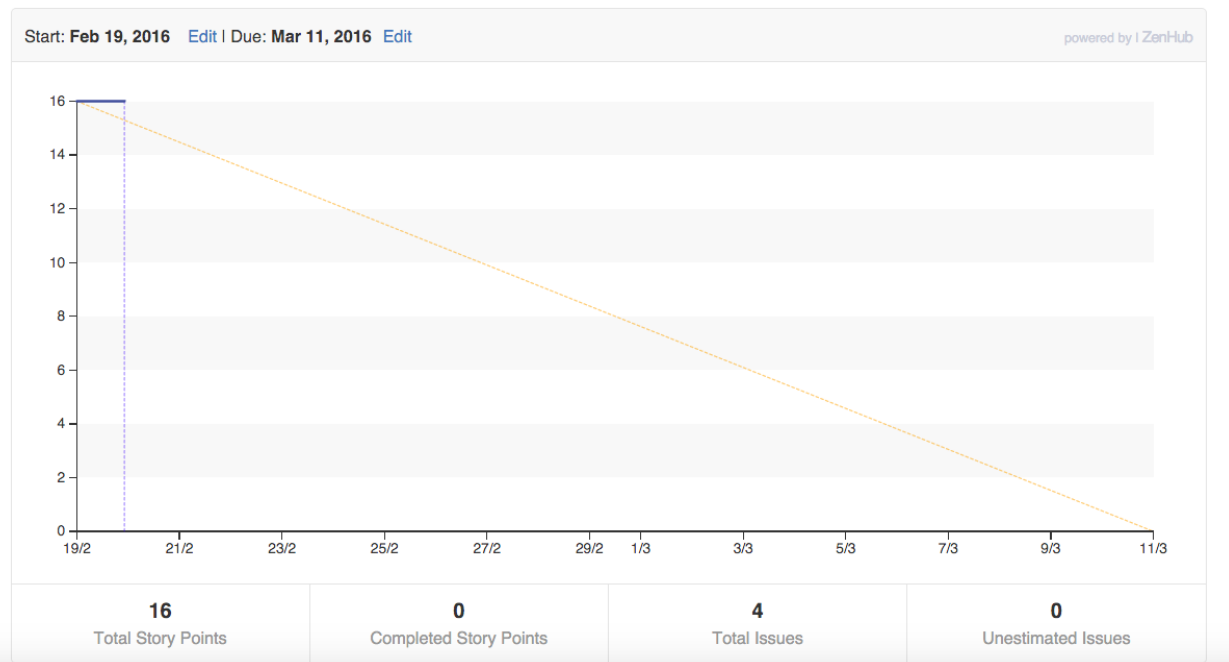
Filter milestones

- No due date
- 1st increment**
Due a day ago
- ✓ **2nd increment**
Due in 20 days
- 3rd increment**
Due in 2 months
- 4th increment**
Due in 2 months
- Proposal**

Burndown chart:

2nd increment

 Edit Milestone  Change Milestone ▼



C. Increment 3

List of work:

- a. Image/objects recognition.
- b. Combine image recognition with Romo movement.

Scenario & use case specification & feature design & feature implementation:

Use case 1: The Romo can take photos of objects when required. Then use image recognition API (e.g. Alchemy API) to recognize the object. The result can be sent to smartwatch/phone.

Use case 2: The user can send a command to let the Romo to fetch something to him/her. By making gestures the Romo can arrive at the object and take phone. If the object matches with the command, the Romo can get it and return back to the user.

Boards:

summermerD / BigData-Spring2016-BaymaxDuo

<> Code ⓘ Issues 8 🔗 Pull requests 0 ||| Boards 📊 Burndown 📖 Wiki 📶 Pulse

↗️ Repos (1/1) show one 🏷️ Labels 📌 3rd inc... ✕ 👤 Assignees ⓘ 🔍 🔄

12 Backlog (2)

- BigData-Spring2016-BaymaxDuo #13
Image recognition
4
- BigData-Spring2016-BaymaxDuo #14
Combine image recognition with Romo movement
8

0 To Do (0)

Filter Issues by milestone

Filter milestones

✕ Clear milestone filter

Issues with no milestone
No due date

1st increment
Due a day ago

2nd increment
Due in 20 days

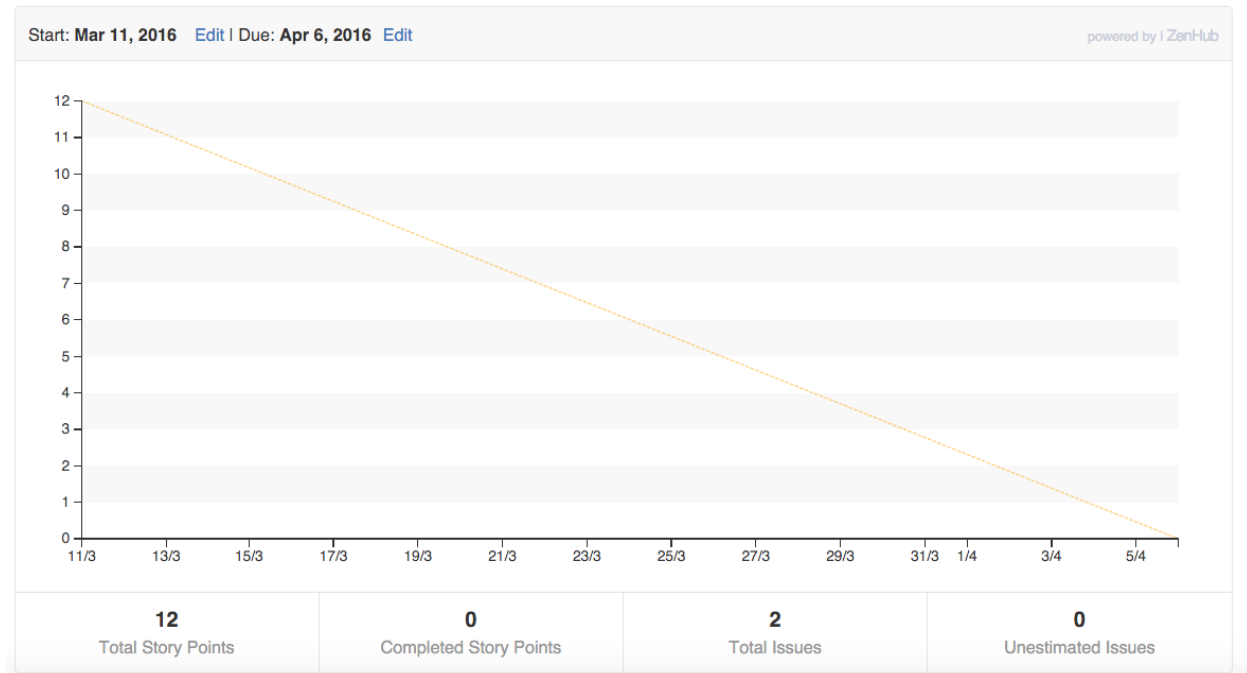
✓ **3rd increment**
Due in 2 months

4th increment
Due in 2 months

Burndown chart:

3rd increment

 Edit Milestone  Change Milestone ▾



D. Increment 4

List of work

- a. Friends/criminal recognition.
- b. Take necessary actions when the user suffers health issue.

Scenario & use case specification & feature design & feature implementation:

Use case 1: When someone knocks the door, the Romo can take photo of him/her and send the photo to phone and the phone will analyze it. If he/she is a criminal, the results will be sent to the user and let the user make the decision (e.g. call police). If he/she is a friend, the result will be sent to user and let the user make the decision (e.g. open the door). We will use some APIs to analyze friend/criminal.

Use case 2: When the user who wears the smartwatch has the health issue (heart rate abnormal), the smartwatch will send message the related people and let the Romo come to the user (the Romo has the necessary medicine with it).

Boards:

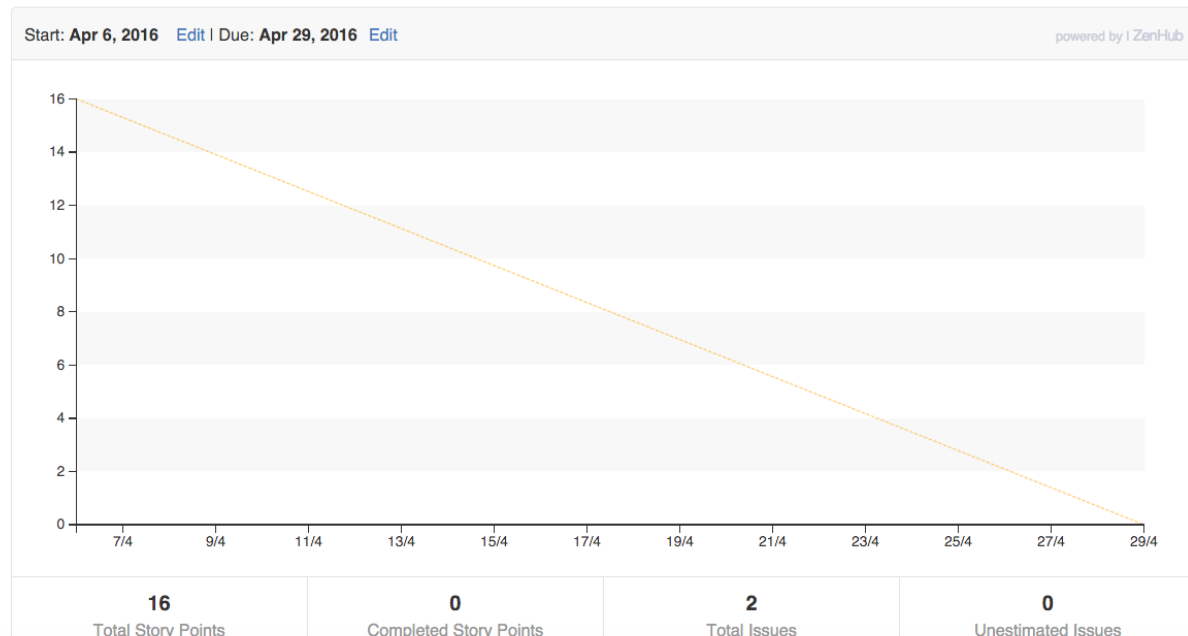
The screenshot displays the GitHub Boards interface for the repository **summermerD / BigData-Spring2016-BaymaxDuo**. The top navigation bar includes links for Code, Issues (8), Pull requests (0), Boards (selected), Burndown, Wiki, and Pulse. Below the navigation bar, the interface shows a 'Backlog' column with two issues and a 'To Do' column. A dropdown menu titled 'Filter Issues by milestone' is open, showing the following options:

- Filter milestones (input field)
- Clear milestone filter
- Issues with no milestone (No due date)
- 1st increment (Due a day ago)
- 2nd increment (Due in 20 days)
- 3rd increment (Due in 2 months)
- 4th increment (Due in 2 months) (selected)

Burndown chart:

4th increment

 Edit Milestone  Change Milestone ▾



2) Project Timelines, Members, Task Responsibility

In general, each of our team members will have a very clear separation regarding to each section of the tasks. For instance, Mohamed will be responsible for testing all the exist applications that we have developed and report potential issues to us. Vipin will be responsible for modifying the existing issues and also looking for opportunities to improve the functionalities of all apps. Ting and Wei will be constantly working on developing new apps and considering all sorts of possibilities that how the new apps could fit into our project and how those functions might interact with others. By doing in this, we could form a basic project development cycle and guaranty that the smoothness of all the functions.

In terms of timelines, we are considering launch the basic functions such as sensors, AlchemyAPI on phone apps. Before the increment 2 due time, we should have a very clear picture of what kind of actual data we can stored and processed by using either Spark, Hadoop, R etc. and then use those trained data to implement the potential situations. Before increment 3, we are planning to combine image recognition with Romo movement. and by increment 4, we should have all the tuned functions. Lastly, we will compare human face image with criminal database to check if this person will be a match with anybody.

First Increment Report

All the features we have developed for this increment, write a documentation describing the design, implementation, testing, and deployment (including the precise descriptions and screenshots).

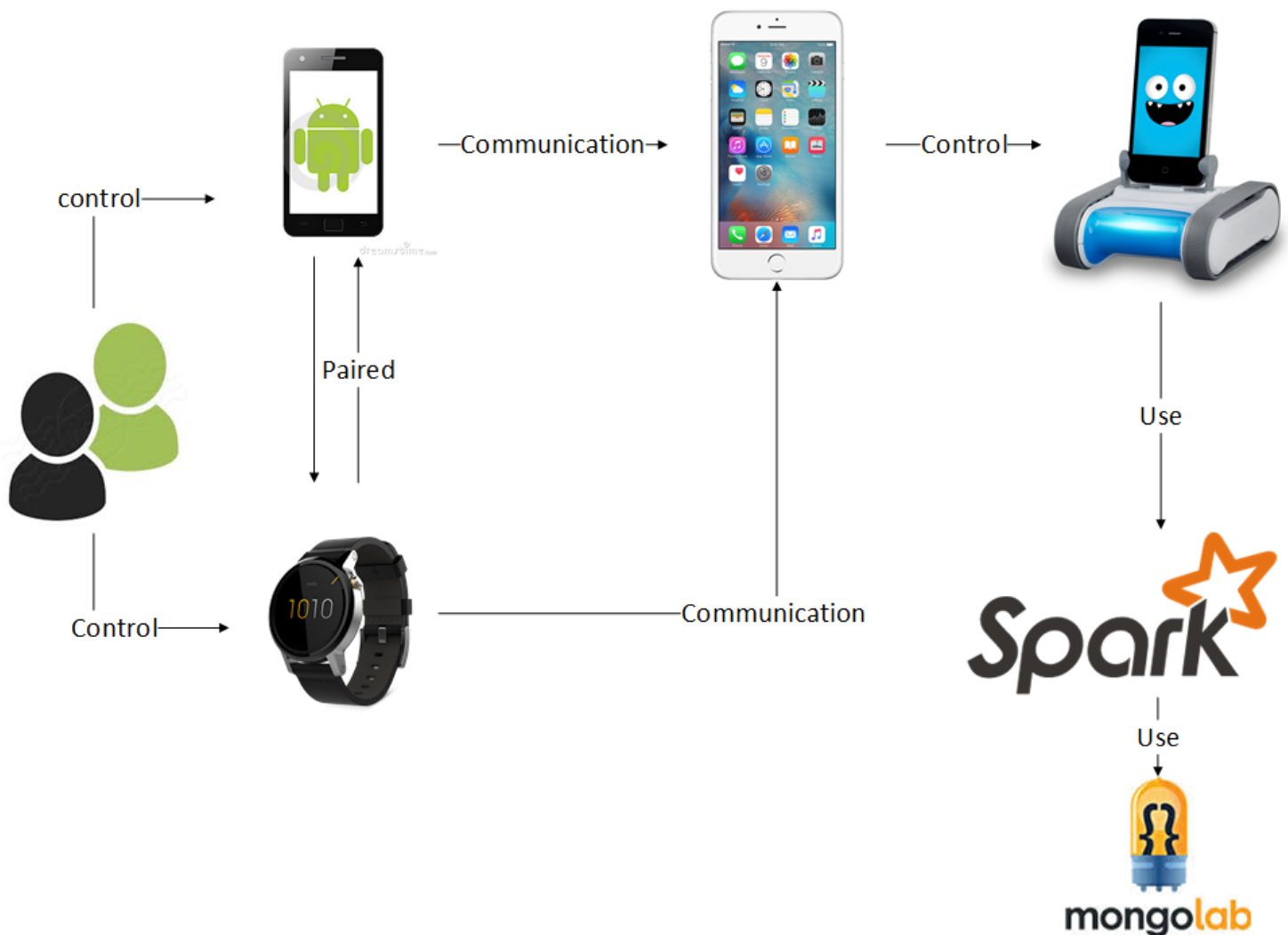
- Existing services, widget, API or source code you used in your project.
 1. Sending certain notification that have collected from phone to watch and display the data

2. Access camera function that on phone and send image that captured from phone to watch and display on phone screen
 3. Basic environment sensors such as light, proximity, magnetic
- Design of Features

o Architecture diagram/Class diagram/Sequence diagram

Architecture diagram:

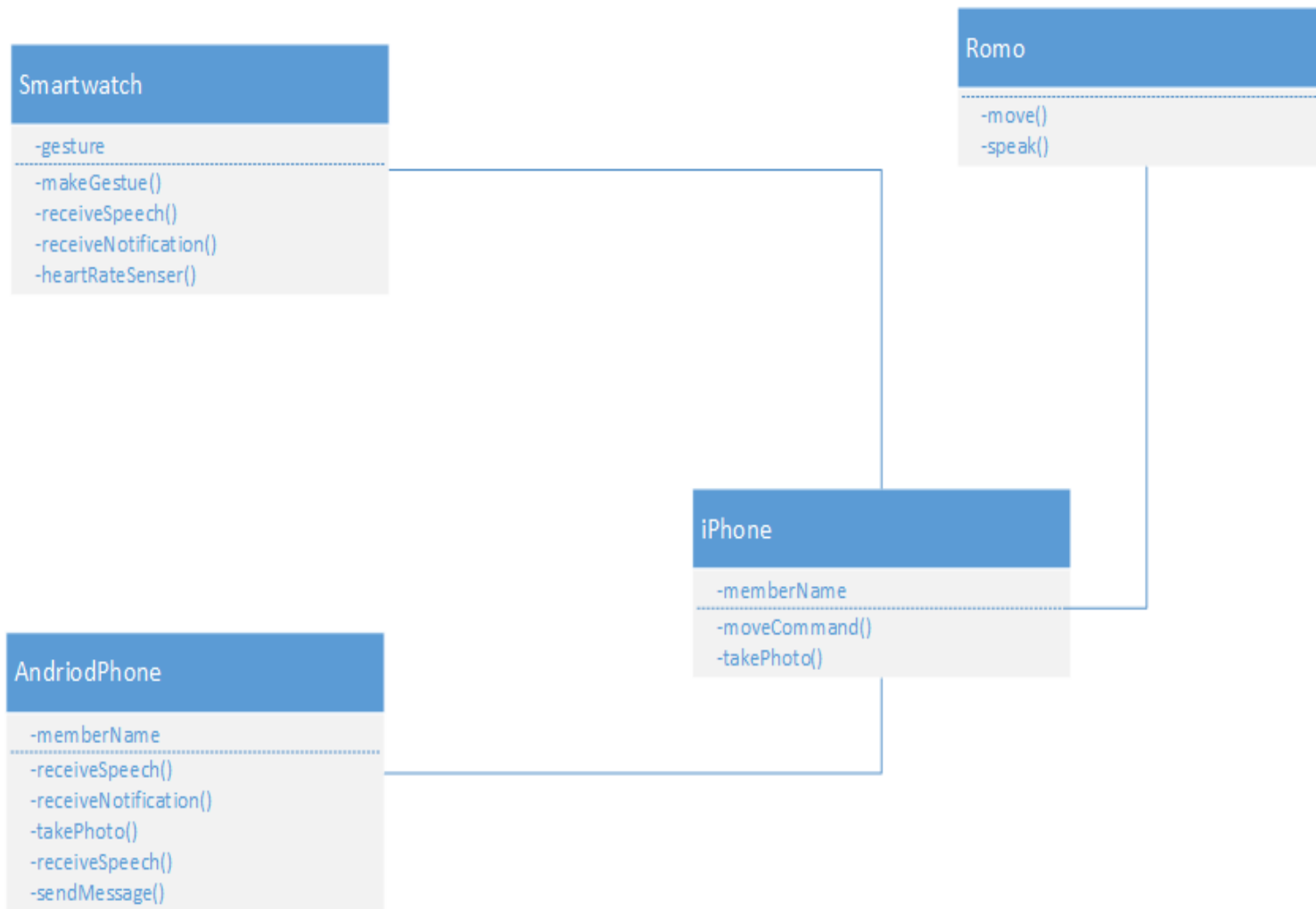
It contains four devices: the android smartwatch, android phone, iPhone, and Romo. The user can control the android phone and smartwatch to communicate with the iPhone. Then after receiving the command (user's gesture), the Romo can move accordingly. Also, iPhone can take photo when required. The photo will be analyzed and the results will be sent to the user. Spark is used to analyzed the data sets and Mongo lab is used to store the data. The smartwatch and phone are paired, so the communication is easy between the two.





Class diagram:

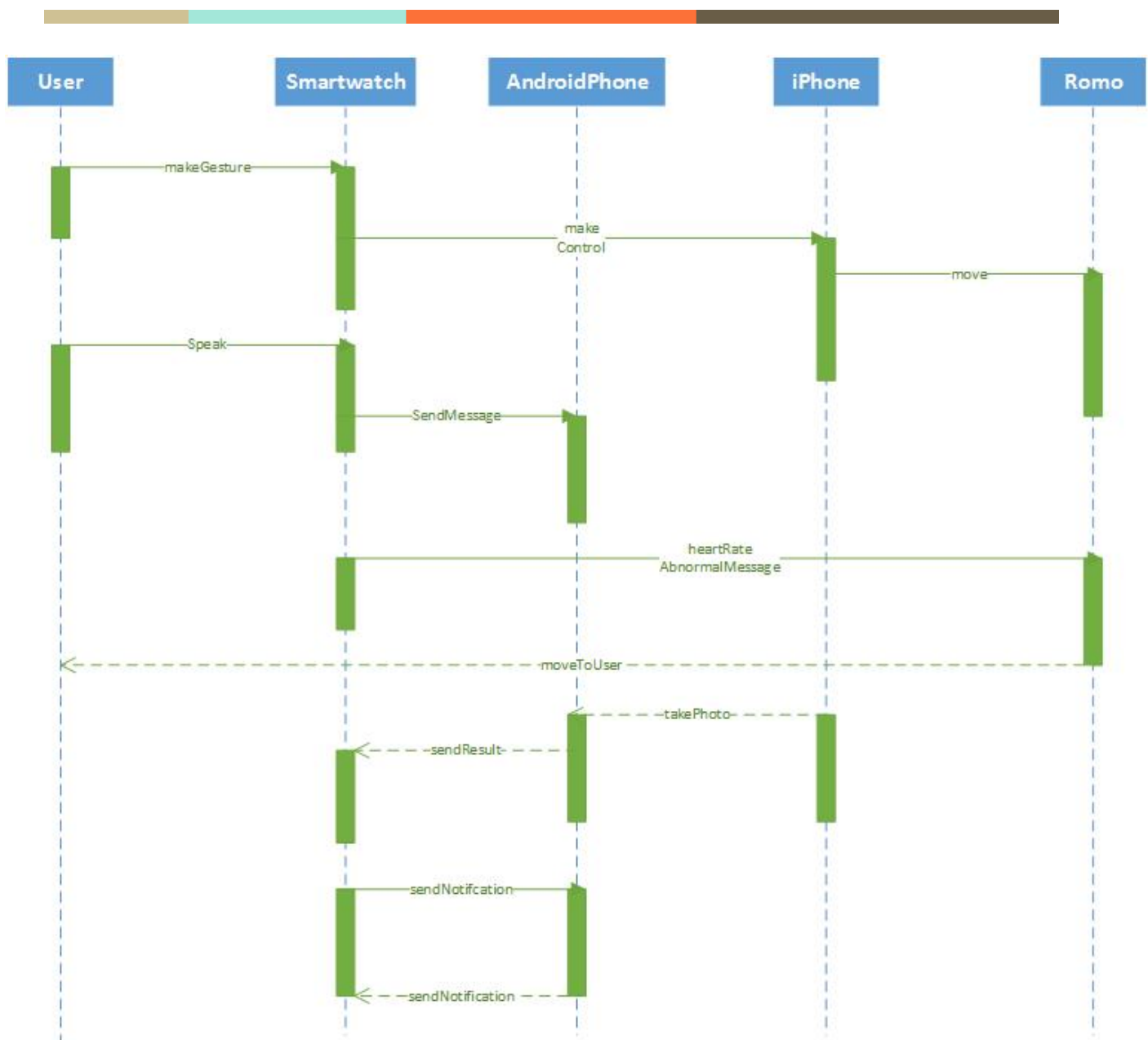
Four classes are listed as follows: smartwatch, android phone, iPhone and Romo. The methods are included in the diagram.



Sequence diagram:

Four scenarios:

1. The user makes gestures to control the movement of the Romo.
2. Speech control
3. Heart rate detection and action
4. Communication between smartwatch and android phone.



o Hadoop/Machine Learning Algorithms

In Hadoop/Machine learning, we are planning to use it as one of our core techniques to processing the data. In the later on project increment, it will behaved as the part that “force” the robot to react upon certain data we have collected or we have trained to the data. For example, in SparkR, we can use it to process certain amount of data to calculate K-Means, K centroid and Expectation Maximization(EM) and use it as a best representation of certain amount of data which fall under a defined category. Consequently, we can shrink the static data size into smaller ones so that it is easier to process.

o Datasets

- Implementation

- o Mobile Client Implementation (Smartwatch, Smartphone, Robot)

We will implement the mobile Client by utilizing smartwatch and smartphone

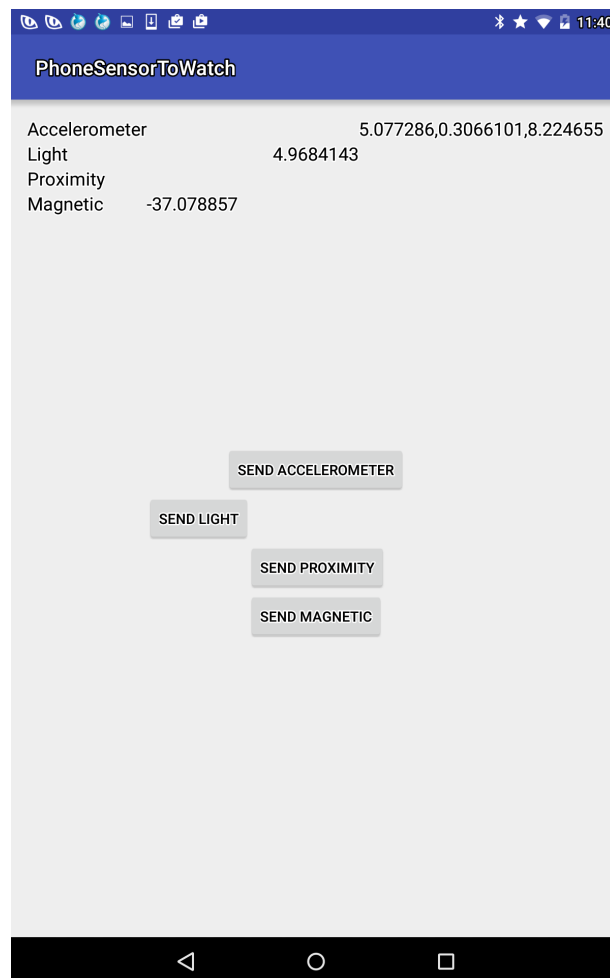
- o Machine Learning Application

- Personal health: By comparing heart rate history to determine to determine user's current health conditions. If monitoring exceeding certain limitations, instant alert notification will be sent to watch to draw user's attention. Otherwise, display as "Normal".
- Environmental safety: Base on people's face characteristic(may requires collecting large amount of face features data online), by training robot on matching captured human's face image with certain database to identify if specific person is an "enemy" or "friend".

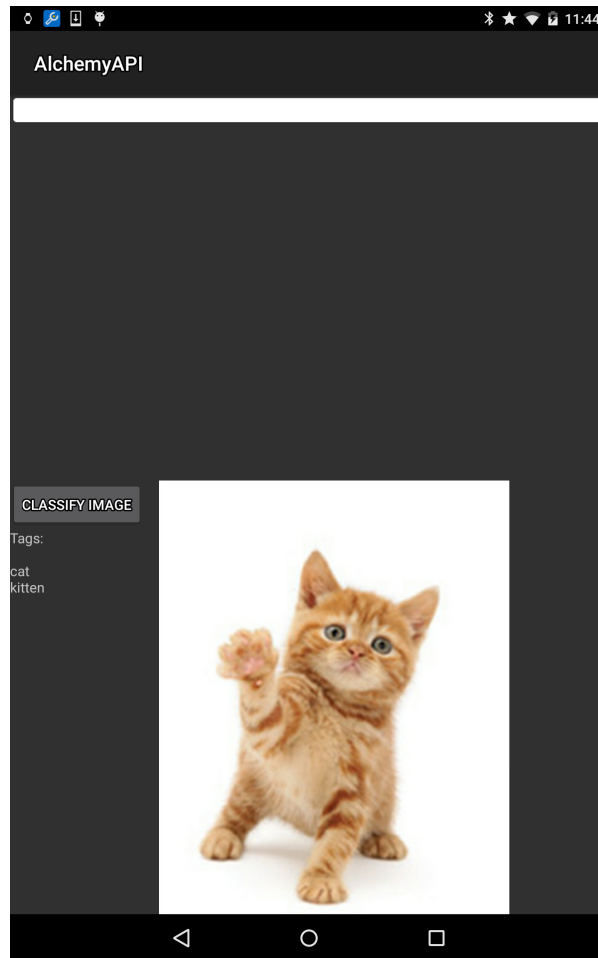
Deployment

- o Deploy your mobile app to smartphones and describe it including the screenshots

1. Notification to smartwatch



2. Image recognition (Use Alchemy API)



o Implementation status report

Work completed:

Descriptions and timelines

- Jan 28- Feb 4, our team tried to get familiar with the basic functions that watch can do with android studio. For example, how to send a non-static notification from android studio to emulator. And we discussed how we could use this features in our coming project.
- Feb 5-Feb 11, by utilizing the source code provided in tutorial lab 3, we created heart rate monitoring function and pass the reading data to the tablet. Related numbers show on the tablet as it showed on watch.
- Feb 12- Feb 17, we are currently trying to see if there are any functionalities we could possibly utilize by using hadoop and meta-data processing technique in our project when we deal with large amount of data etc.

Responsibility (Task, Person)

- Testing for existing features between phone and watch and identify potential issues that may exist in previous code. Provide suggestions on which specific part of functions need to be improved in terms of user experience, easiness, capabilities of each functions so that to guarantee the smooth transpassing between existing and further functions we will implement----Gharibi, Mohamed
- Based on lab/tutorial examples to modified detail source code and implement specific functions to match with the need our project ----Huang, Wei
- Assisted Wei and Xia on the detail code implementation . Formatted user's function layout on smartphone----Sattineni, Vipin Reddy
- Tested on all the existing command based on our project particular definitions and from user's watch---Xia, Ting

Time taken (#hours)

- 45 hours in total

Contributions (members/percentage)

- Gharibi, Mohamed/ 25%
- Huang, Wei/ 25%
- Sattineni, Vipin Reddy/ 25%
- Xia, Ting/ 25%


Work to be completed

Description

- Start thinking about how to utilize the image/camera features on the phone and combine it with our project. May considering capture image of people's face and compare with a general database for checking purposes.
- Start trying to implement objective C code to realize simply robot moving (forward, back, left, right etc)

Responsibility (Task, Person)

- Testing for existing features between phone and watch and identify potential issues that may exist in previous code. Provide suggestions on which specific part of functions need to be modified so that to guarantee the smooth function overflow when new functions are added in the future. Get involved in robot motion controls by using objective C---- Gharibi, Mohamed
- Based on Mohamed suggestion improve previous features(app layout, functions stabilities etc). Based on lab/tutorial examples to modify detail source code and add into new functions as needed. Get involved in robot motion controls by using objective C and image capture(sending certain notifications based on criteria defined) ---Huang, Wei

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- Get involved in robot motion controls by using objective C. Doing more research on how to realize two-ways communication between watch and phone and then sending real time data/notifications to each other---Sattineni, Vipin Reddy
 - Get involved in robot motion controls by using objective C. Doing research on how to train data to recognize human face and automatically comparing with certain database at backstage. Then execute certain command by definition or from user's watch--Xia, Ting

Time to be taken (estimated #hours)

- Approximately 5-8 hours in tuning the new features such as how to control the robot to move by using objective C and RomoMe functions.
- Another 5-8 hours in improving the previous features such as how to send message from watch to phone or from phone to watch in the real time manner.

Issues/Concerns

- Though we start considering new features such as image capture/recognition, automatic robot traceback features, we are not sure how well our overall program can handle the more complex situations since large amount of data will flow into the system(especially image file etc)

Bibliography

1. Android Developers website: <http://developer.android.com/index.html>
2. IBM Alchemyapi:
<https://www.ibm.com/smarterplanet/us/en/ibmwatson/developercloud/services-catalog.html>
3. CS 5542 lab tutorial source code 2 and 3