CS5542 Big Data Analytics and Applications

Project proposal

Project Group Number: 7

Team Members:

1. Abhiram Ampabathina (1)
2. Harshini Medikonda(14)
3. Hirenbhai Harshadbhai Shah(27)

Project Goal and Objectives:

Motivation:

The heart rate of a person depends on age, gender, daily physical activity, mental stress and many other activities/conditions. Furthermore, there is no proper equipment that can keep a track of heart beat rate.

Significance/Uniqueness:

We intend to do a system that can collect the person's daily heart rate activity, store it in a database, analyze the heart rate and the activity the person is performing. Moreover, the application can analyze the data and recommend mental or physical activities to be performed by the user to keep the heart rate optimal. It can also suggest the timings of the abnormal heart rate. All these would give a clear idea of the medical condition of the user and the better usage of it can help in a longer life.

This heart rate system is an android application which he can view even through the smart watch. This application works with the heart rate sensor embedded in the smart watch.

The user can install the application in the android mobile and view his activity and get recommendations accordingly.

Objectives:

1) Convenient and efficient
2) Have a track of medical record
3) Cost-effective
4) Recommendations from analysis

System features:

- Continuous collection of heart rate data
- Storage of data
- Analysis on the tasks done and the heart rate

- Suggest possible consequences
- Recommendations of precautions to be taken.

Related Work:

None

BIBILIOGRAPHY:

http://www.wareable.com/fitbit/fitbit-70-of-people-ignore-heart-rate-data-1523

https://dev.fitbit.com/docs/heart-rate/

http://www.livescience.com/42132-heart-rate-activity-tracker-useful.html

Backup Project:

Motivation:

It is difficult to consult a doctor for every small ailment. So in our project we intend to build an android mobile app that takes symptoms that are being experienced by the patient.

Significance/Uniqueness:

Based on the input provided by the user, analyses it and gives out related disease and suitable medication for it.

PROJECT PLAN:

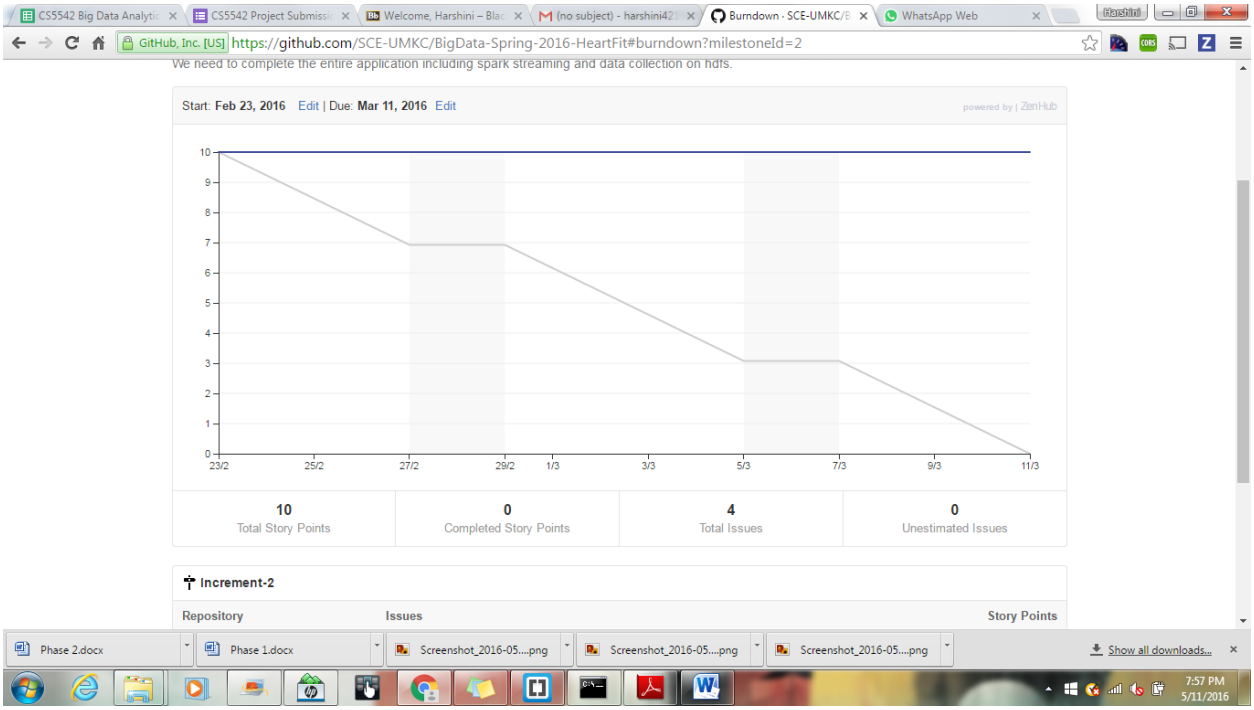
As mentioned in Zenhub:

We implemented the features for every increment.

Fourth Increment:

Third Increment:

Second Increment:



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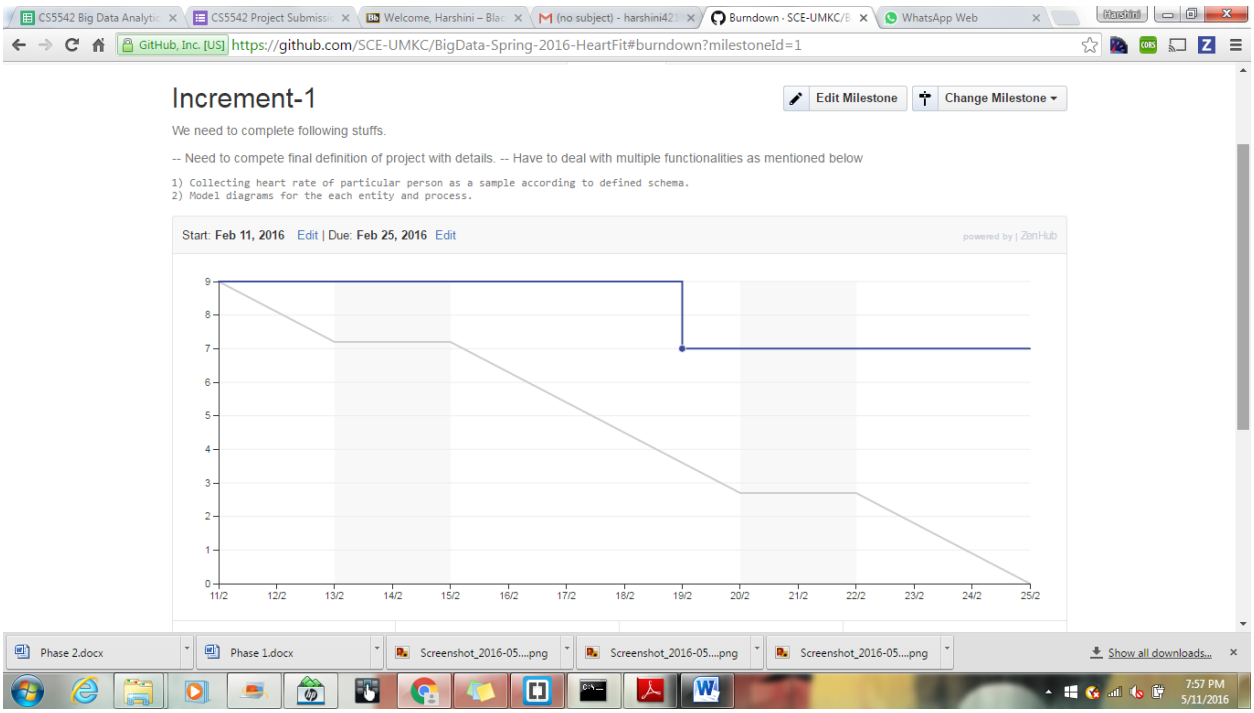

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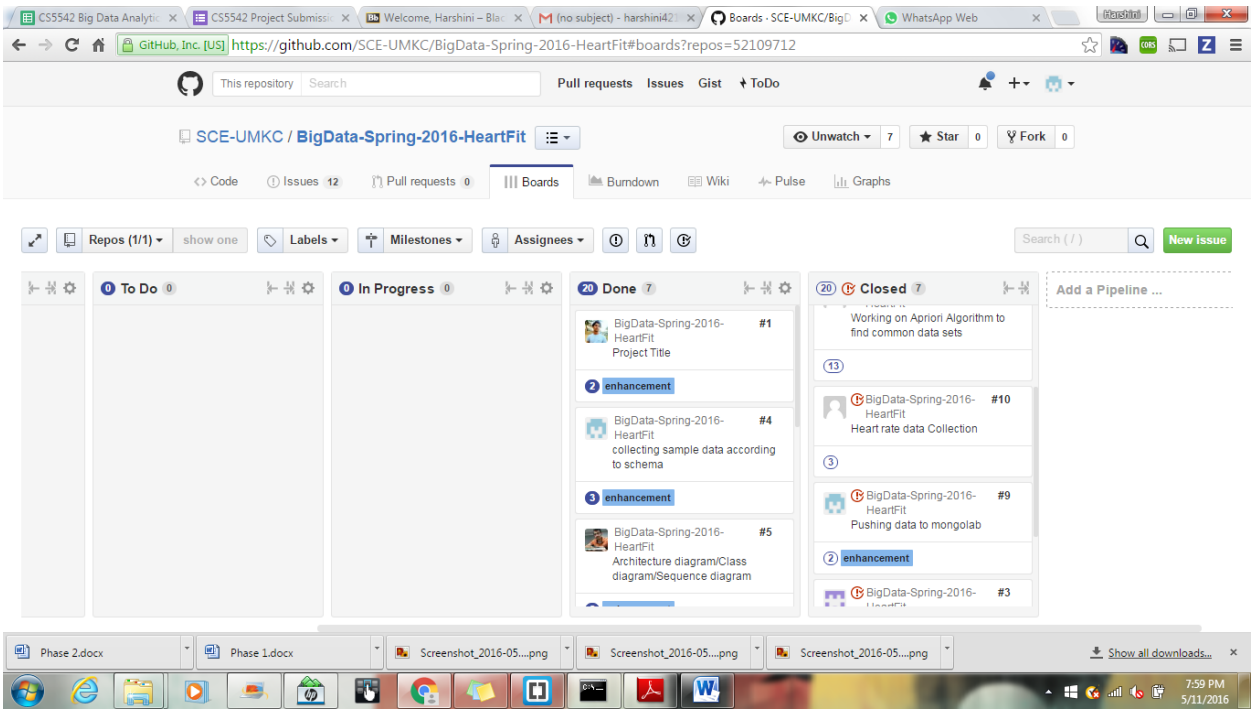
https://github.com/SCE-UMKC/BigData-Spring-2016-HeartFit#boards?repos=52109712
SCE-UMKC / BigData-Spring-2016-HeartFit
Unwatch 7
Star 0
Fork 0
Code
Issues 12
Pull requests 0
Boards
Burndown
Wiki
Pulse
Graphs
Repos (1/1)
show one
Labels
Milestones
Assignees
Search (/)
New issue
To Do 0
In Progress 0
Done 7
Closed 7
Add a Pipeline ...
BigData-Spring-2016-HeartFit #1
Project Title
enhancement
BigData-Spring-2016-HeartFit #4
collecting sample data according to schema
enhancement
BigData-Spring-2016-HeartFit #5
Architecture diagram/Class diagram/Sequence diagram
Working on Apriori Algorithm to find common data sets
BigData-Spring-2016-HeartFit #10
Heart rate data Collection
BigData-Spring-2016-HeartFit #9
Pushing data to mongolab
enhancement
BigData-Spring-2016-HeartFit #3
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Phase 1.docx
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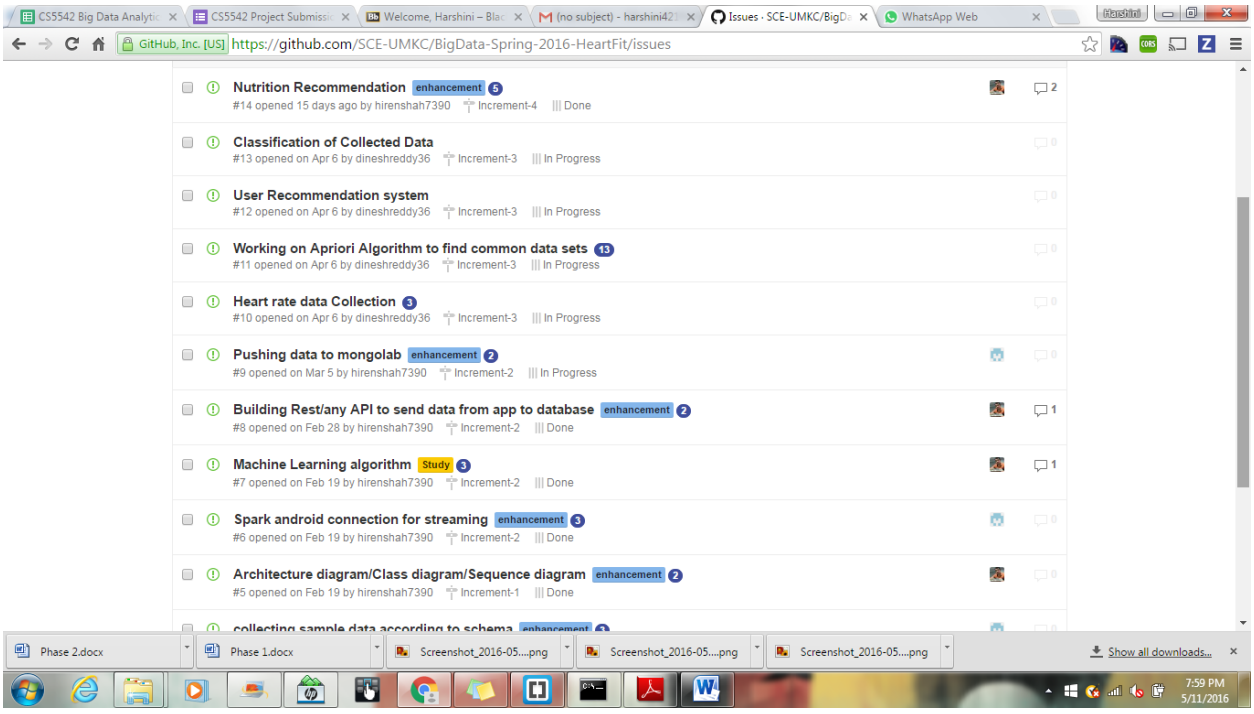
https://github.com/SCE-UMKC/BigData-Spring-2016-HeartFit/issues
Nutrition Recommendation enhancement 5
#14 opened 15 days ago by hirenshah7390 Increment-4 Done
Classification of Collected Data
#13 opened on Apr 6 by dineshreddy36 Increment-3 In Progress
User Recommendation system
#12 opened on Apr 6 by dineshreddy36 Increment-3 In Progress
Working on Apriori Algorithm to find common data sets 13
#11 opened on Apr 6 by dineshreddy36 Increment-3 In Progress
Heart rate data Collection 3
#10 opened on Apr 6 by dineshreddy36 Increment-3 In Progress
Pushing data to mongolab enhancement 2
#9 opened on Mar 5 by hirenshah7390 Increment-2 In Progress
Building Rest/any API to send data from app to database enhancement 2
#8 opened on Feb 28 by hirenshah7390 Increment-2 Done
Machine Learning algorithm Study 3
#7 opened on Feb 19 by hirenshah7390 Increment-2 Done
Spark android connection for streaming enhancement 3
#6 opened on Feb 19 by hirenshah7390 Increment-2 Done
Architecture diagram/Class diagram/Sequence diagram enhancement 2
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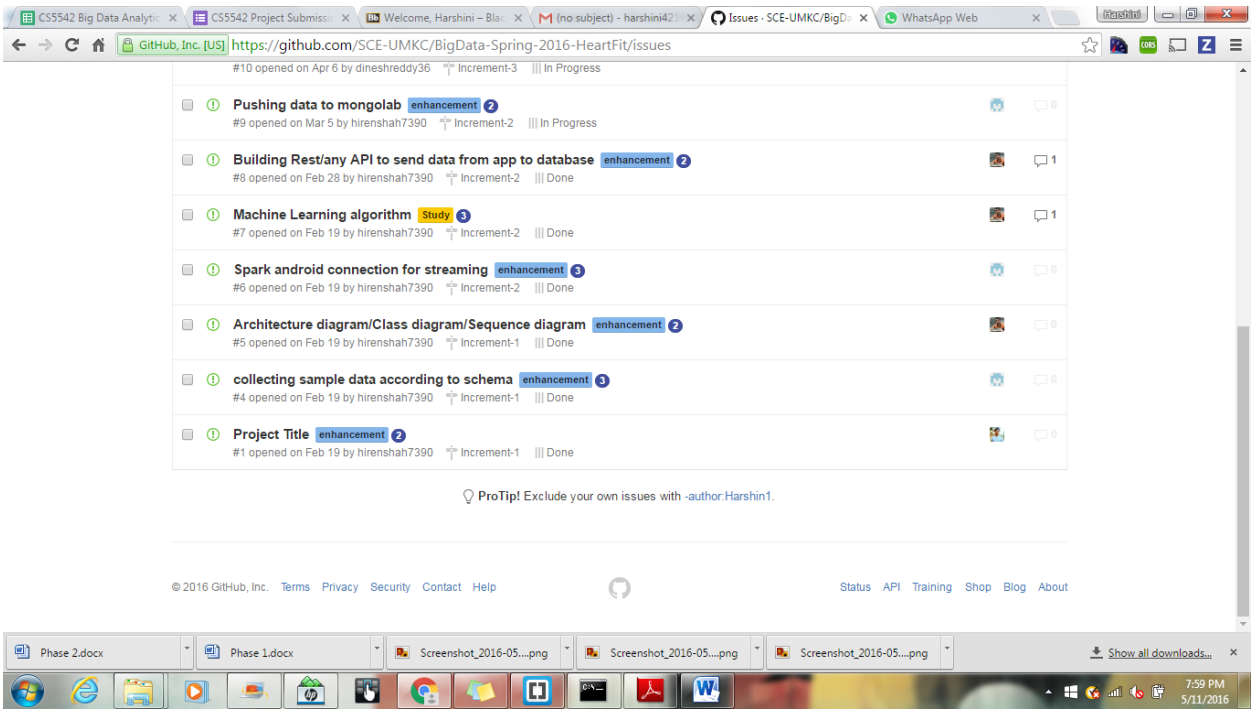
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Project Title enhancement 2
#1 opened on Feb 19 by hirenshah7390 Increment-1 Done
ProTip! Exclude your own issues with -author:Harshin1.
© 2016 GitHub, Inc. Terms Privacy Security Contact Help
Status API Training Shop Blog About
Phase 2.docx
Phase 1.docx
Screenshot_2016-05....png
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CS5542 BIG DATA ANALYTICS AND APPS

Increment -1 Report (02/19/2016)

Project Group -7

By

Abhiram Ampabathina (1)

Harshini Medikonda (14)

Hirenbhai Harshadbhai Shah(27)

Dinesh Reddy (19)

I.INTRODUCTION:

The heart rate of a person depends on age, gender, daily physical activity, mental stress and many other activities/conditions. Furthermore, there is no proper equipment that can keep a track of heart beat rate. We intend to do a system that can collect the person's daily heart rate activity, store it in a database, analyze the heart rate and the activity the person is performing. Moreover, the application can analyze the data and recommend mental or physical activities to be performed by the user to keep the heart rate optimal. It can also suggest the timings of the abnormal heart rate. All these would give a clear idea of the medical condition of the user and the better usage of it can help in a longer life.

II.PROJECT GOAL AND OBJECTIVES:

OVERALL GOAL:

The goal of the project is to build a system that can take care of the user's health. This heart rate system is an android application which he can view even through the smart watch. This application works with the heart rate sensor embedded in the smart watch. It can observe the patterns of the heart rate and determine the health condition. It recommends the user with the necessary physical and mental activity.

SPECIFIC OBJECTIVE:

The objectives that would be achieved are as follows:

- Collect the heart rate and step count of the user
- Store the heart rate in regular intervals
- Get the heart rate onto HDFS per day basis
- Analyze it using machine learning algorithms.
- Notifying the health conditions using smart watch and smart phone
- Recommend the activities to be done by the user.
- Have a medical record, convenient and cost efficient.

SPECIFIC FEATURES:

The specific features designed in the project are:

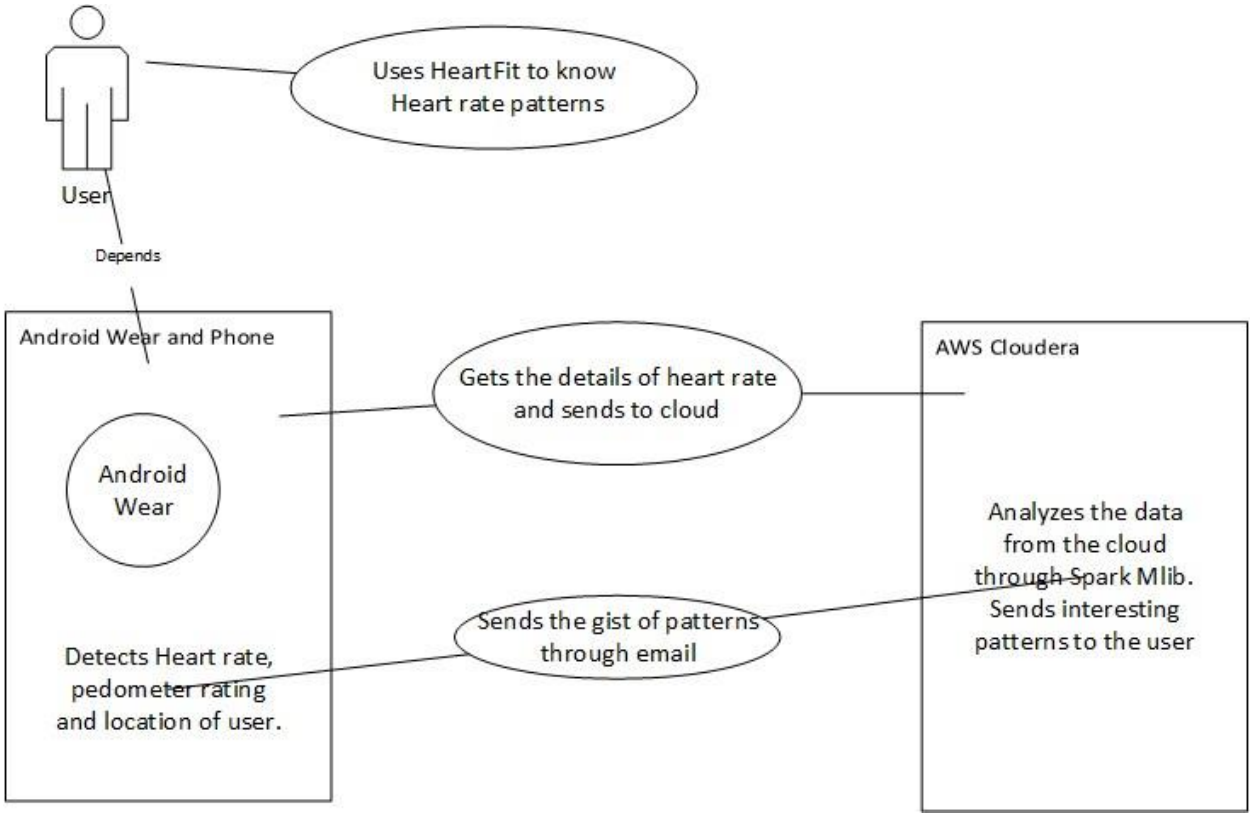
- Heart beat analysis
- Step count analysis
- Notification of current health condition
- Recommendation of health care

SIGNIFICANCE:

The main significance of this application is it is a system that is required for every person in their daily life. It is a trending smart application which makes the life easier. It is beneficial and becomes a part of the life in the upcoming years.

III. PROJECT PLAN:

1. Stories : Scenario & Use case specification



FEATURE DESIGN:

The application is designed to have the following features

1. Ability to run the application background all the time.

2. Ability to read heart rate accurately.

3. Ability to read the location of the user accurately.

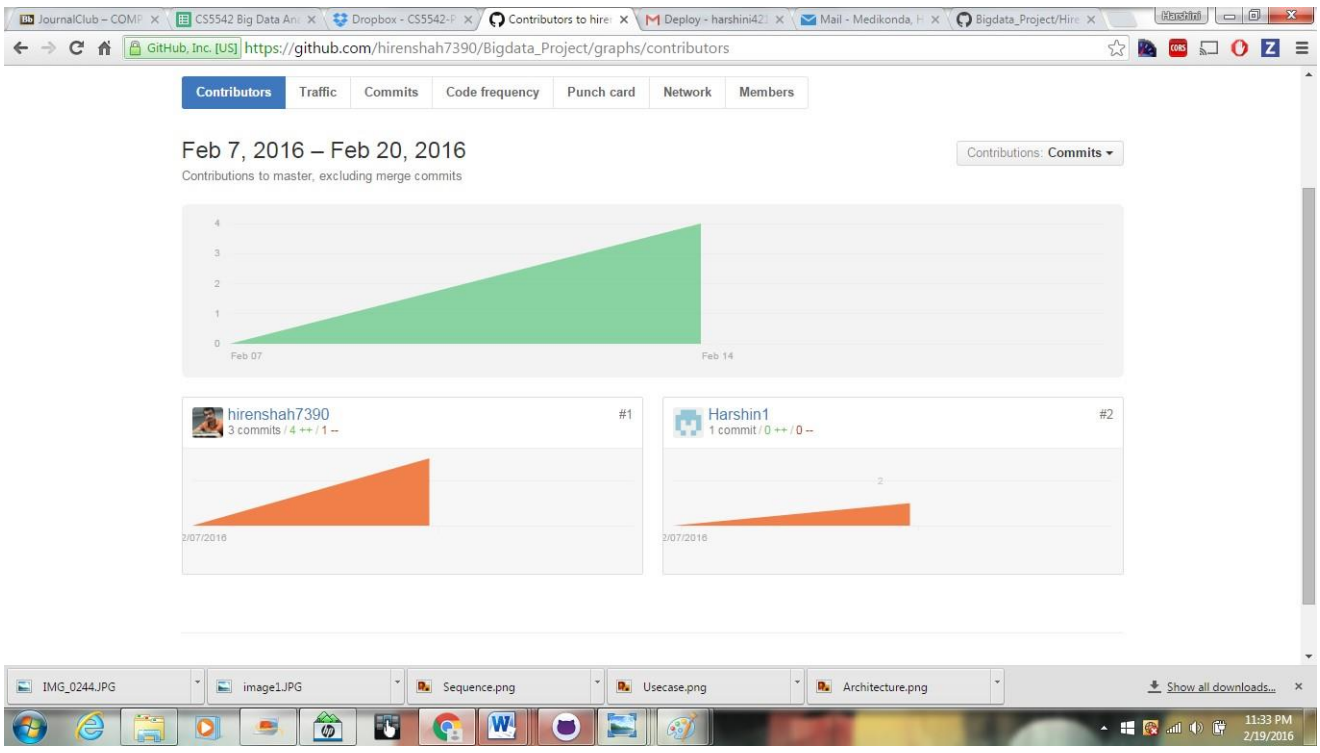
4. Ability to send the information to cloud DB when internet is connected.

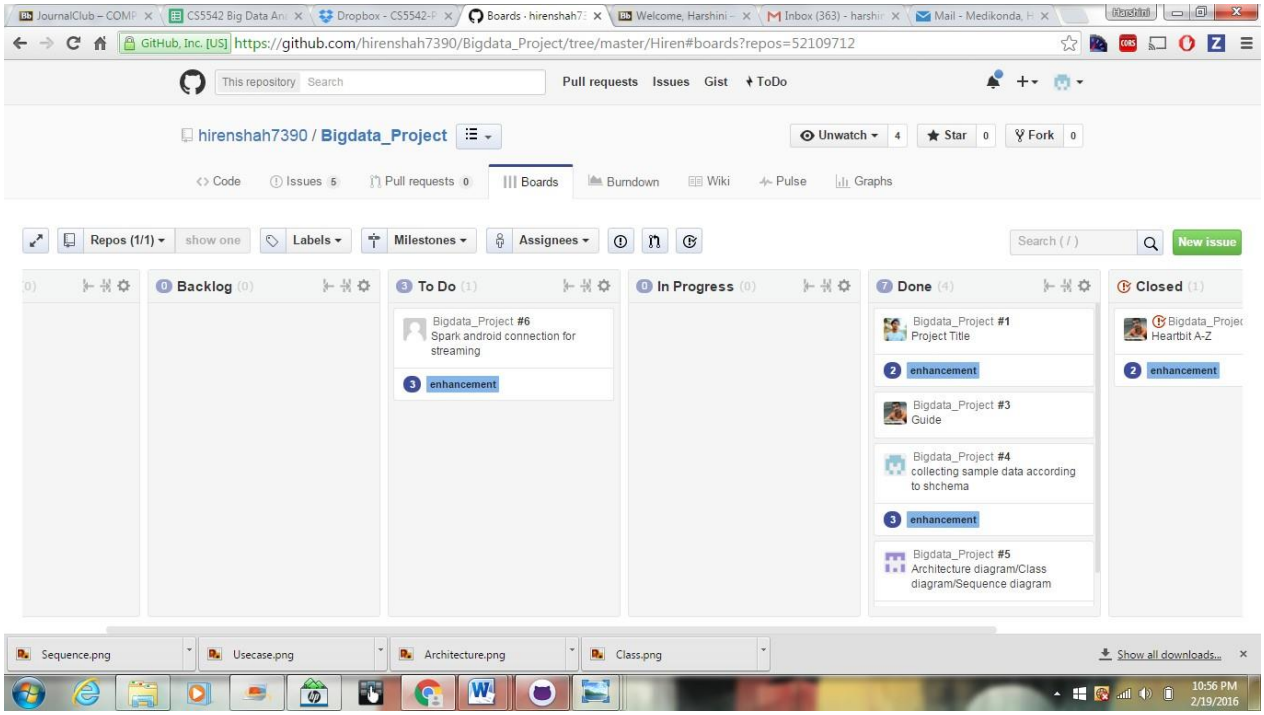
Each feature is designed accordingly to the specifications it should perform.

FEATURE IMPLEMENTATION:

The application is designed to work continuously in the background. For this we added permission in android activity.xml . So, that the phone or the wear supports to run the application in background. To read user heart rate, we added heart rate sensor as a dependency to the application dependency list. This will accurately detect user's heart rate and return it to mobile. Our application will also send location details of user. For this we included GPS Location dependency plugin to android. This will send us the co-ordinates of the user's location. We also need to make sure the device is connected to internet in order to send the user's details to cloud DB, furtherly to analyze the data in cloudera.

2. PROJECT TIMELINES, MEMBERS, TASK RESOPNSIBILITY:





BURNDOWN CHARTS:

IV. FIRST INCREMENT REPORT:

EXISTING API:

1. MongoLab API:

https://api.mongolab.com/api/1/databases/my-db/collections?apiKey=myAPIKey

This API is used to store the heart rate and step count in the database and get the heart rate from the database.

2. HeartRate and Step counter Sensor

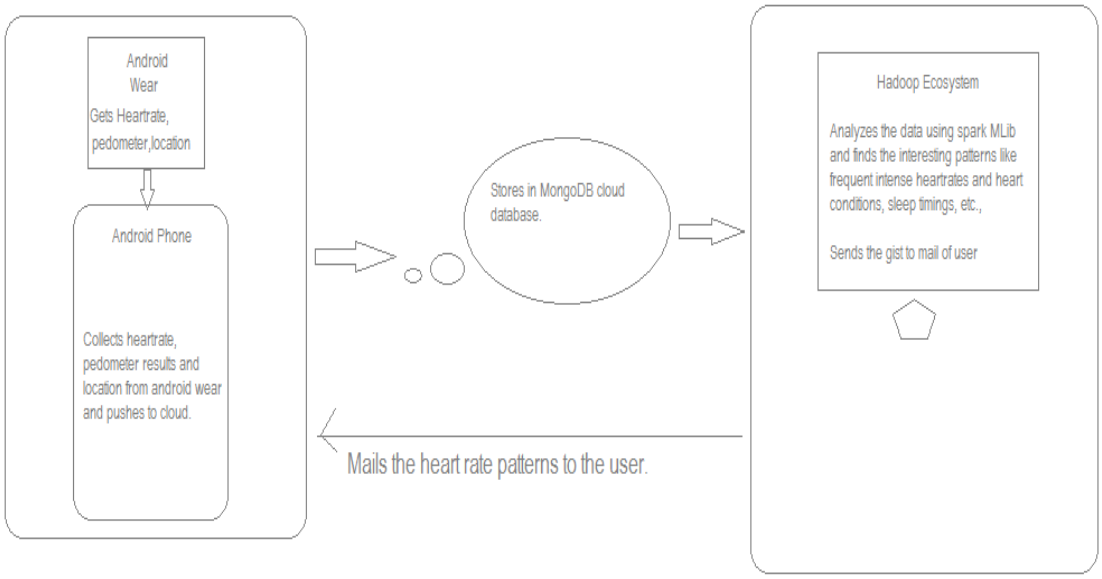
The heart rate and step counter sensors are embedded in the smart watch which can be used to get the data. This data is sent to the Spark HDFS system on a per-day basis.

3. Java Mail API

This is used to send an email of the results to the user as an email.

DESIGN OF FEATURES

ARCHITECHTURE DIAGRAM:



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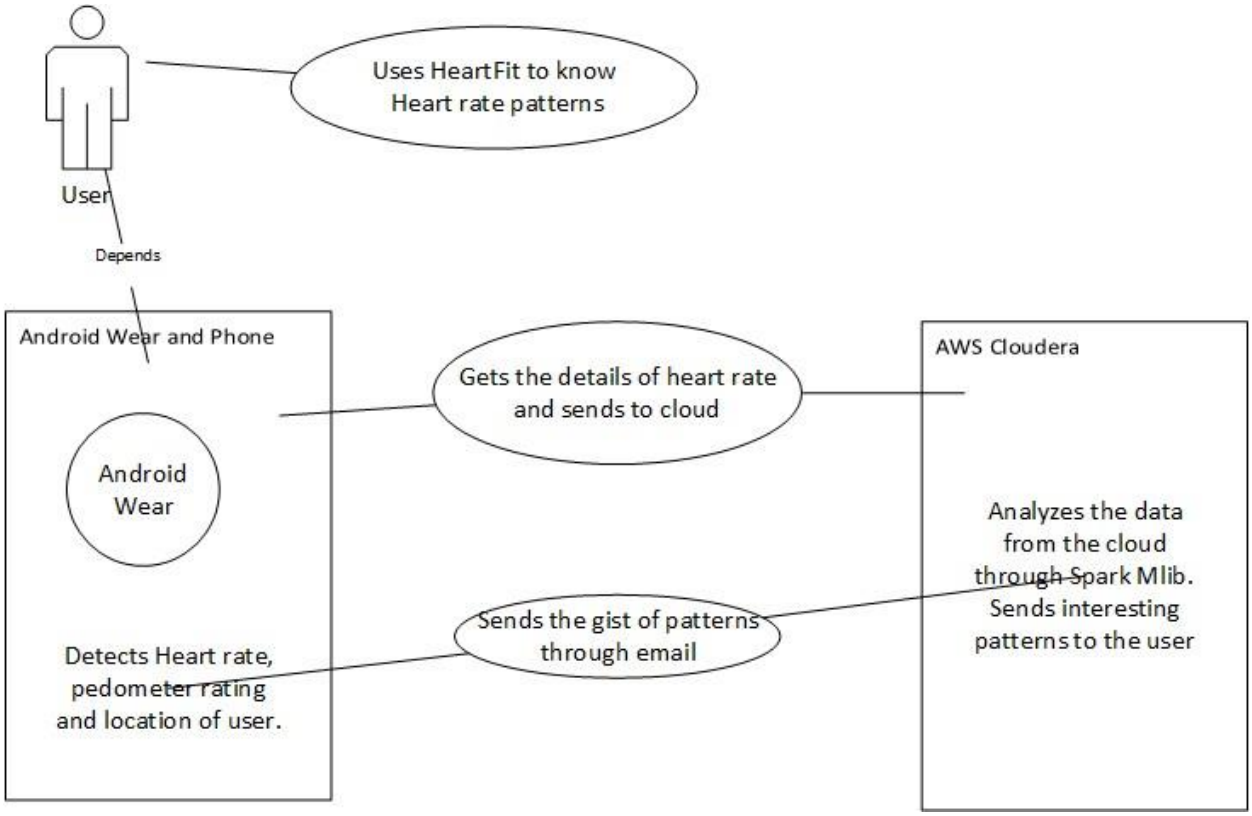

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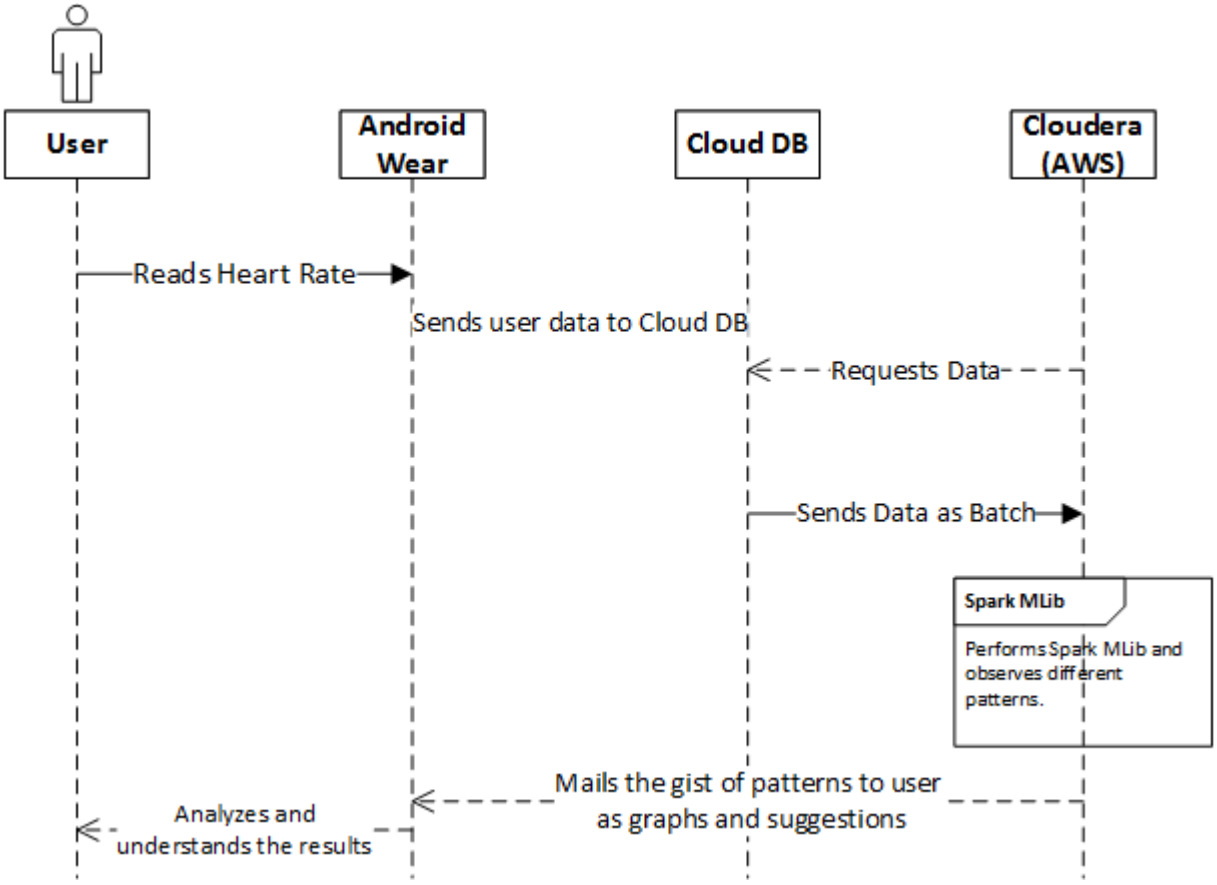
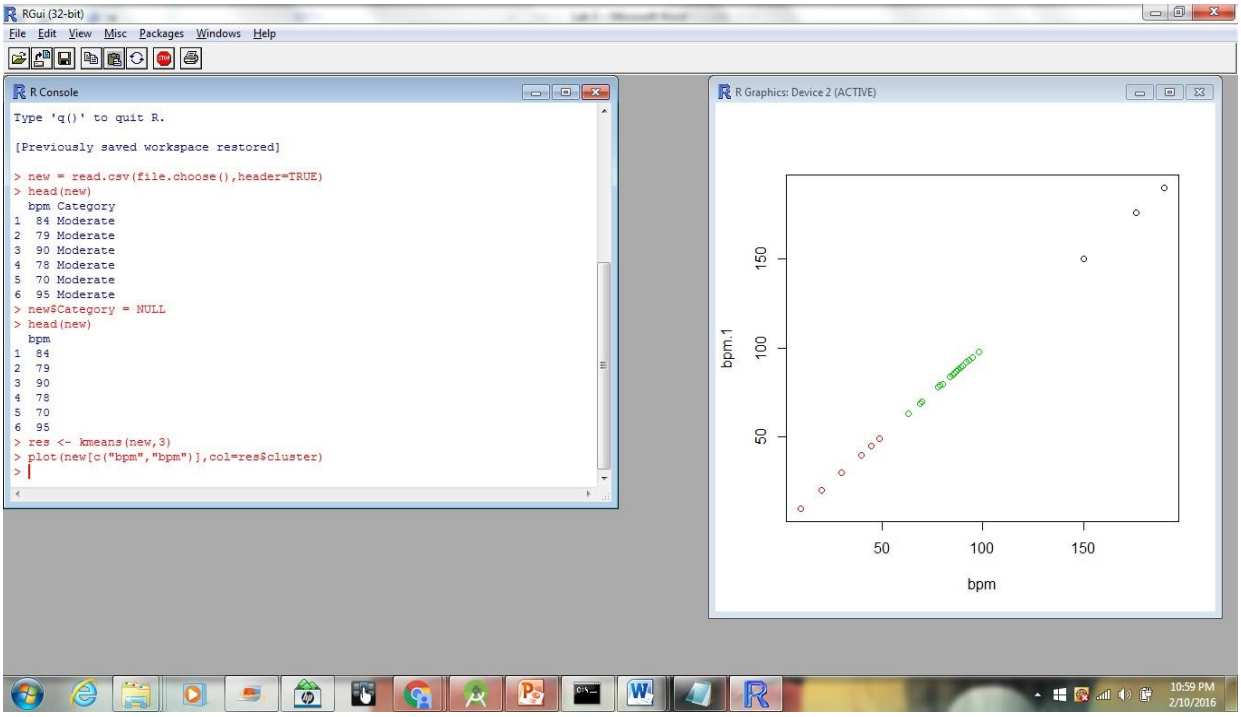


HADOOP/MACHINE LEARNING ALGORITHMS:

In this application, we are planning to use the below machine learning algorithms to analyze the data.

1. **K-means Clustering:**

K-means clustering algorithm is a cluster analysis in which k clusters are formed with n observations. The similar observations are clustered determining the centroid. Here the similar heart rates are clustered and the patterns are determined.



2. Apriori Algorithm:

The Apriori algorithm is an algorithm for mining frequent datasets. Since the heart rate of the user when collected it produces similar data and frequent datasets are formed. This enables the use of this algorithm to determine the patterns.

DATASETS:

The datasets in the Heartfit application consists of heart rate data, the steps walked for the day, the timing, the geolocation where it is captured. These datasets are analyzed with the machine learning algorithms and the corresponding patterns are generated.

It would appear as Step Count, Heart rate, time stamp, geolocation. Few more features can be added.

IMPLEMENTATION:

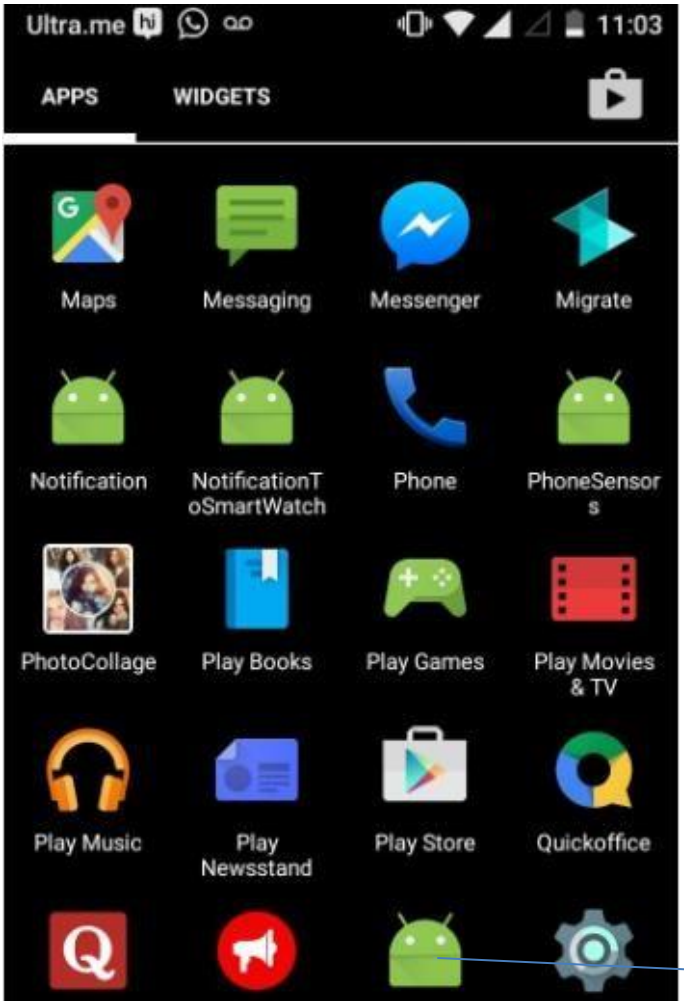
Mobile Client Implementation:

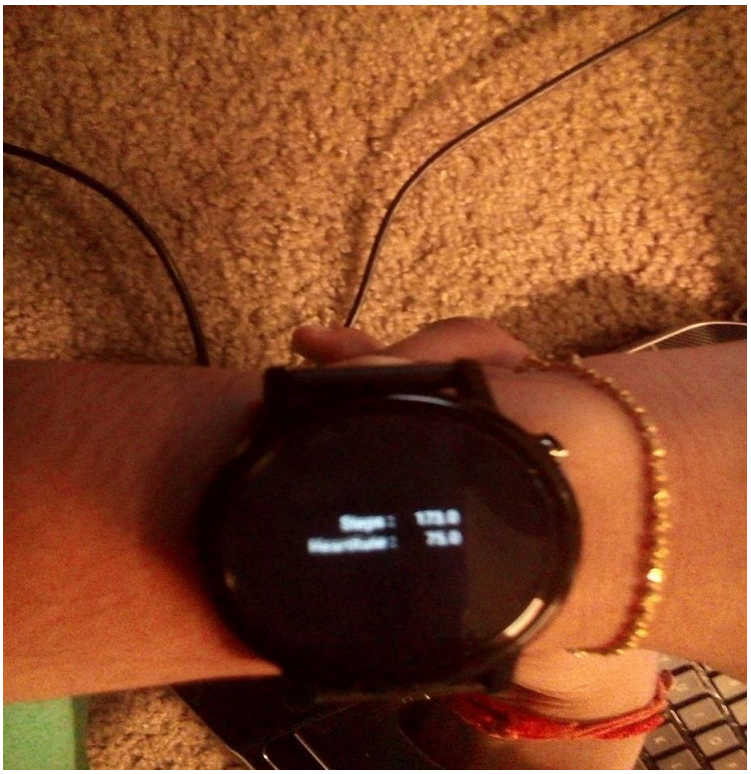
This is smartphone-smartwatch application in which the smart watch senses the data and the data is collected, stored in cloud database. The analysis is performed on the collected data and the results are sent as an email or notification the smartphone. The Spark Mlib and machine learning algorithms are used to perform analysis and determine the patterns from the user health conditions.

Machine Learning Application:

This is the main part of the application, where the machine analyzes and sends the suggests the patterns to user via mail. The machine learning algorithms provide high accuracy of data mining and results. It also results in different patterns that humans cannot determine at the same time. This is an application which is available in hand with the user and keeps a track of the medical history. This medical history can be used in medical field for research purposes as well.

DEPLOYMENT:





Github link: https://github.com/hirenshah7390/Bigdata_Project/tree/master/Hiren

PROJECT MANAGEMENT:

Planning

We as a team discussed about the project idea, project flow , features that are to be implemented. Roles and responsibilities are being discussed and given below.

Time: 8 hours

Members Participated: Harshini, Abhiram, HirenShah, Dinesh Reddy

Design and Requirements gathering

In this phase all the functional, architechtural and non-functional requirements are being discussed.

Responsibility: UML diagrams

Time: 6 hours

Participants: HirenShah, Dinesh Reddy

Responsibility: Usecases

Time: 6 hours

Participants: Abhiram, Harshini

Implementation

The step counter and heart sensor data is collected at different times using the sensors in the smart watch.

Responsibility: Data collection, Zenhub

Time: 8 hours

Participants: Harshini, Abhiram, HirenShah, Dinesh Reddy

Testing

Test cases for all the above designed pages were implemented.

Responsibility: Tried to collect data at different times when sleeping, walking,etc

Time: 4 hours

Participants: HirenShah, Dinesh Reddy, Abhiram, Harshini

BIBILIOGRAPHY:

https://www.firstbeat.com/science-and-physiology/

http://www.wareable.com/fitbit/fitbit-70-of-people-ignore-heart-rate-data-1523

https://dev.fitbit.com/docs/heart-rate/

http://www.livescience.com/42132-heart-rate-activity-tracker-useful.html

CS5542 BIG DATA ANALYTICS AND APPS

Increment -2 Report (03/11/2016)

Project Group -7

By

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Harshini Medikonda (14)

Hirenbhai Harshadbhai Shah(27)

Dinesh Reddy (19)

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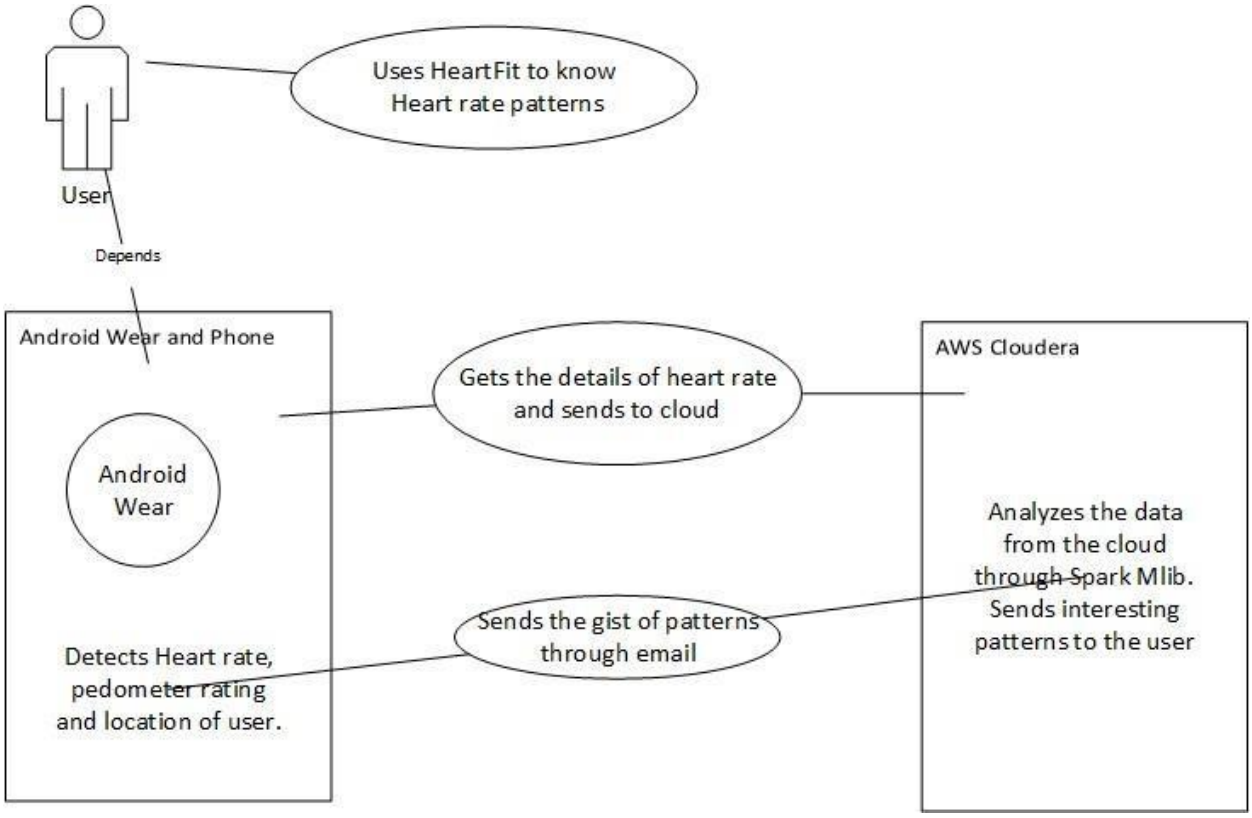

FEATURE DESIGN:

The application is designed to have the following features

1. Ability to run the application background all the time.

2. Ability to read heart rate accurately.

3. Ability to read the location of the user accurately.

4. Ability to send the information to cloud DB when internet is connected.

The system performs clustering based on the heart rate data of the user and

recommends the user of the exercises to follow to stay healthy.

Each feature is designed accordingly to the specifications it should perform.

FEATURE IMPLEMENTATION:

The application is designed to work continuously in the background. For this we added permission in android activity.xml . So, that the phone or the wear supports to run the application in background. To read user heart rate, we added heart rate sensor as a dependency to the application dependency list. This will accurately detect user's heart rate and return it to mobile. Our application will also send location details of user. For this we included GPS Location dependency plugin to android. This will send us the co-ordinates of the user's location. We also need to make sure the device is connected to internet in order to send the user's details to cloud DB, furtherly to analyze the data in cloudera.

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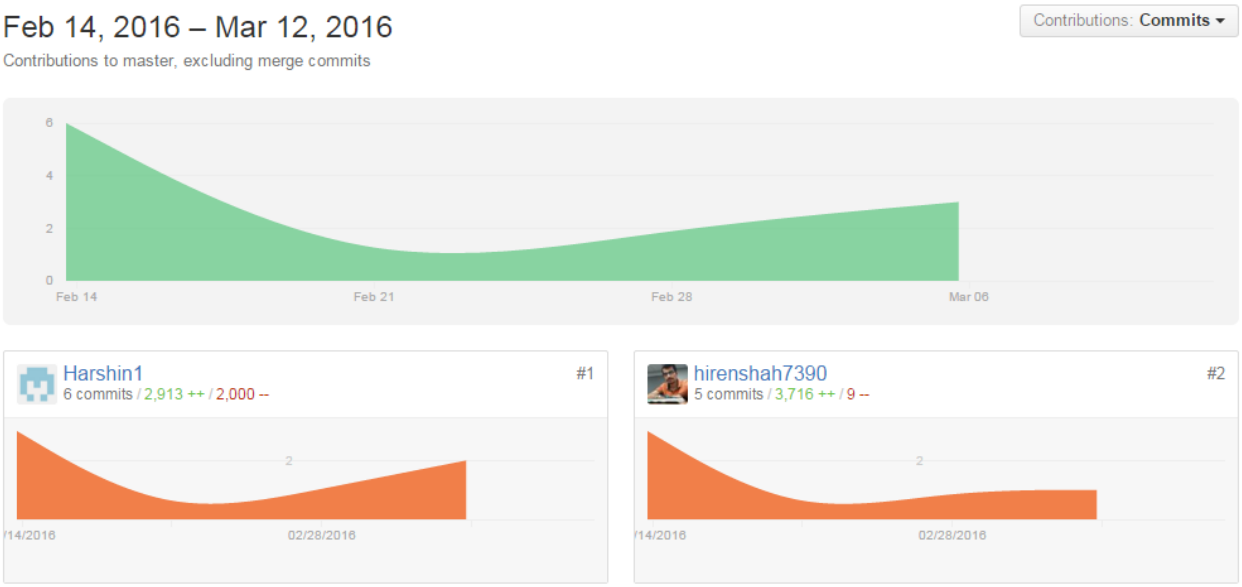

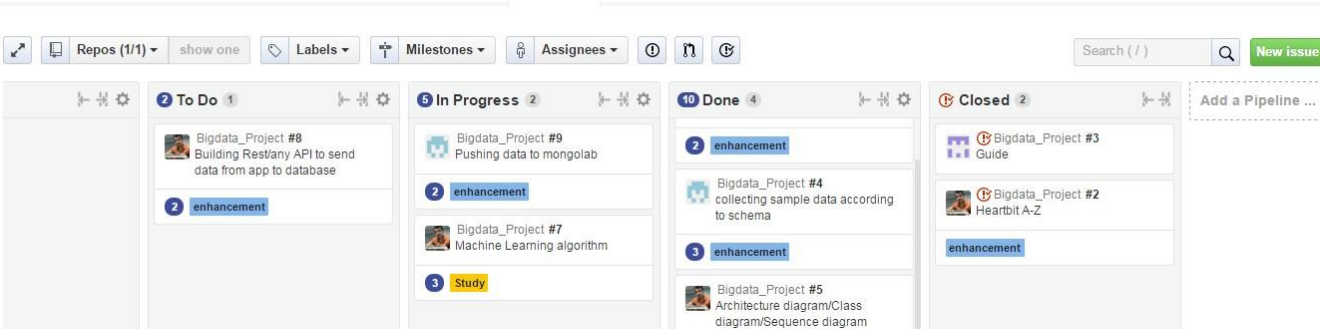

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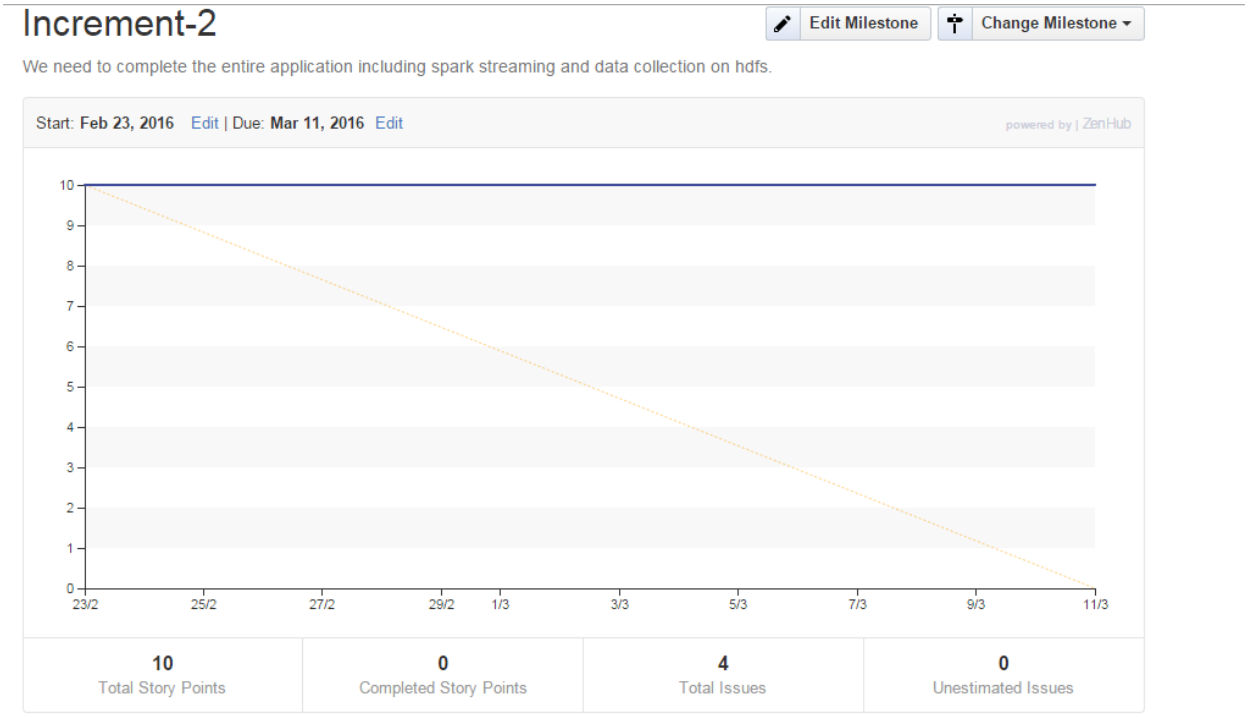

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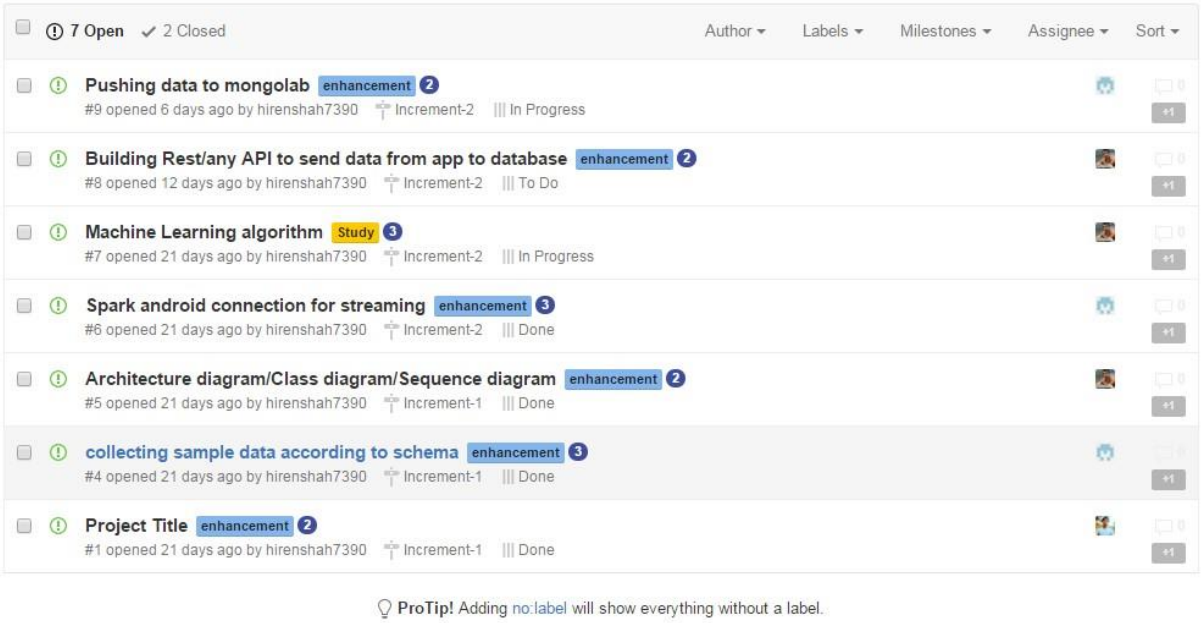
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Project Title enhancement 2
#1 opened 21 days ago by hirenshah7390 Increment-1 Done
ProTip! Adding no:label will show everything without a label.

IV. SECOND INCREMENT REPORT:

EXISTING API:

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This API is used to store the heart rate and step count in the database and get the heart rate from the database.

- HeartRate and Step counter Sensor

The heart rate and step counter sensors are embedded in the smart watch which can be used to get the data. This data is sent to the Spark HDFS system on a per-day basis.

- Java Mail API

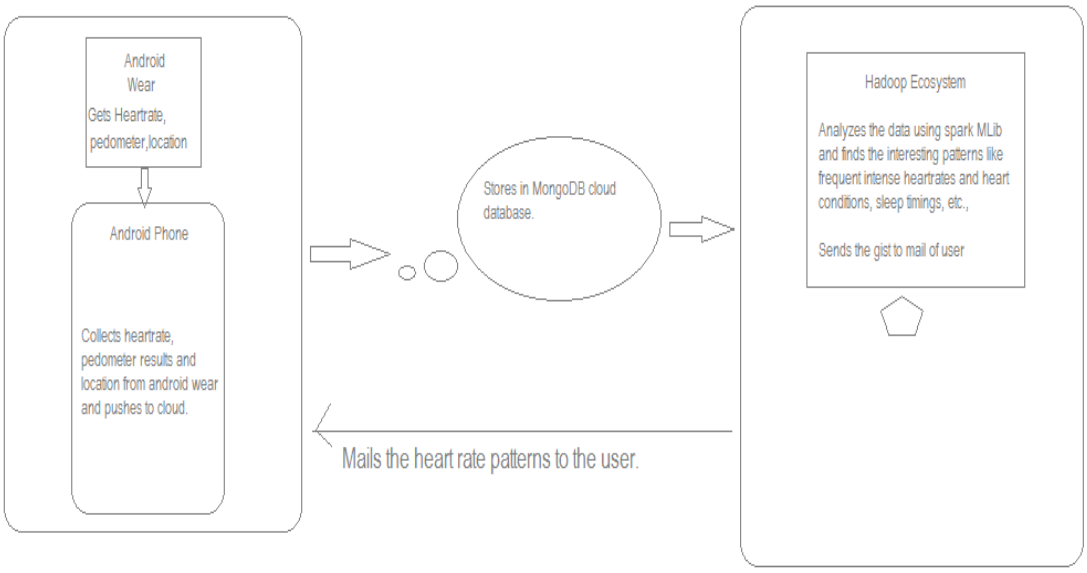
This is used to send an email of the results to the user as an email.

- Twitter Streaming API

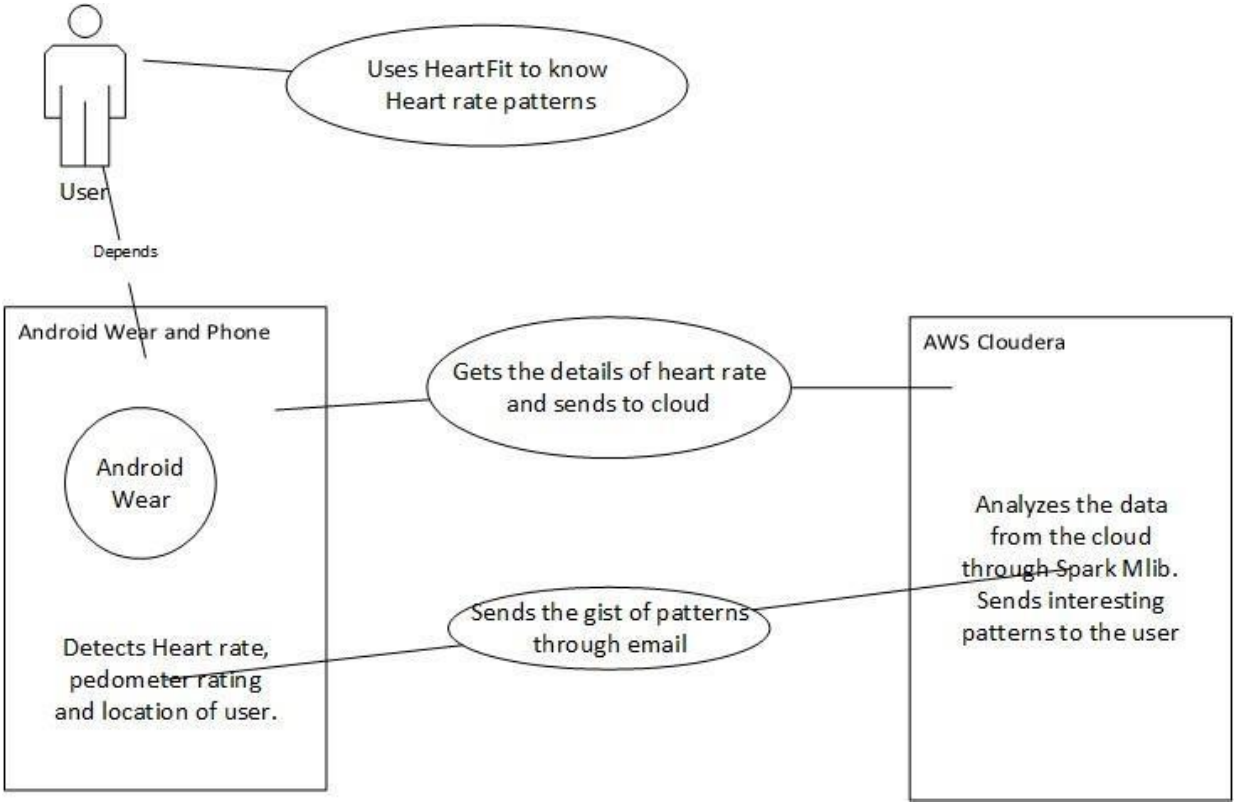
The tweets are collected as per the keywords heartrate, fitness, pulse, health and these are analyzed.

DESIGN OF FEATURES

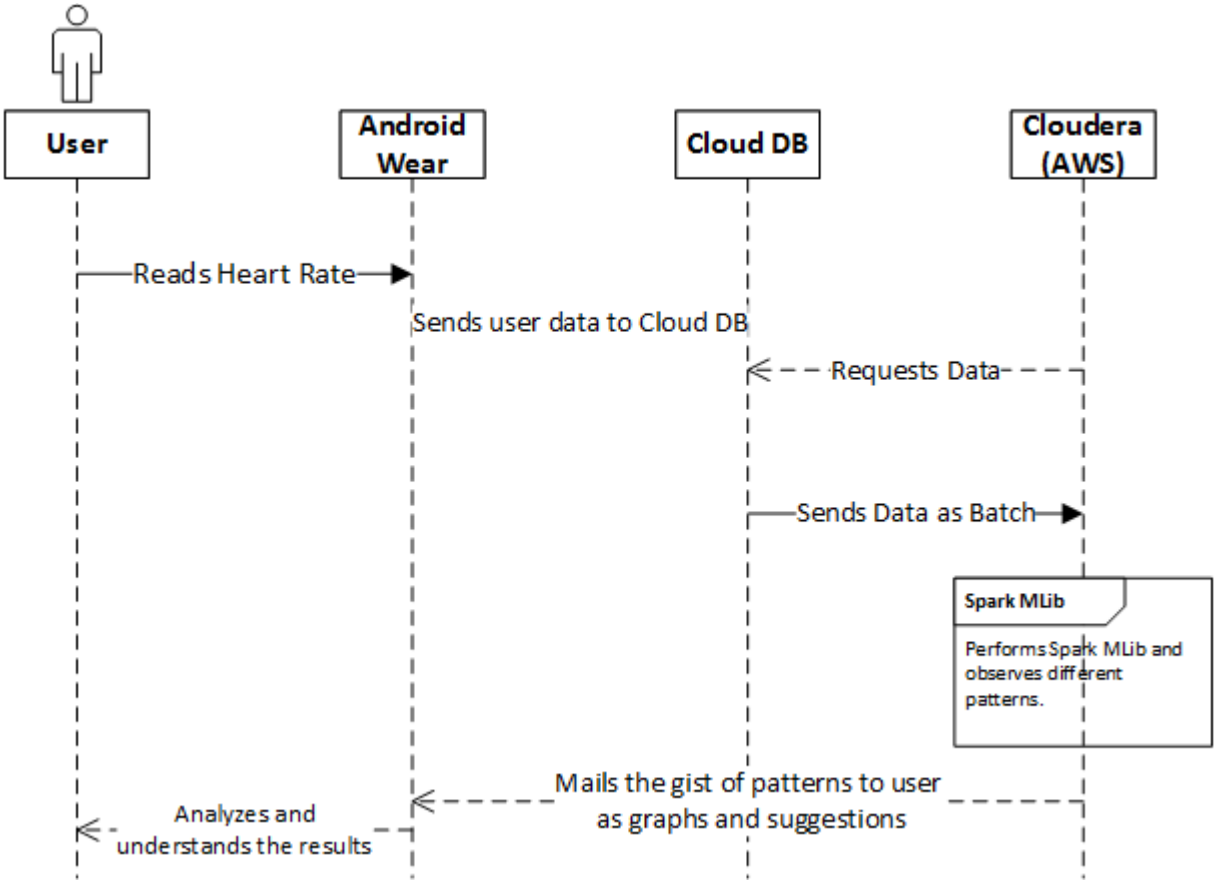
ARCHITECHTURE DIAGRAM:



CLASS DIAGRAM:



SEQUENCE DIAGRAM:



SPARK/MACHINE LEARNING ALGORITHMS:

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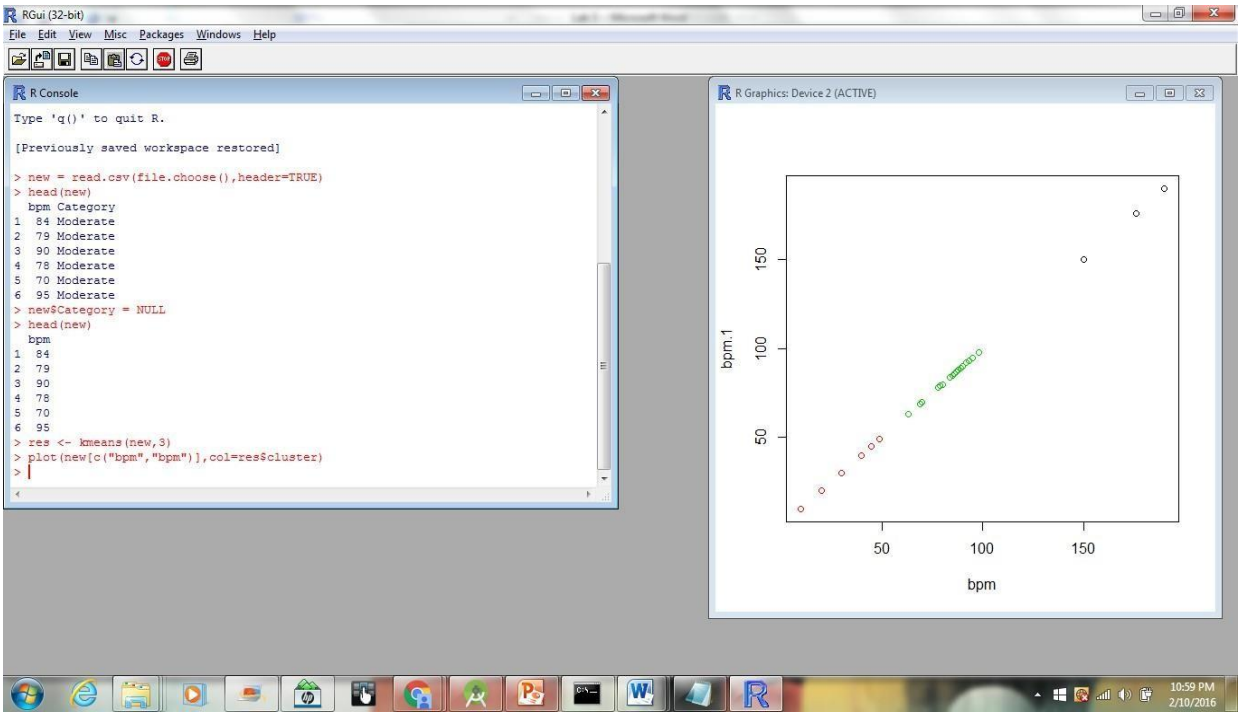

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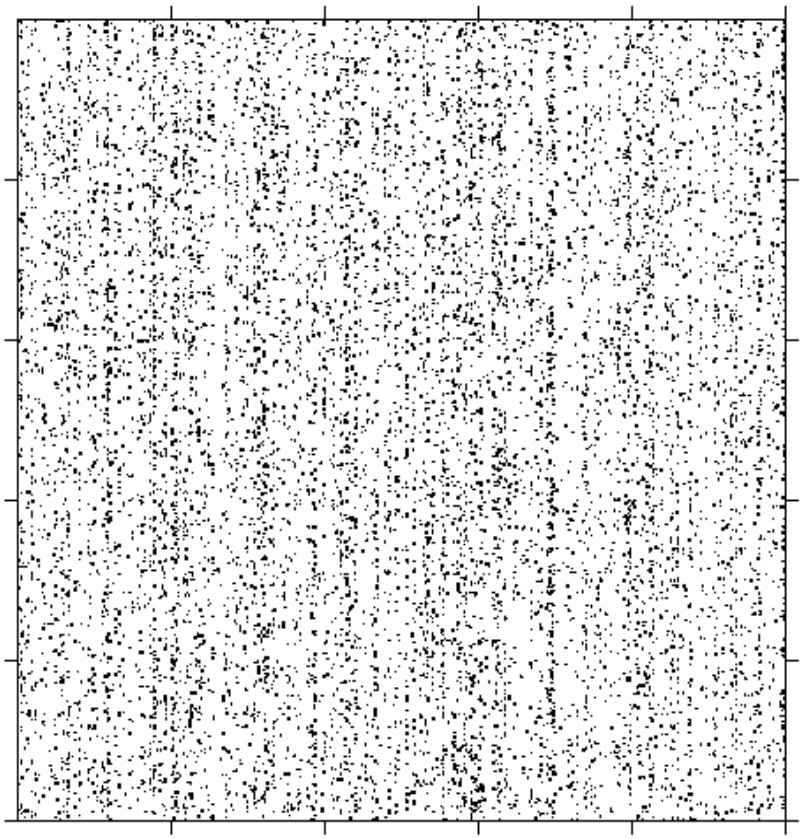

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The datasets in the Heartfit application consists of heart rate data, the steps walked for the day, the timing, the geolocation where it is captured. These datasets are analyzed with the machine learning algorithms and the corresponding patterns are generated.

It would appear as Step Count, Heart rate, time stamp, geolocation. Few more features can be added.

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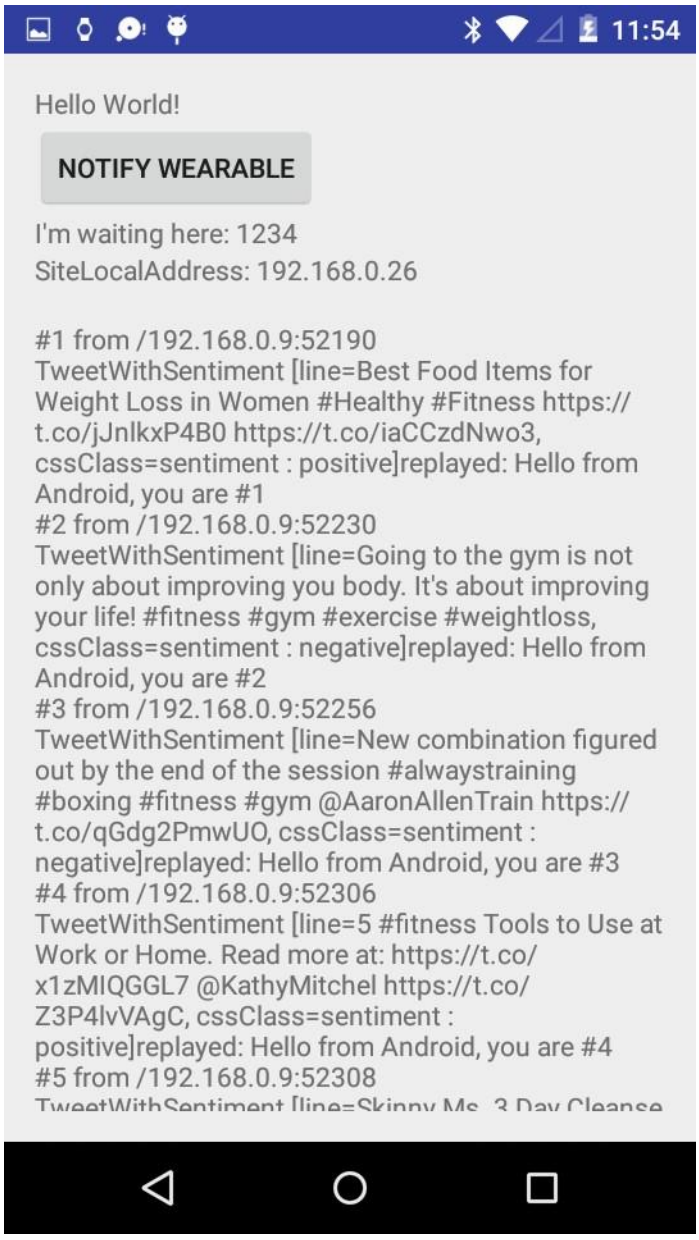

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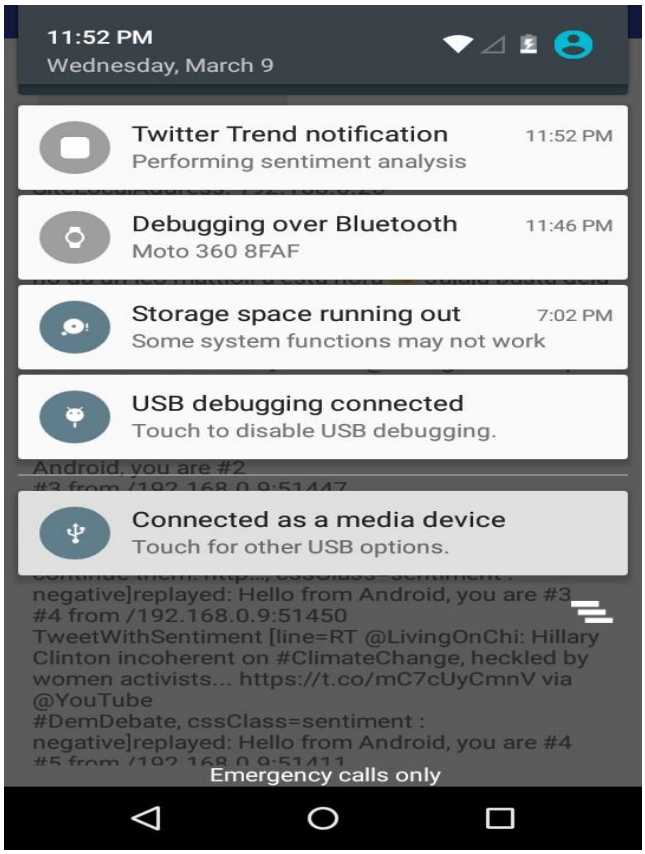

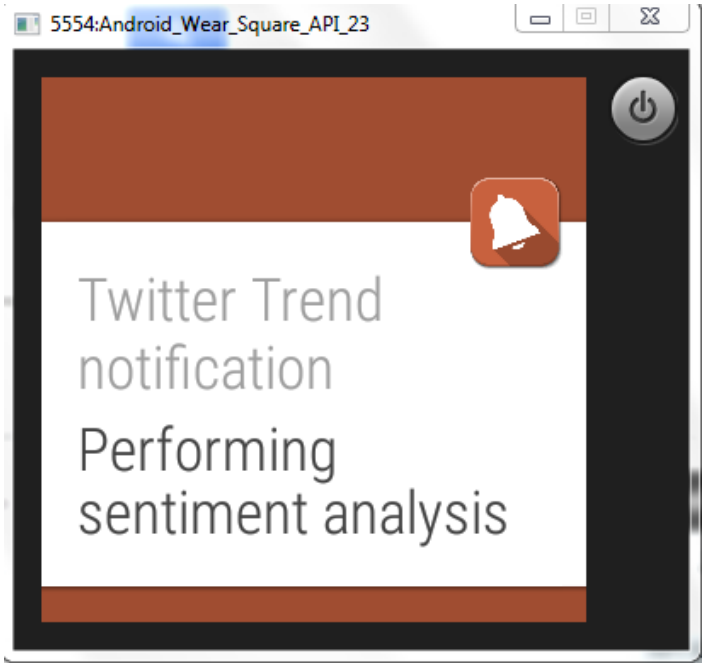

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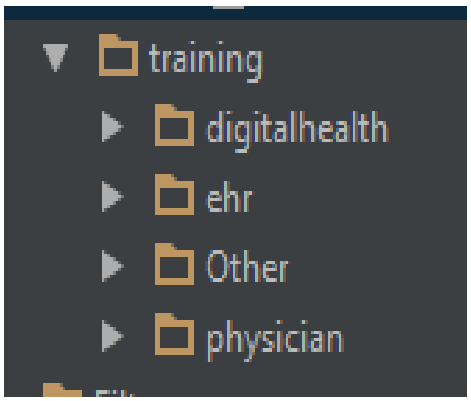

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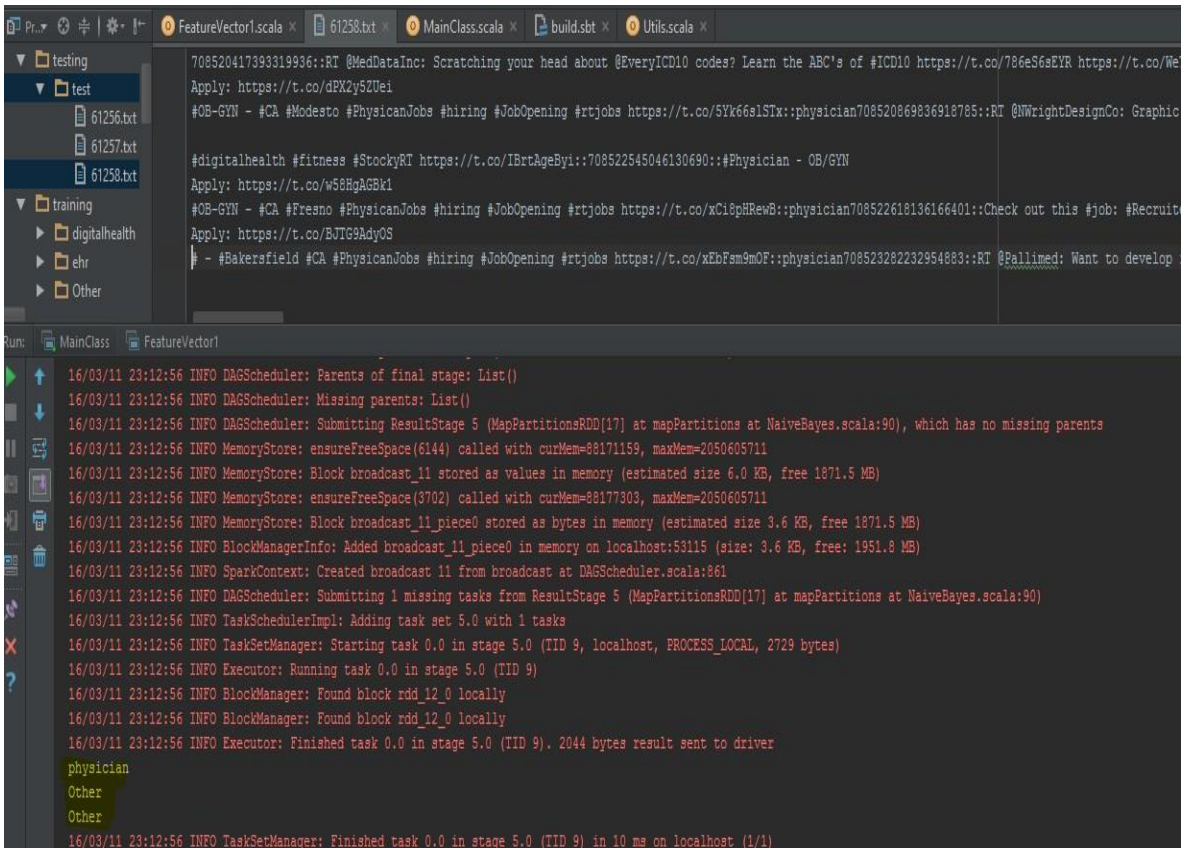
FeatureVector1.scala
61258.txt
MainClass.scala
build.sbt
Utils.scala
testing
test
61256.txt
61257.txt
61258.txt
training
digitalhealth
ehr
Other
708520417393319936::RT @MedDataInc: Scratching your head about @EveryICD10 codes? Learn the ABC's of #ICD10 https://t.co/786eS6sEYR https://t.co/We
Apply: https://t.co/dPX2y5ZUei
#OB-GYN - #CA #Modesto #PhysicanJobs #hiring #JobOpening #rtjobs https://t.co/5Yk66slSTx::physician708520869836918785::RT @NWrightDesignCo: Graphic
#digitalhealth #fitness #StockyRT https://t.co/IBrtAgeByi::708522545046130690::#Physician - OB/GYN
Apply: https://t.co/w58HgAGBk1
#OB-GYN - #CA #Fresno #PhysicanJobs #hiring #JobOpening #rtjobs https://t.co/xCi8pHRewB::physician708522618136166401::Check out this #job: #Recruit
Apply: https://t.co/BJTG9AdyOS
- #Bakersfield #CA #PhysicanJobs #hiring #JobOpening #rtjobs https://t.co/xEbFsm9mOF::physician708523282232954883::RT @Pallimed: Want to develop
Run:
MainClass
FeatureVector1
16/03/11 23:12:56 INFO DAGScheduler: Parents of final stage: List()
16/03/11 23:12:56 INFO DAGScheduler: Missing parents: List()
16/03/11 23:12:56 INFO DAGScheduler: Submitting ResultStage 5 (MapPartitionsRDD[17] at mapPartitions at NaiveBayes.scala:90), which has no missing parents
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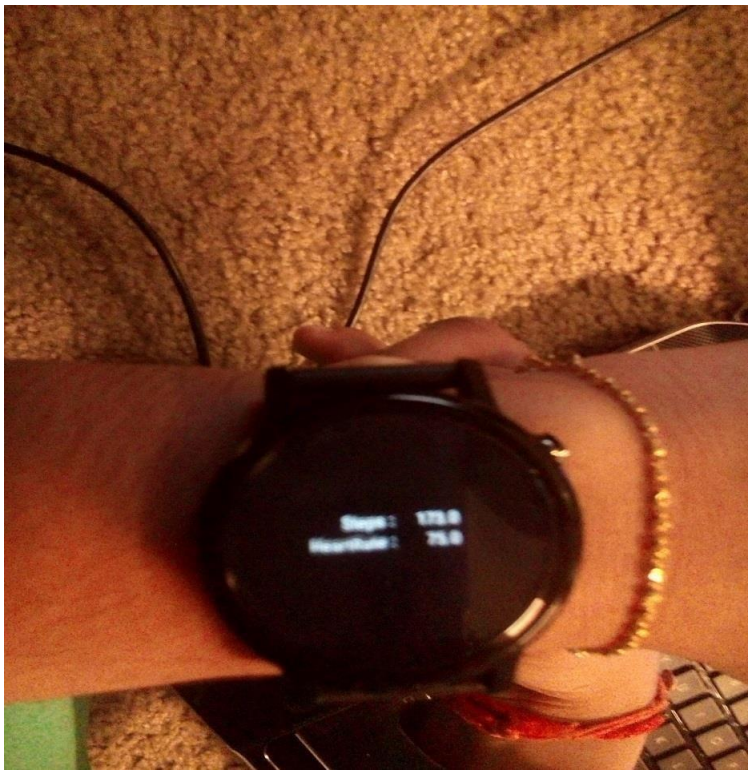
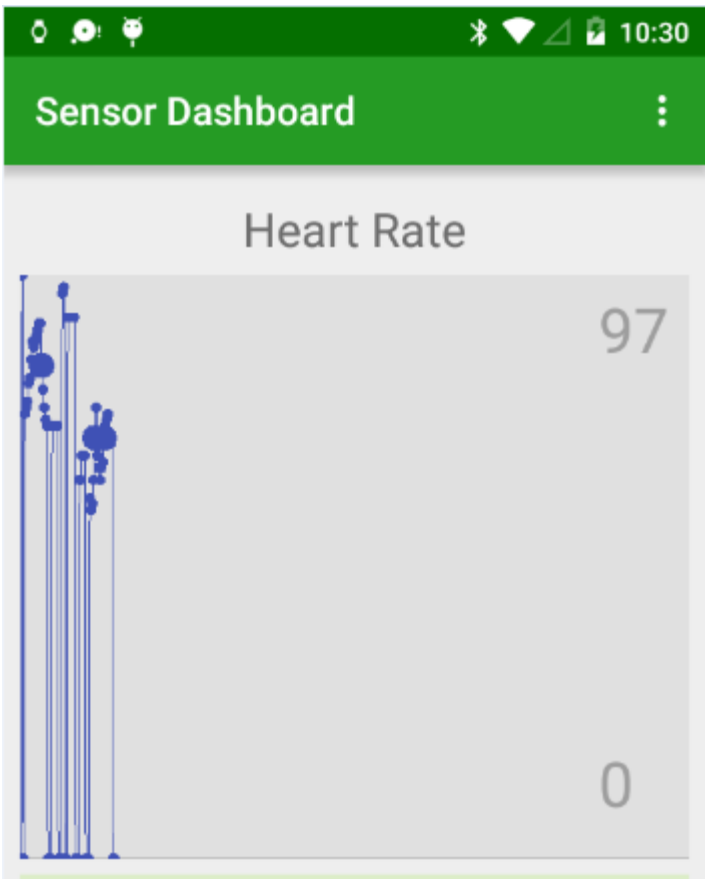
physician
Other
Other
16/03/11 23:12:56 INFO TaskSetManager: Finished task 0.0 in stage 5.0 (TID 9) in 10 ms on localhost (1/1)

DEPLOYMENT:

HeartFit application


Steps : 113.0
HeartRate : 82.0





Github link: https://github.com/hirenshah7390/Bigdata_Project/tree/master/Hiren

PROJECT MANAGEMENT:

Planning

We as a team discussed about the project idea, project flow , features that are to be implemented. Roles and responsibilities are being discussed and given below.

Time: 8 hours

Members Participated: HirenShah, Abhiram, Harshini, Dinesh Reddy

Implementation

The step counter and heart sensor data is collected continuously using the sensors in the smart watch.

The data is sent to the smartphone and graphs are plotted on phone. The collected data is classified and

working on recommendation systems.

The machine learning algorithms were implemented

Responsibility: Data collection, Zenhub

Time: 30 hours

Participants: Harshini, Abhiram, HirenShah, Dinesh Reddy

Testing

Test cases for all the above designed pages were implemented.

Responsibility: Tried to collect data at different times when sleeping, walking,etc

Time: 4 hours

Participants: HirenShah, Dinesh Reddy, Abhiram, Harshini

BIBILIOGRAPHY:

http://www.r-bloggers.com/association-rule-learning-and-the-apriori-algorithm/

http://www.dreamincode.net/forums/topic/324137-periodically-collect-accelerometer-data-in-android/

http://www.wareable.com/fitbit/fitbit-70-of-people-ignore-heart-rate-data-1523

https://dev.fitbit.com/docs/heart-rate/

http://www.livescience.com/42132-heart-rate-activity-tracker-useful.html

CS5542 BIG DATA ANALYTICS AND APPS

Increment -3 Report (04/06/2016)

Project Group -7

By

Abhiram Ampabathina (1)

Harshini Medikonda (14)

Hirenbhai Harshadbhai Shah(27)

Dinesh Reddy (19)

I.INTRODUCTION:

The heart rate of a person depends on age, gender, daily physical activity, mental stress and many other activities/conditions. Furthermore, there is no proper equipment that can keep a track of heart beat rate. We intend to do a system that can collect the person's daily heart rate activity, store it in a database, analyze the heart rate and the activity the person is performing. Moreover, the application can analyze the data and recommend mental or physical activities to be performed by the user to keep the heart rate optimal. It can also suggest the timings of the abnormal heart rate. All these would give a clear idea of the medical condition of the user and the better usage of it can help in a longer life.

II.PROJECT GOAL AND OBJECTIVES:

OVERALL GOAL:

The goal of the project is to build a system that can take care of the user's health. This heart rate system is an android application which he can view even through the smart watch. This application works with the heart rate sensor embedded in the smart watch. It can observe the patterns of the heart rate and determine the health condition. It recommends the user with the necessary physical and mental activity.

SPECIFIC OBJECTIVE:

The objectives that would be achieved are as follows:

- Collect the heart rate and step count of the user
- Store the heart rate in regular intervals
- Get the heart rate onto HDFS per day basis
- Analyze it using machine learning algorithms.
- Notifying the health conditions using smart watch and smart phone
- Recommend the activities to be done by the user.
- Have a medical record, convenient and cost efficient.

SPECIFIC FEATURES:

The specific features designed in the project are:

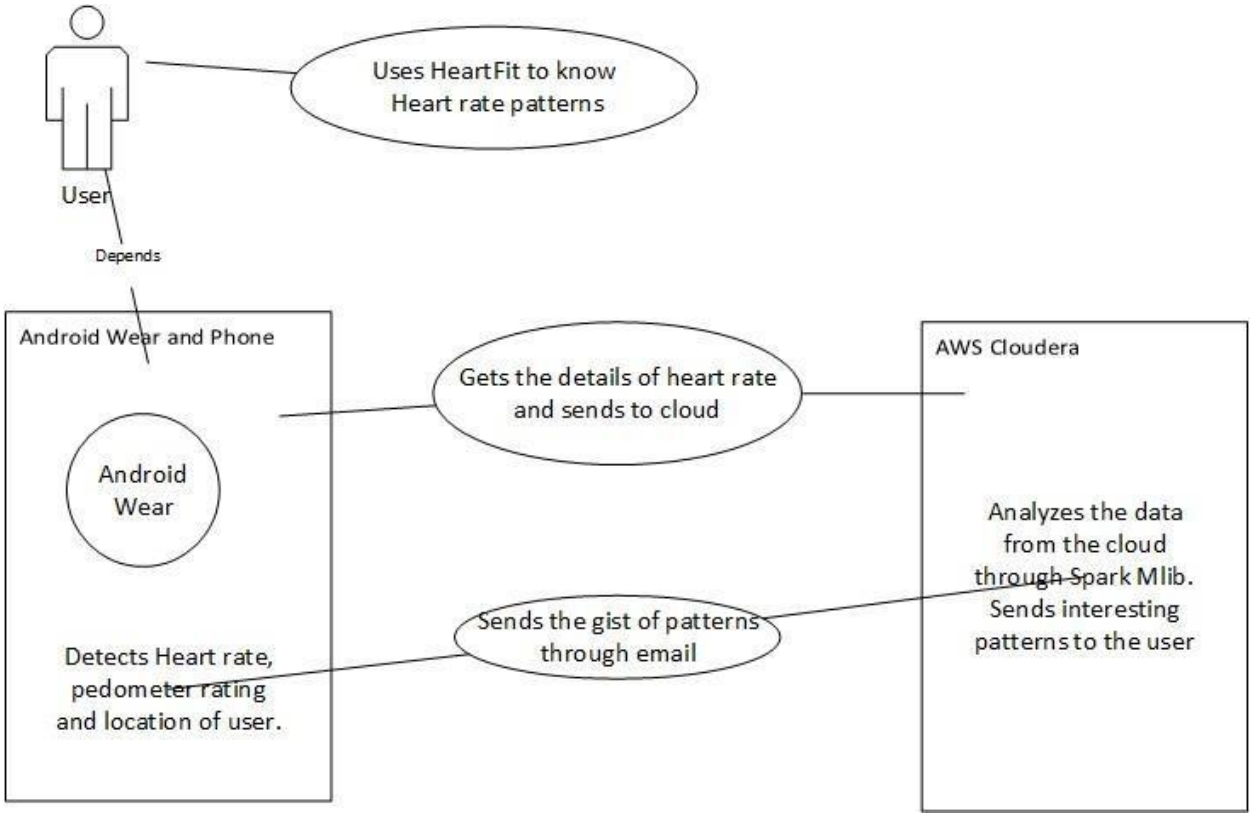
- Heart beat analysis
- Step count analysis
- Notification of current health condition
- Recommendation of health care

SIGNIFICANCE:

The main significance of this application is it is a system that is required for every person in their daily life. It is a trending smart application which makes the life easier. It is beneficial and becomes a part of the life in the upcoming years.

III. PROJECT PLAN:

1. Stories : Scenario & Use case specification



FEATURE DESIGN:

The application is designed to have the following features

1. Ability to run the application background all the time.

2. Ability to read heart rate accurately.

3. Ability to read the location of the user accurately.

4. Ability to send the information to cloud DB when internet is connected.

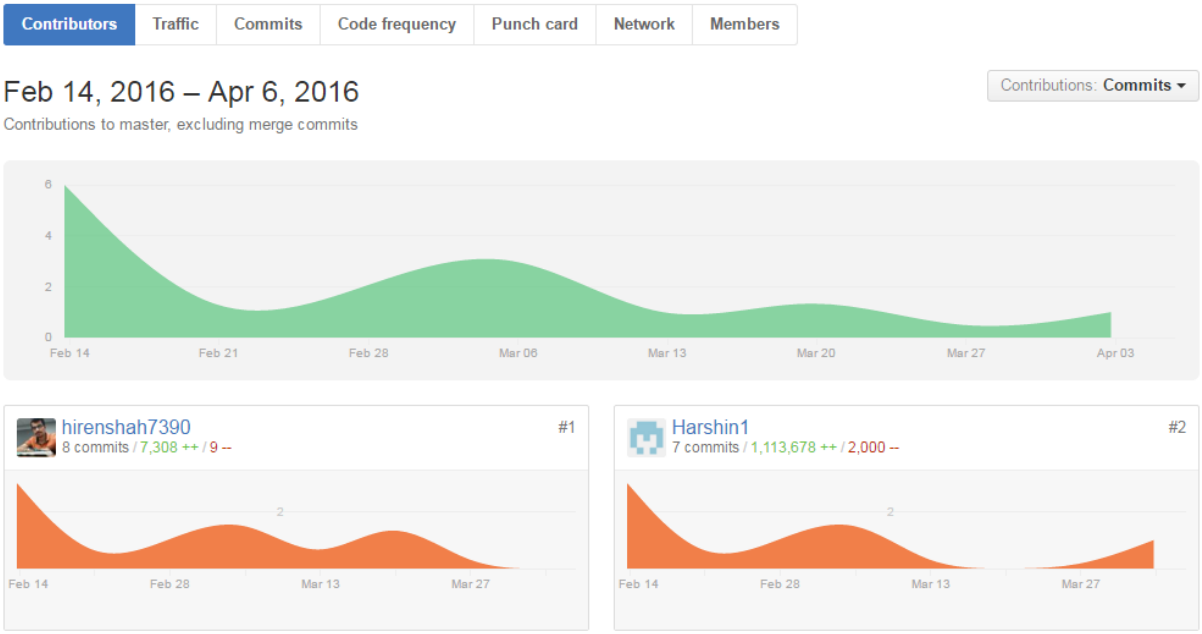
The system performs clustering based on the heart rate data of the user and recommends the user of the exercises to follow to stay healthy.

Each feature is designed accordingly to the specifications it should perform.

FEATURE IMPLEMENTATION:

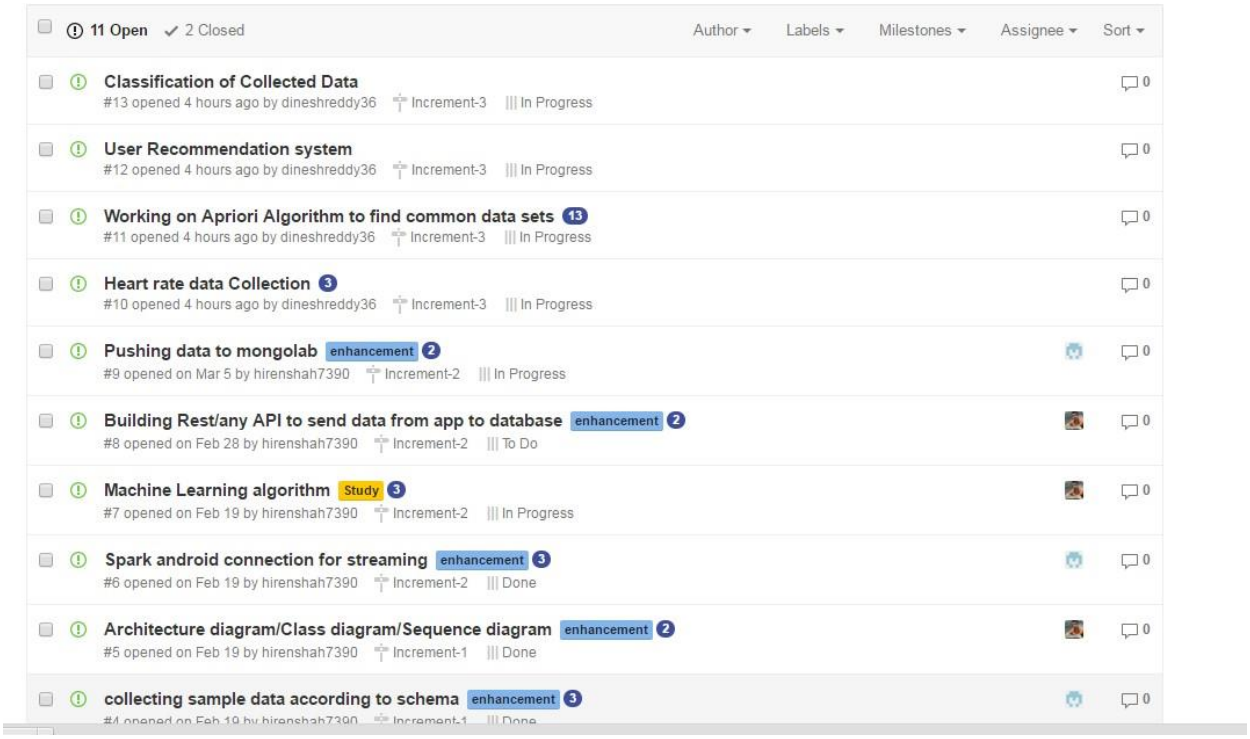
The application is designed to work continuously in the background. For this we added permission in android activity.xml . So, that the phone or the wear supports to run the application in background. To read user heart rate, we added heart rate sensor as a dependency to the application dependency list. This will accurately detect user's heart rate and return it to mobile. Our application will also send location details of user. For this we included GPS Location dependency plugin to android. This will send us the co-ordinates of the user's location. We also need to make sure the device is connected to internet in order to send the user's details to cloud DB, furtherly to analyze the data in cloudera.

2. PROJECT TIMELINES, MEMBERS, TASK RESOPNSIBILITY:



BURNDOWN CHARTS:

ISSUES:


11 Open
2 Closed
Author
Labels
Milestones
Assignee
Sort
Classification of Collected Data
#13 opened 4 hours ago by dineshreddy36 Increment-3 In Progress
User Recommendation system
#12 opened 4 hours ago by dineshreddy36 Increment-3 In Progress
Working on Apriori Algorithm to find common data sets 13
#11 opened 4 hours ago by dineshreddy36 Increment-3 In Progress
Heart rate data Collection 3
#10 opened 4 hours ago by dineshreddy36 Increment-3 In Progress
Pushing data to mongolab enhancement 2
#9 opened on Mar 5 by hirenshah7390 Increment-2 In Progress
Building Rest/any API to send data from app to database enhancement 2
#8 opened on Feb 28 by hirenshah7390 Increment-2 To Do
Machine Learning algorithm Study 3
#7 opened on Feb 19 by hirenshah7390 Increment-2 In Progress
Spark android connection for streaming enhancement 3
#6 opened on Feb 19 by hirenshah7390 Increment-2 Done
Architecture diagram/Class diagram/Sequence diagram enhancement 2
#5 opened on Feb 19 by hirenshah7390 Increment-1 Done
collecting sample data according to schema enhancement 3

IV. THIRD INCREMENT REPORT:

EXISTING API:

- MongoLab API:

https://api.mongolab.com/api/1/databases/my-db/collections?apiKey=myAPIKey

This API is used to store the heart rate and step count in the database and get the heart rate from the database.

- Heart Rate and Step counter Sensor

The heart rate and step counter sensors are embedded in the smart watch which can be used to get the data. This data is sent to the Spark HDFS system on a per-day basis.

- Java Mail API

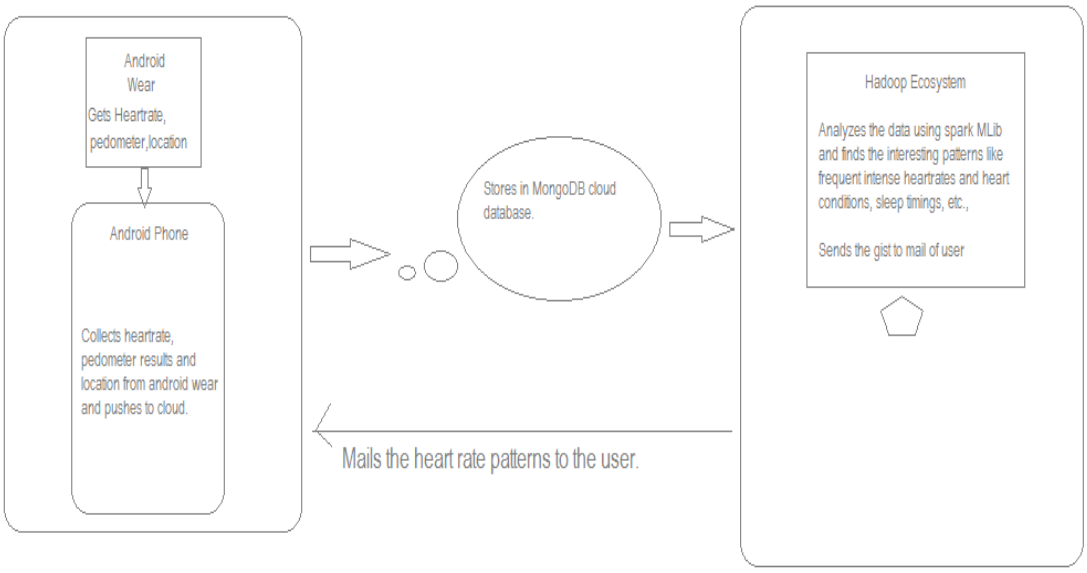
This is used to send an email of the results to the user as an email.

- Twitter Streaming API

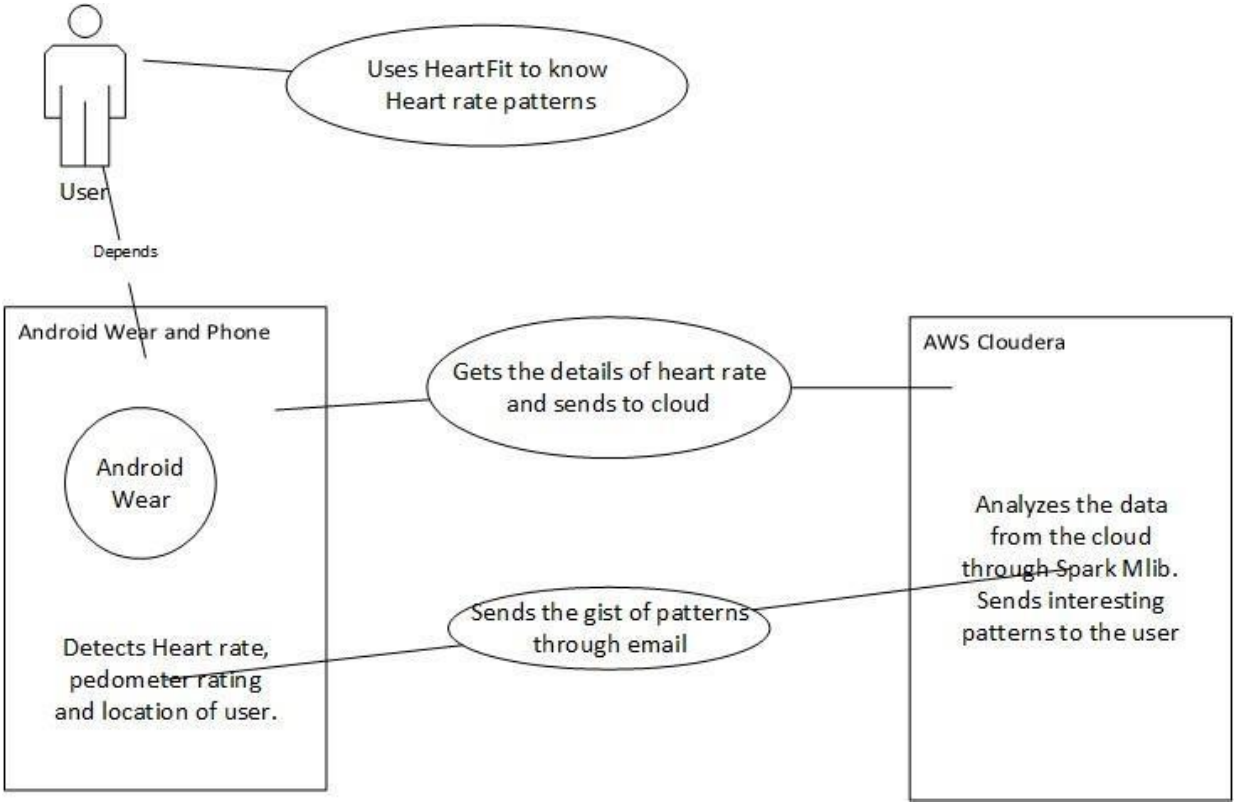
The tweets are collected as per the keywords heartrate, fitness, pulse, health and these are analyzed.

DESIGN OF FEATURES

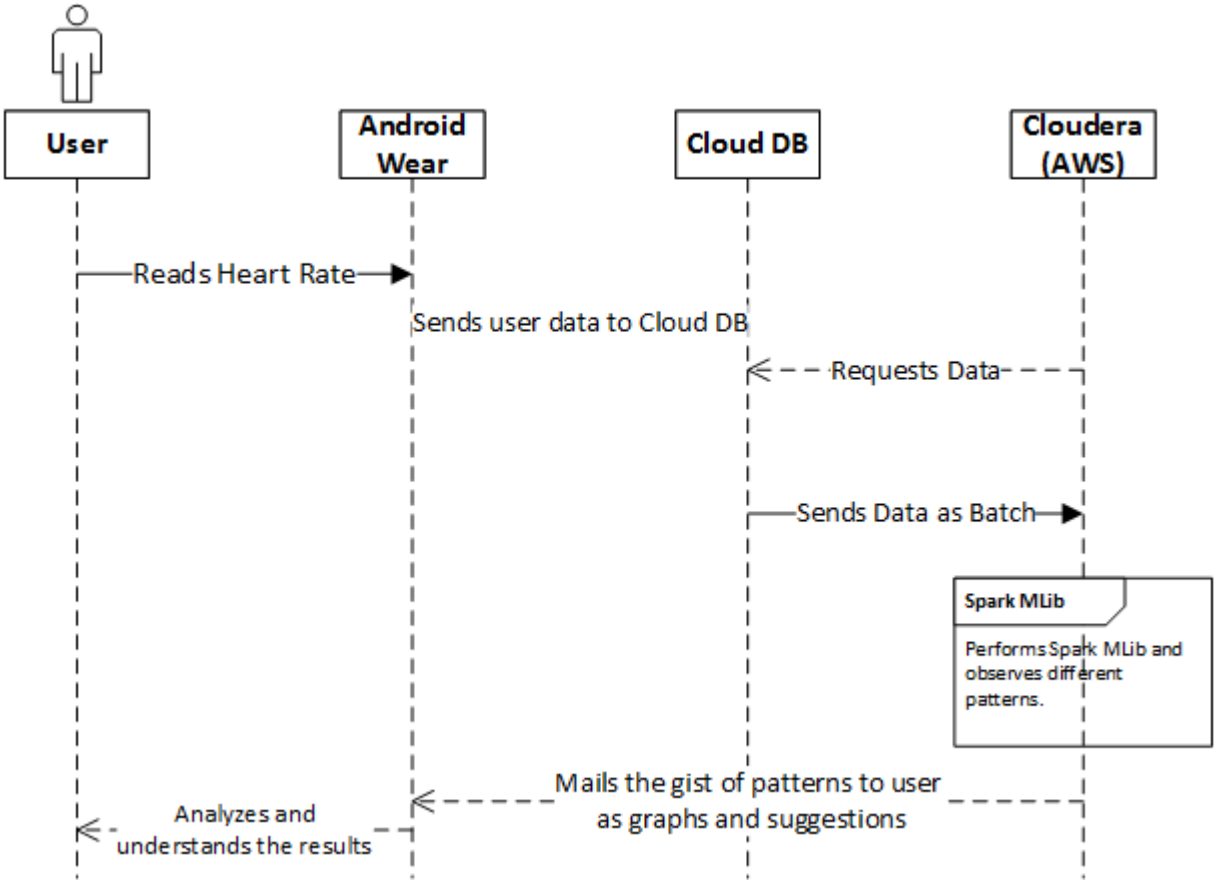
ARCHITECHTURE DIAGRAM:



CLASS DIAGRAM:



SEQUENCE DIAGRAM:

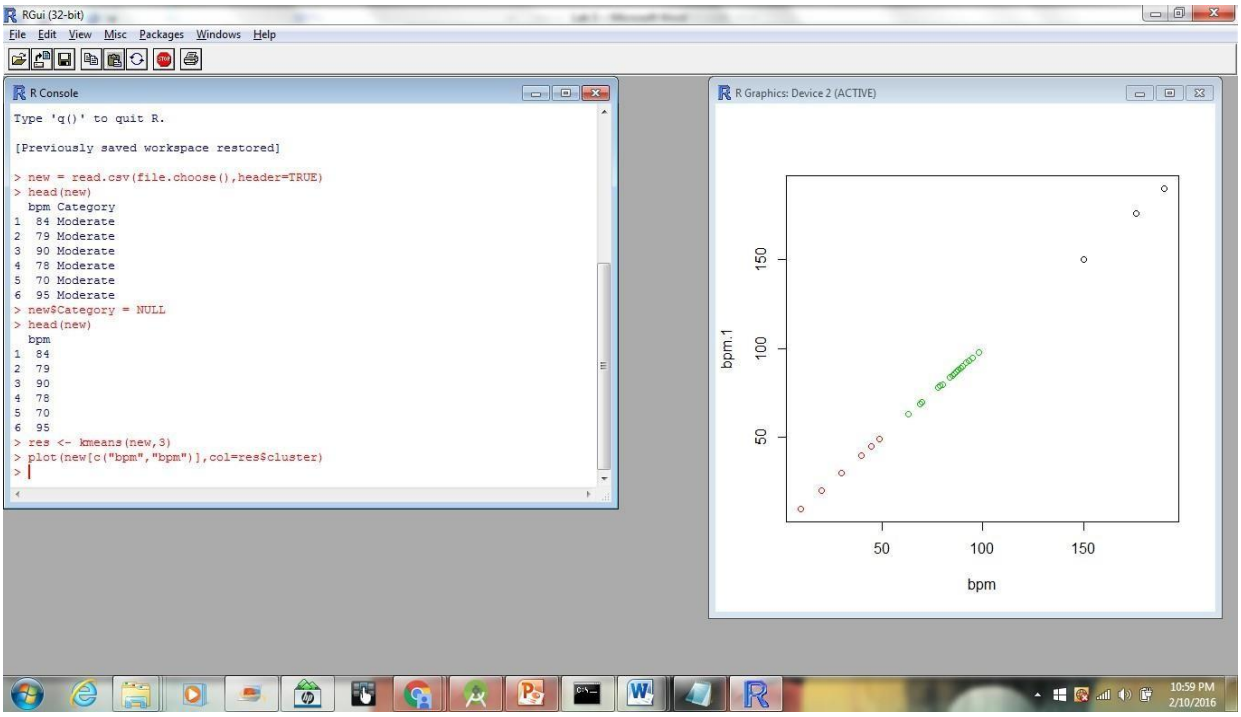


SPARK/MACHINE LEARNING ALGORITHMS:

In this application, we are planning to use the below machine learning algorithms to analyze the data.

1. **K-means Clustering:**

K-means clustering algorithm is a cluster analysis in which k clusters are formed with n observations. The similar observations are clustered determining the centroid. Here the similar heart rates are clustered and the patterns are determined.



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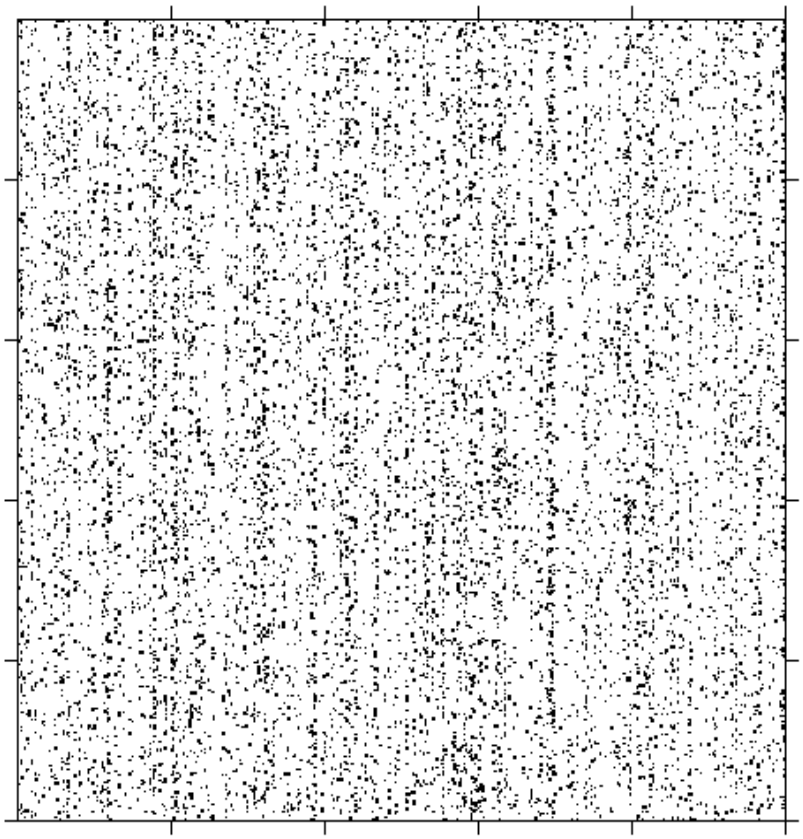

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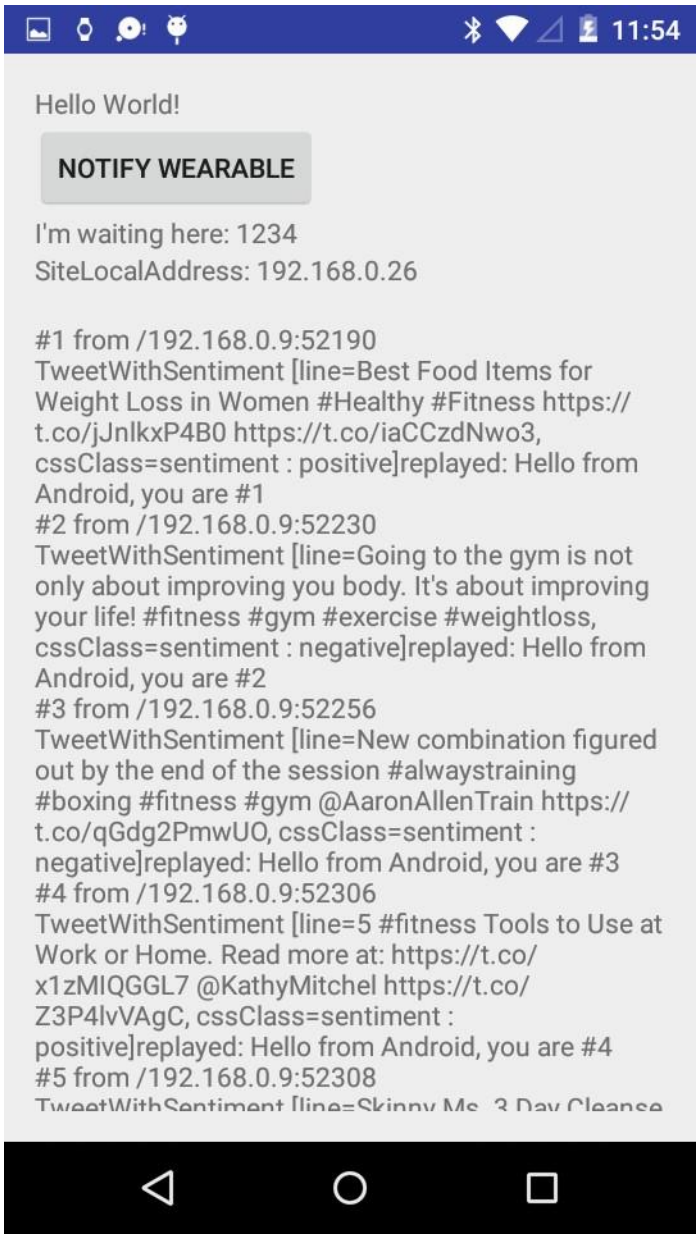

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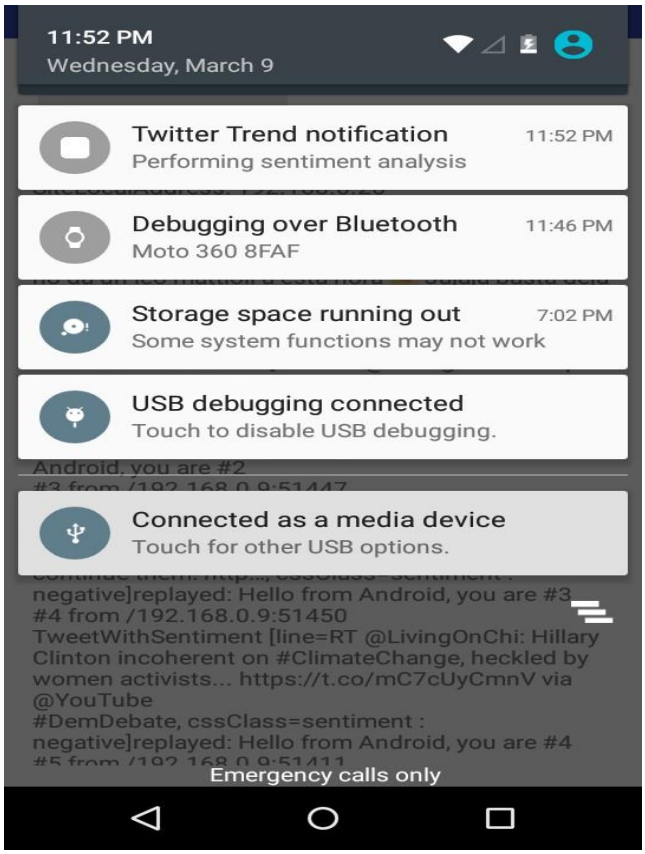

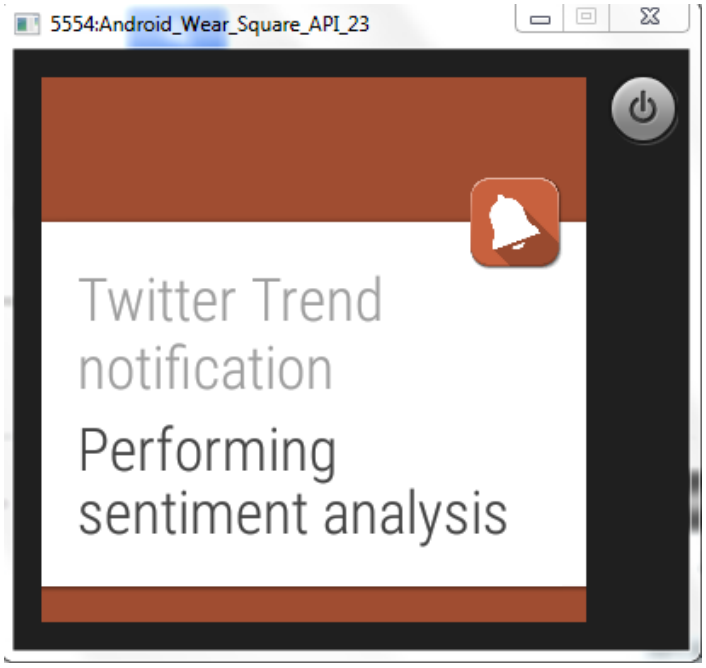

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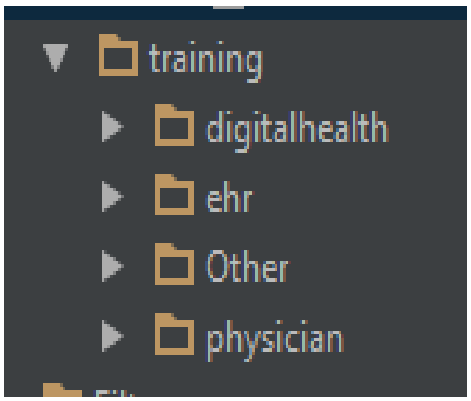

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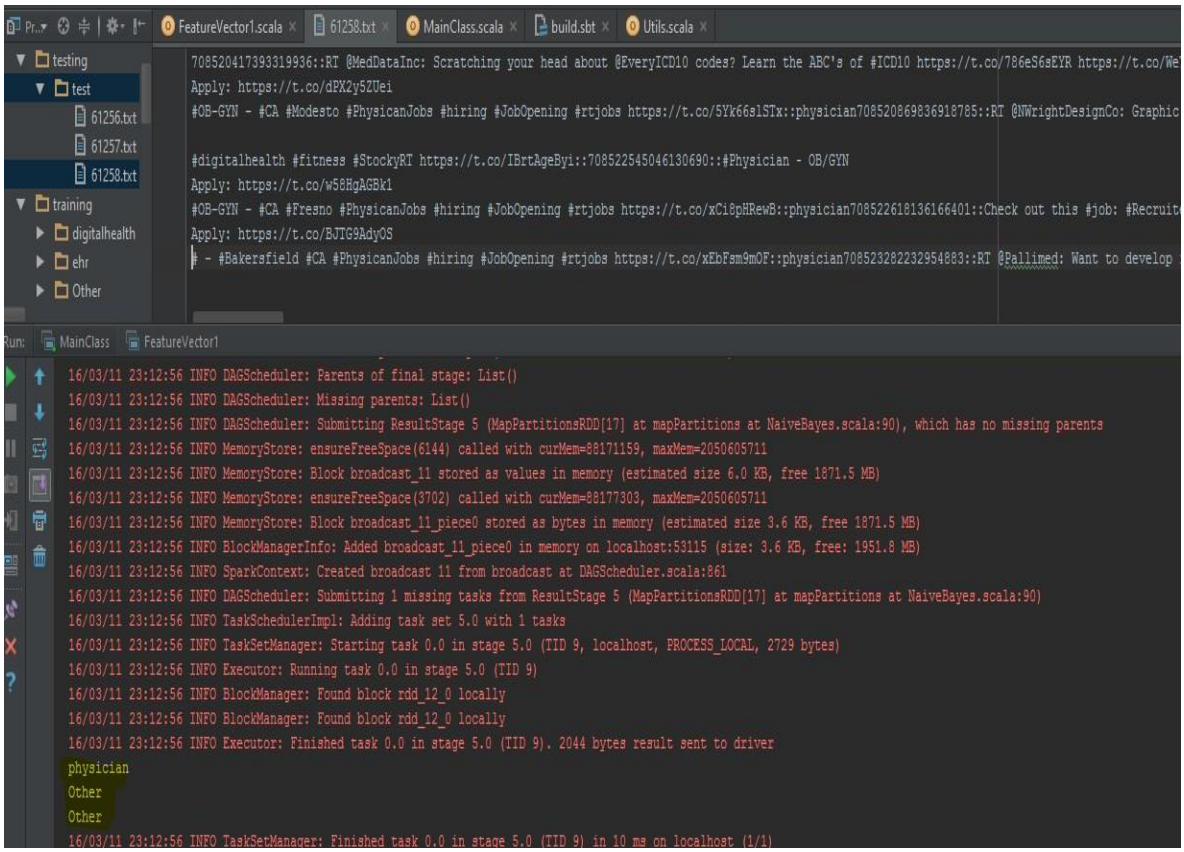
FeatureVector1.scala
61258.txt
MainClass.scala
build.sbt
Utils.scala
testing
test
61256.txt
61257.txt
61258.txt
training
digitalhealth
ehr
Other
708520417393319936::RT @MedDataInc: Scratching your head about @EveryICD10 codes? Learn the ABC's of #ICD10 https://t.co/786eS6sEYR https://t.co/We
Apply: https://t.co/dPX2y5ZUei
#OB-GYN - #CA #Modesto #PhysicanJobs #hiring #JobOpening #rtjobs https://t.co/5Yk66slSTx::physician708520869836918785::RT @NWrightDesignCo: Graphic
#digitalhealth #fitness #StockyRT https://t.co/IBrtAgeByi::708522545046130690::#Physician - OB/GYN
Apply: https://t.co/w58HgAGBk1
#OB-GYN - #CA #Fresno #PhysicanJobs #hiring #JobOpening #rtjobs https://t.co/xCi8pHRewB::physician708522618136166401::Check out this #job: #Recruit
Apply: https://t.co/BJTG9AdyOS
- #Bakersfield #CA #PhysicanJobs #hiring #JobOpening #rtjobs https://t.co/xEbFsm9mOF::physician708523282232954883::RT @Pallimed: Want to develop
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DEPLOYMENT:


Ultra.me
11:03
APPS
WIDGETS
Maps
Messaging
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Notification
NotificationToSmartWatch
Phone
PhoneSensors
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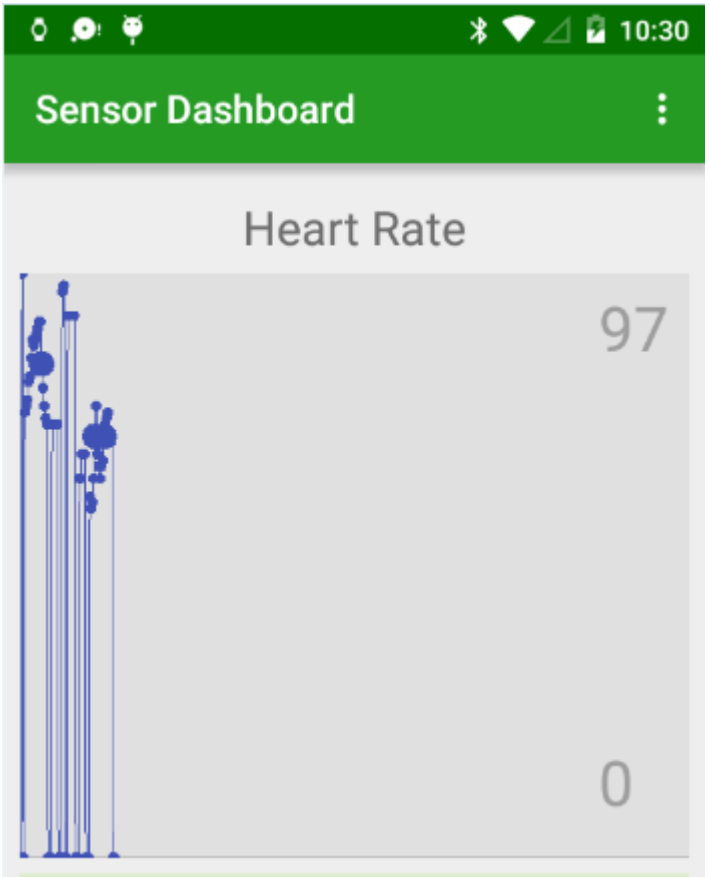
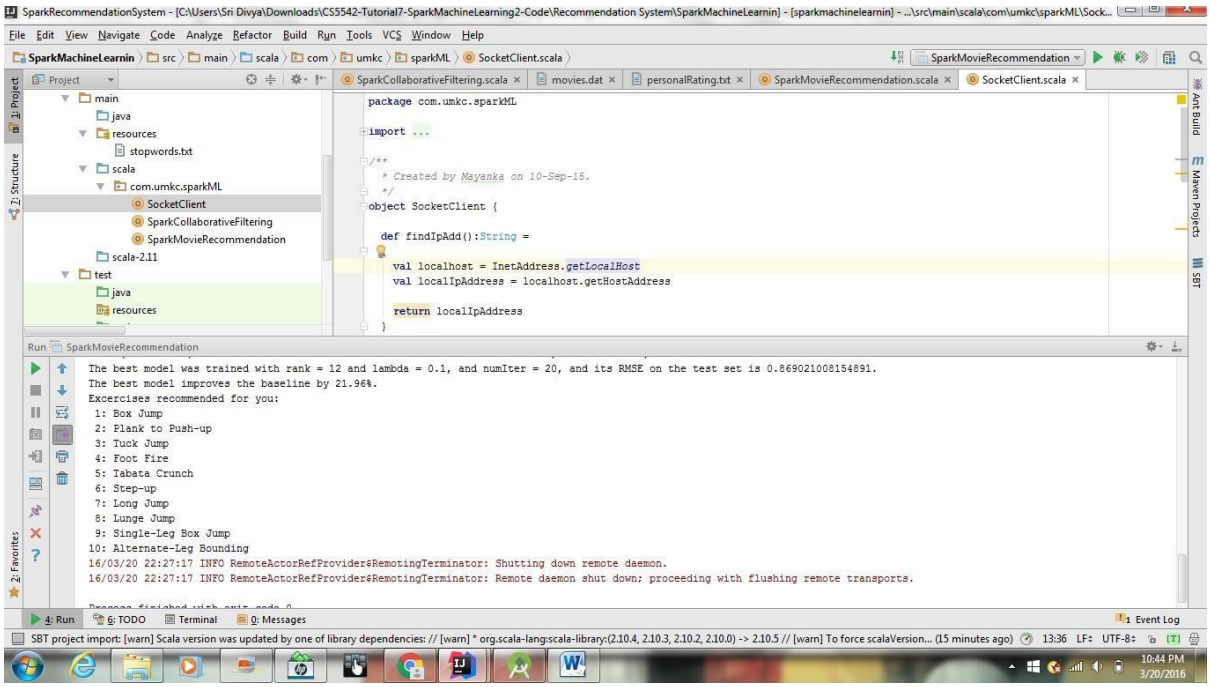
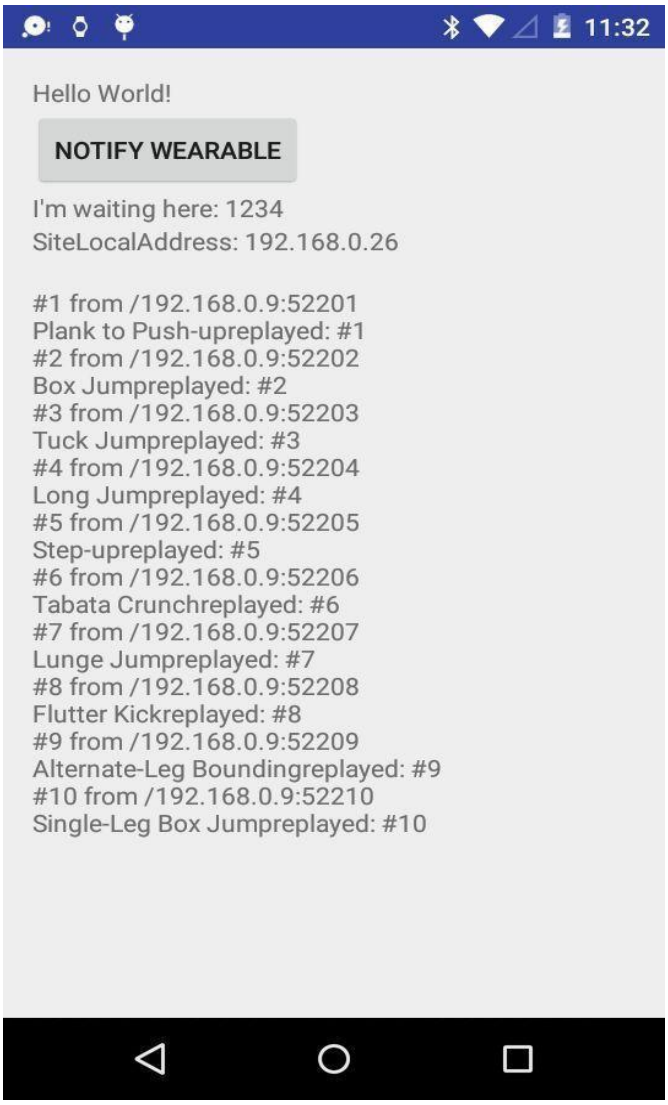
Steps : 113.0
HeartRate : 82.0


10:30
Sensor Dashboard
Heart Rate
97
0

In our project, we are recommending the users some physical and heart exercises based on their health condition and their daily routine. Based on the personal ratings and ratings of other users followed the recommendations are given.



The same is sent to smartwatch/ smart phone.



Frequent Pattern Mining – Spark - MLib

For matching the frequent patterns , we have used FP growth alogorithm.

FP-growth

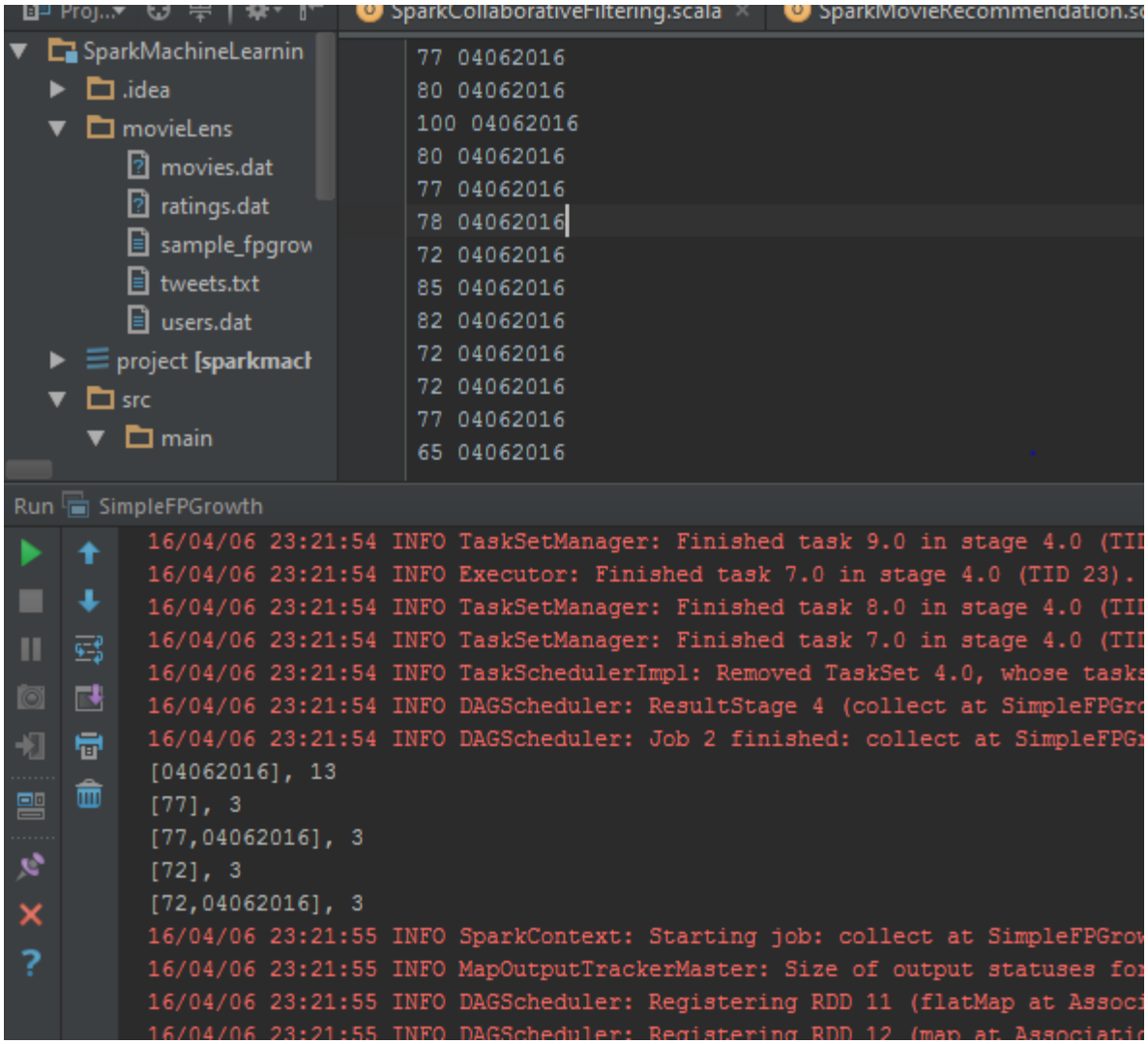
`spark.mllib`'s FP-growth implementation takes the following (hyper-)parameters:

- `minSupport`: the minimum support for an itemset to be identified as frequent. For example, if an item appears 3 out of 4 transactions, it has a support of 3/4=0.75.
- `numPartitions`: the number of partitions that are used to distribute the work.

Below is the implementation of algorithm for our heart bit data to find out the pattern on partocular day to check working of heart bit, whether its behaving normal or not. The output for our sample file is

included below it.

```scala
object SimpleFPGrowth {

  def main(args: Array[String]) {
    System.setProperty("hadoop.home.dir","c:\\winutils")

    val conf =new SparkConf().setMaster("local[*]").setAppName("SparkNaiveBayes").set("spark.driver.memory", "3g").set("spark.executor.mem
    val sc = new SparkContext(conf)
   // val conf = new SparkConf().setAppName("SimpleFPGrowth")
    //val sc = new SparkContext(conf)

    // $example on$
    val data = sc.textFile("movieLens/sample_fpgrowth.txt")

    val transactions: RDD[Array[String]] = data.map(s => s.trim.split(' '))

    val fpg = new FPGrowth()
      .setMinSupport(0.2)
      .setNumPartitions(10)
    val model = fpg.run(transactions)

    model.freqItemsets.collect().foreach { itemset =>
      println(itemset.items.mkString("[", ",", "]") + ", " + itemset.freq)
    }

    val minConfidence = 0.8
    model.generateAssociationRules(minConfidence).collect().foreach { rule =>
      println(
        rule.antecedent.mkString("[", ",", "]")
          + " => " + rule.consequent .mkString("[", ",", "]")
          + ", " + rule.confidence)
    }
```



Github link: https://github.com/hirenshah7390/Bigdata_Project/tree/master/Hiren

PROJECT MANAGEMENT:

Planning

We as a team discussed about the project idea, project flow , features that are to be implemented. Roles and responsibilities are being discussed and given below.

Time: 8 hours

Members Participated: HirenShah, Abhiram, Harshini, Dinesh Reddy

Implementation

The step counter and heart sensor data is collected continuously using the sensors in the smart watch.

The data is sent to the smartphone and graphs are plotted on phone. The collected data is classified and

working on recommendation systems.

The machine learning algorithms were implemented and the recommendation systems was implemented

Responsibility: Data collection, Zenhub, FP growth algorithm, Recommendation system.

Time: 30 hours

Participants: Harshini, Abhiram, HirenShah, Dinesh Reddy

Testing

Test cases for all the above designed pages were implemented.

Responsibility: Tried to collect data at different times when sleeping, walking,etc

Time: 4 hours

Participants: HirenShah, Dinesh Reddy, Abhiram, Harshini

BIBILIOGRAPHY:

http://www.r-bloggers.com/association-rule-learning-and-the-apriori-algorithm/

http://www.dreamincode.net/forums/topic/324137-periodically-collect-accelerometer-data-in-android/

http://www.wareable.com/fitbit/fitbit-70-of-people-ignore-heart-rate-data-1523

https://dev.fitbit.com/docs/heart-rate/

http://www.livescience.com/42132-heart-rate-activity-tracker-useful.html

http://spark.apache.org/docs/latest/mllib-guide.html

CS5542 BIG DATA ANALYTICS AND APPS

Increment -4 Report (04/29/2016)

Project Group -7

By

Abhiram Ampabathina (1)

Harshini Medikonda (14)

Hirenbhai Harshadbhai Shah(27)

Dinesh Reddy (19)

I.INTRODUCTION:

The heart rate of a person depends on age, gender, daily physical activity, mental stress and many other activities/conditions. Furthermore, there is no proper equipment that can keep a track of heart beat rate. We intend to do a system that can collect the person's daily heart rate activity, store it in a database, analyze the heart rate and the activity the person is performing. Moreover, the application can analyze the data and recommend mental or physical activities to be performed by the user to keep the heart rate optimal. It can also suggest the timings of the abnormal heart rate. All these would give a clear idea of the medical condition of the user and the better usage of it can help in a longer life.

II.PROJECT GOAL AND OBJECTIVES:

OVERALL GOAL:

The goal of the project is to build a system that can take care of the user's health. This heart rate system is an android application which he can view even through the smart watch. This application works with the heart rate sensor embedded in the smart watch. It can observe the patterns of the heart rate and determine the health condition. It recommends the user with the necessary physical and mental activity.

SPECIFIC OBJECTIVE:

The objectives that would be achieved are as follows:

- Collect the heart rate and step count of the user
- Store the heart rate in regular intervals
- Get the heart rate onto HDFS per day basis
- Analyze it using machine learning algorithms.
- Notifying the health conditions using smart watch and smart phone
- Recommend the activities to be done by the user.
- Have a medical record, convenient and cost efficient.

SPECIFIC FEATURES:

The specific features designed in the project are:

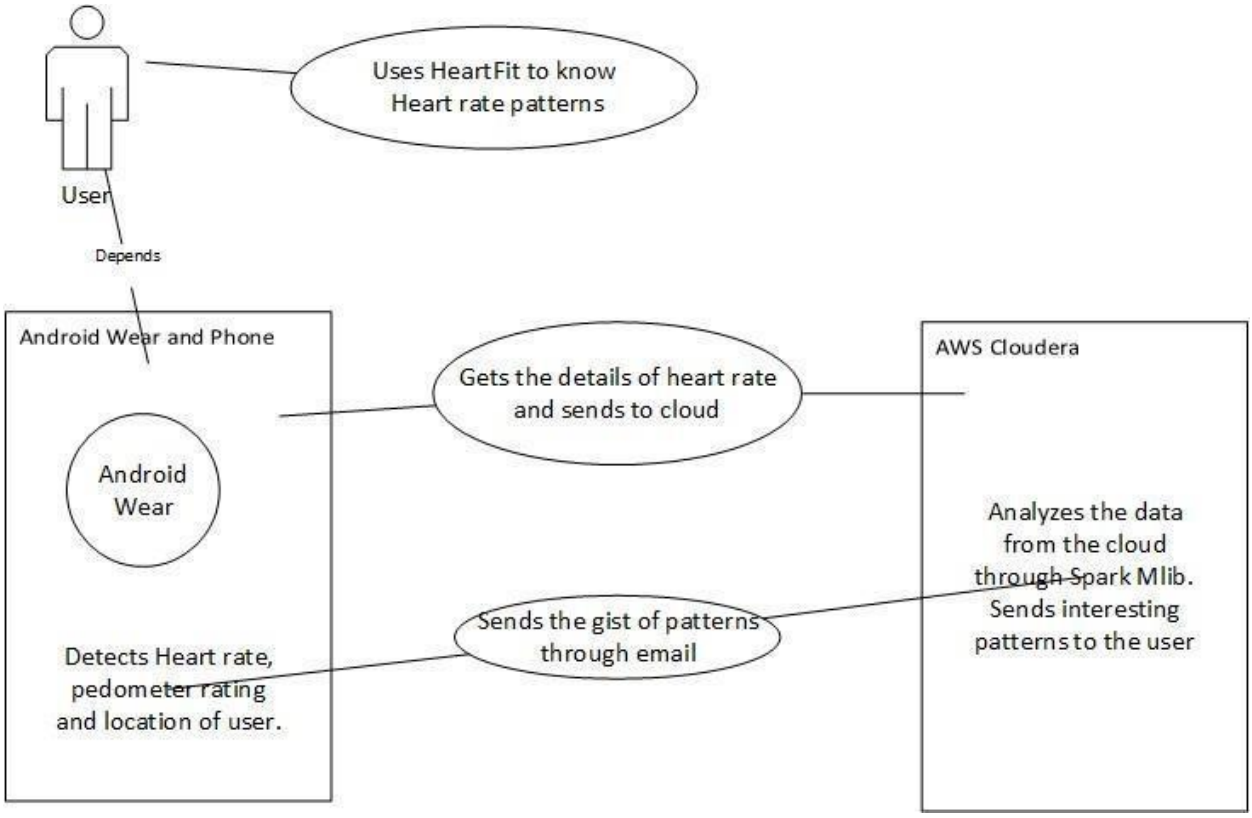
- Heart beat analysis
- Step count analysis
- Notification of current health condition
- Recommendation of health care

SIGNIFICANCE:

The main significance of this application is it is a system that is required for every person in their daily life. It is a trending smart application which makes the life easier. It is beneficial and becomes a part of the life in the upcoming years.

III. PROJECT PLAN:

1. Stories : Scenario & Use case specification



FEATURE DESIGN:

The application is designed to have the following features

1. Ability to run the application background all the time.

2. Ability to read heart rate accurately.

3. Ability to read the location of the user accurately.

4. Ability to send the information to cloud DB when internet is connected.

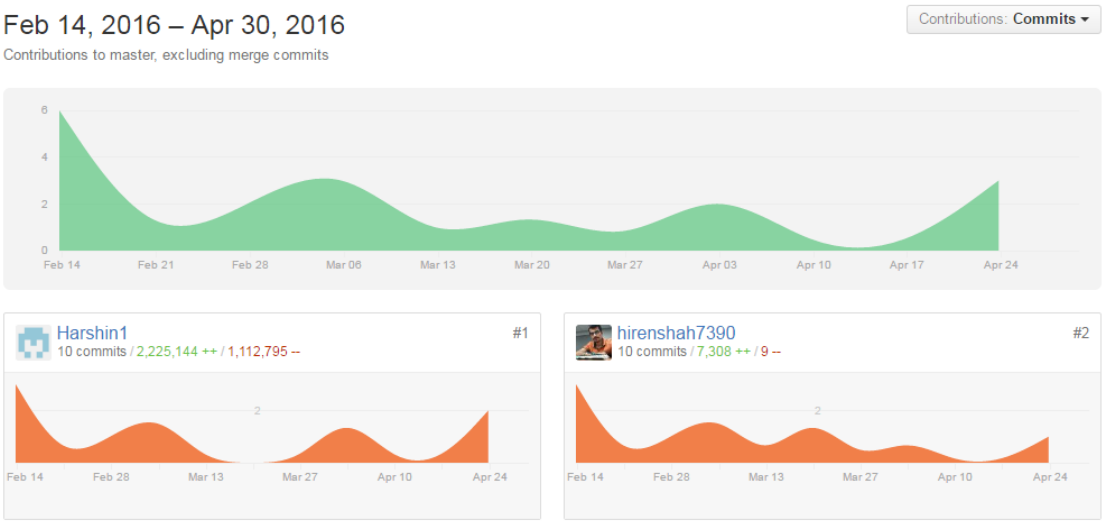
The system performs clustering based on the heart rate data of the user and recommends the user of the exercises to follow to stay healthy.

Each feature is designed accordingly to the specifications it should perform.

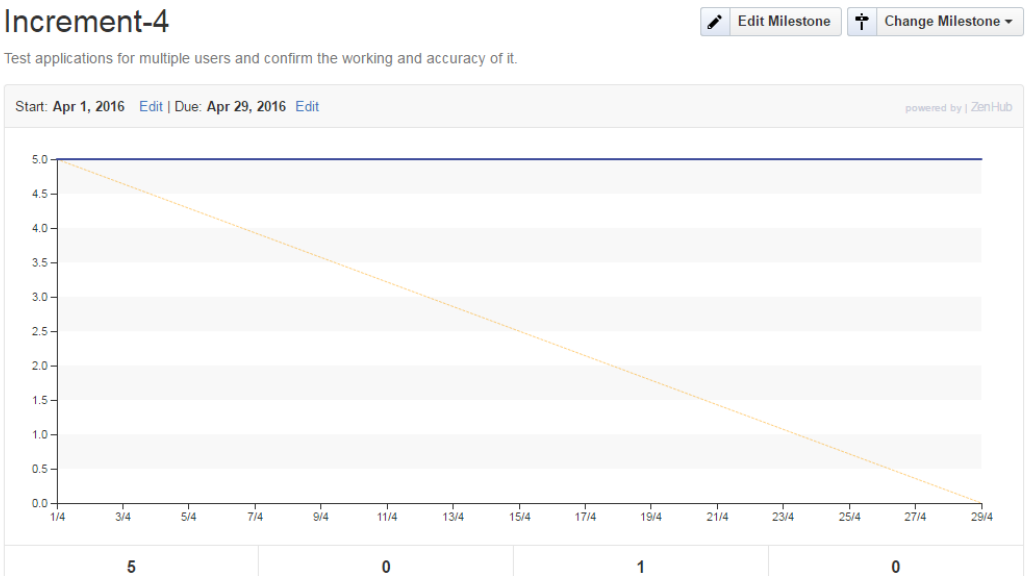
FEATURE IMPLEMENTATION:

The application is designed to work continuously in the background. For this we added permission in android activity.xml . So, that the phone or the wear supports to run the application in background. To read user heart rate, we added heart rate sensor as a dependency to the application dependency list. This will accurately detect user's heart rate and return it to mobile. Our application will also send location details of user. For this we included GPS Location dependency plugin to android. This will send us the co-ordinates of the user's location. We also need to make sure the device is connected to internet in order to send the user's details to cloud DB, furtherly to analyze the data in cloudera.

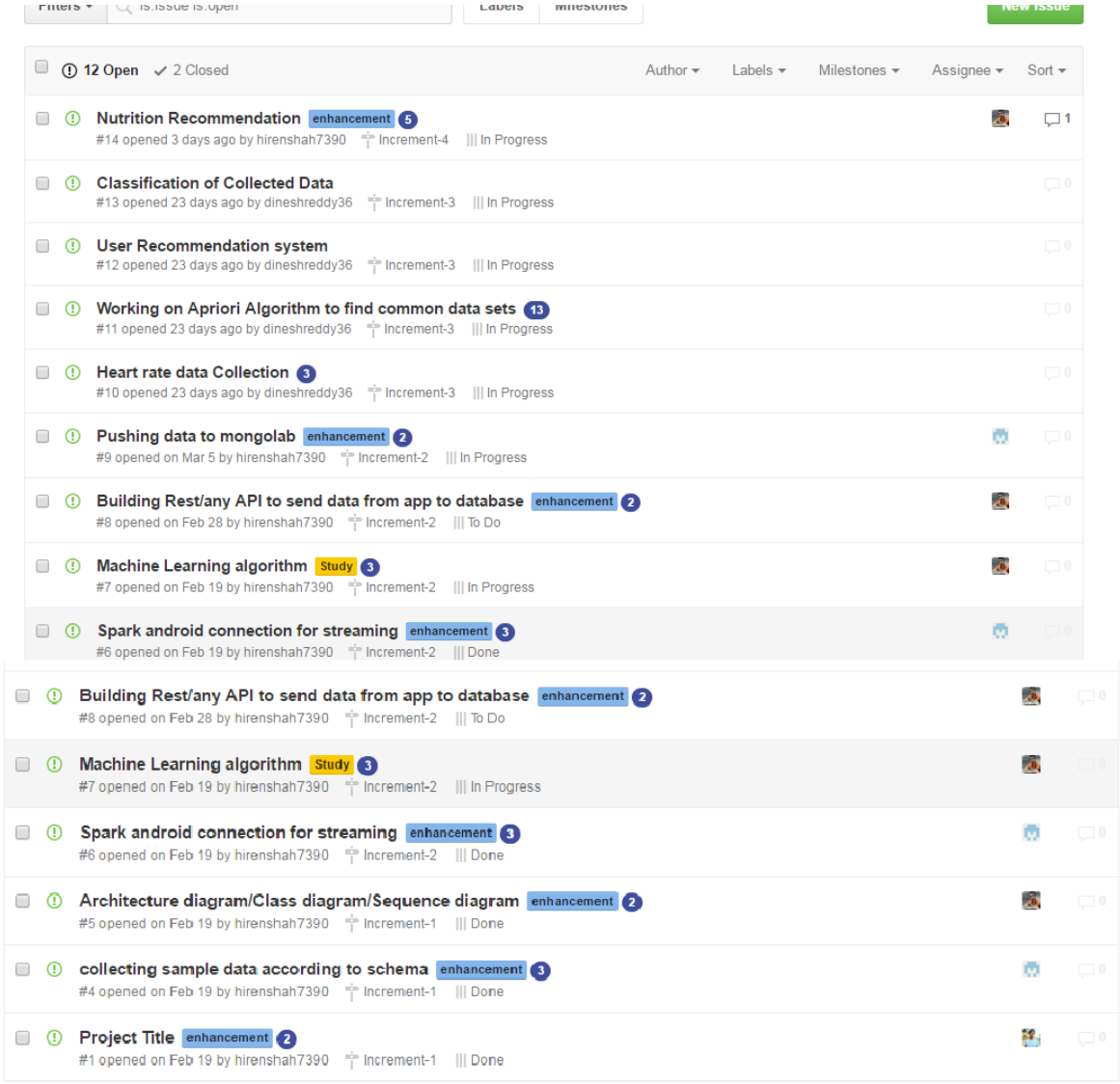
2. PROJECT TIMELINES, MEMBERS, TASK RESOPNSIBILITY:



BURNDOWN CHARTS:



ISSUES:


12 Open
2 Closed
Author
Labels
Milestones
Assignee
Sort
Nutrition Recommendation enhancement 5
#14 opened 3 days ago by hirenshah7390 Increment-4 In Progress
Classification of Collected Data
#13 opened 23 days ago by dineshreddy36 Increment-3 In Progress
User Recommendation system
#12 opened 23 days ago by dineshreddy36 Increment-3 In Progress
Working on Apriori Algorithm to find common data sets 13
#11 opened 23 days ago by dineshreddy36 Increment-3 In Progress
Heart rate data Collection 3
#10 opened 23 days ago by dineshreddy36 Increment-3 In Progress
Pushing data to mongolab enhancement 2
#9 opened on Mar 5 by hirenshah7390 Increment-2 In Progress
Building Rest/any API to send data from app to database enhancement 2
#8 opened on Feb 28 by hirenshah7390 Increment-2 To Do
Machine Learning algorithm Study 3
#7 opened on Feb 19 by hirenshah7390 Increment-2 In Progress
Spark android connection for streaming enhancement 3
#6 opened on Feb 19 by hirenshah7390 Increment-2 Done

Building Rest/any API to send data from app to database enhancement 2
#8 opened on Feb 28 by hirenshah7390 Increment-2 To Do
Machine Learning algorithm Study 3
#7 opened on Feb 19 by hirenshah7390 Increment-2 In Progress
Spark android connection for streaming enhancement 3
#6 opened on Feb 19 by hirenshah7390 Increment-2 Done
Architecture diagram/Class diagram/Sequence diagram enhancement 2
#5 opened on Feb 19 by hirenshah7390 Increment-1 Done
collecting sample data according to schema enhancement 3
#4 opened on Feb 19 by hirenshah7390 Increment-1 Done
Project Title enhancement 2
#1 opened on Feb 19 by hirenshah7390 Increment-1 Done

IV. FOURTH INCREMENT REPORT:

EXISTING API:

- MongoLab API:

https://api.mongolab.com/api/1/databases/my-db/collections?apiKey=myAPIKey

This API is used to store the heart rate and step count in the database and get the heart rate from the database.

- Heart Rate and Step counter Sensor, Others too

The heart rate and step counter sensors are embedded in the smart watch which can be used to get the data. This data is sent to the Spark HDFS system on a per-day basis.

We also collected accelerometer sensor and other sensors to get the accurate location of the person during that time. We are applying machine learning on the collected sensor data to match the patterns and get the user data.

- Java Mail API

This is used to send an email of the results to the user as an email.

- Twitter Streaming API

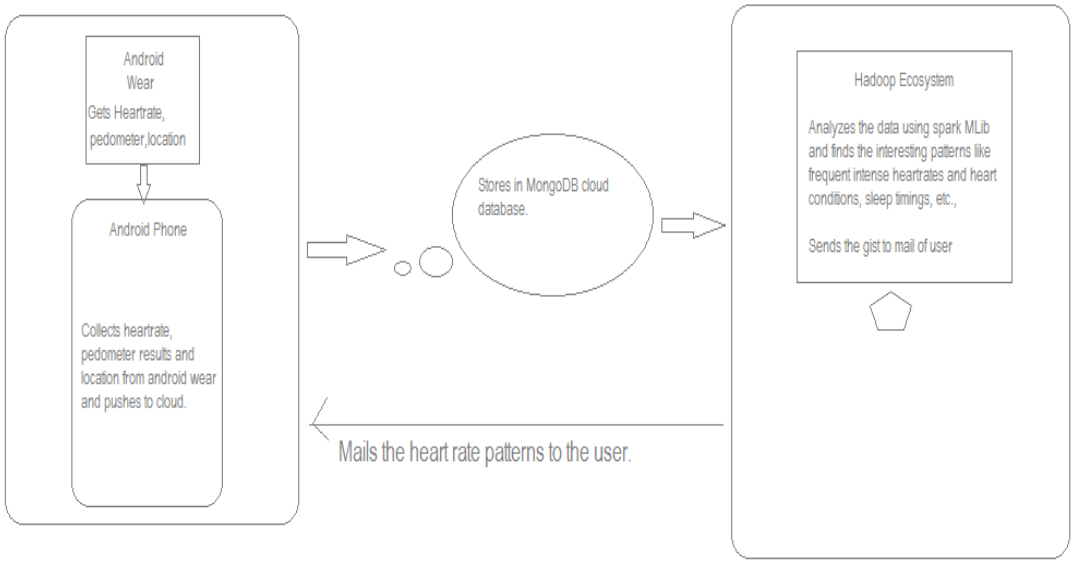
The tweets are collected as per the keywords heart rate, fitness, pulse, health and these are analyzed.

- Nutrients Database

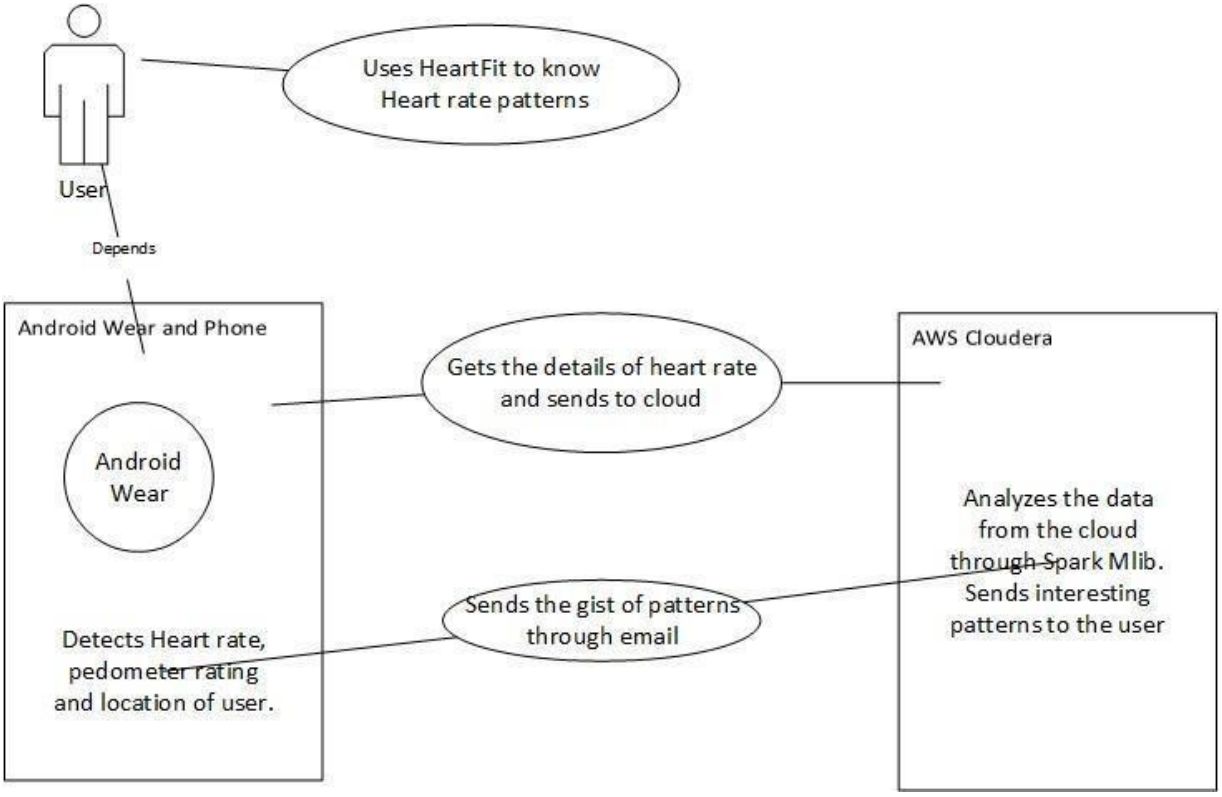
The nutrients data base we have taken for food recommendation has all the food data such as type of food, calories, proteins, nutrients, etc. This is being used to recommend the user to tell him the similar items he can consume based on his preference.

DESIGN OF FEATURES:

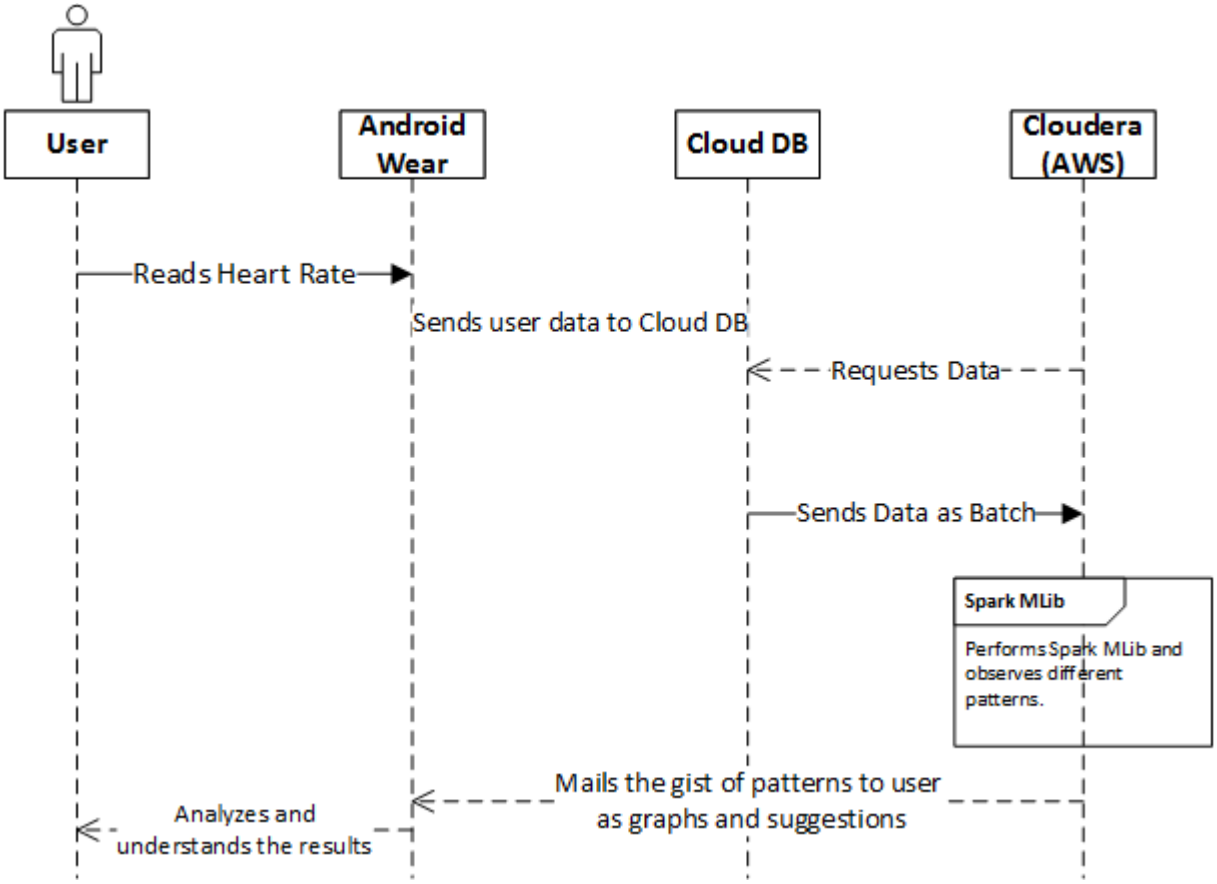
ARCHITECHTURE DIAGRAM:



CLASS DIAGRAM:



SEQUENCE DIAGRAM:

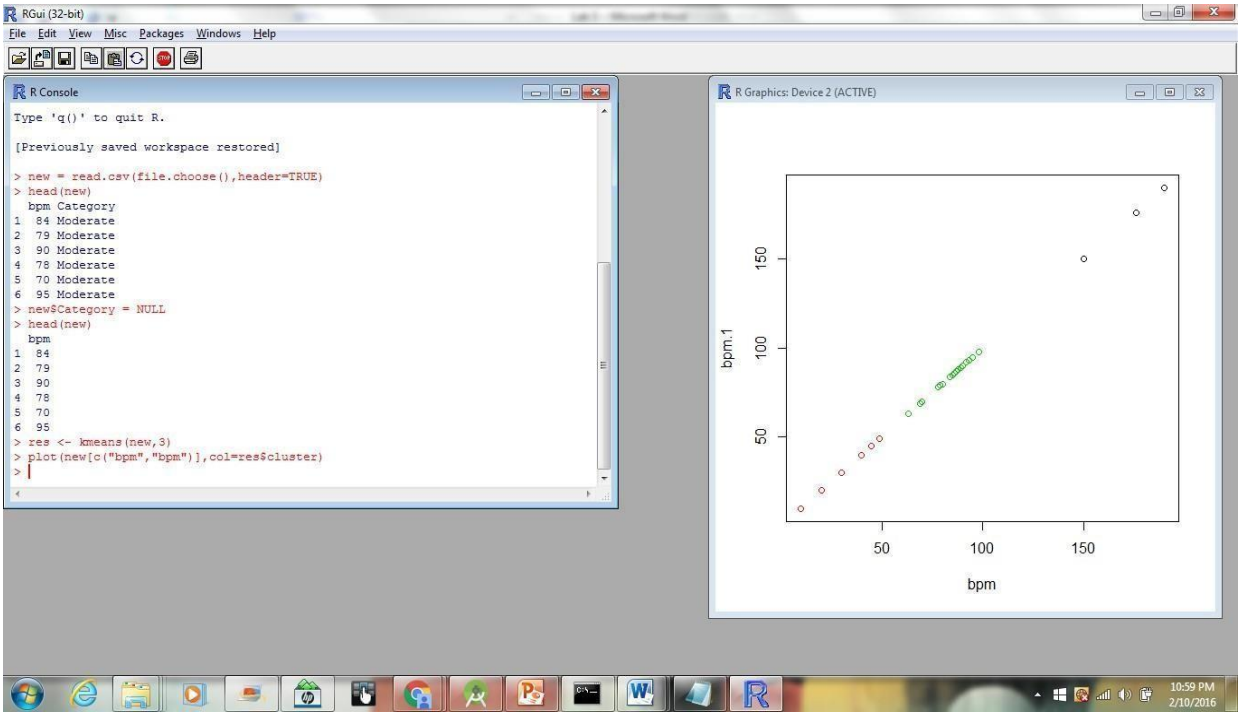


SPARK/MACHINE LEARNING ALGORITHMS:

In this application, we are planning to use the below machine learning algorithms to analyze the data.

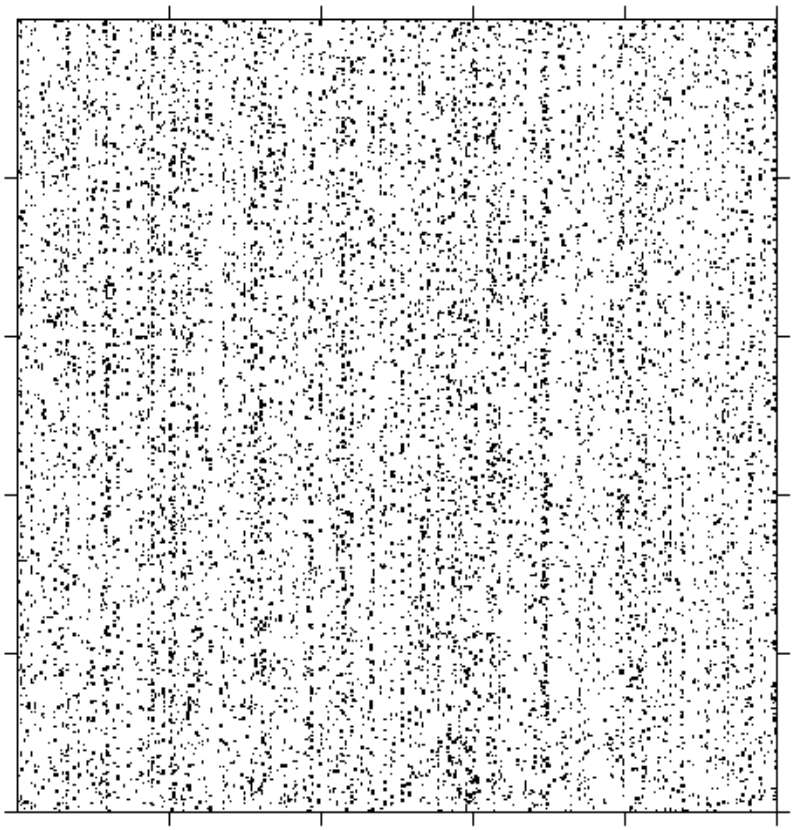
1. **K-means Clustering:**

K-means clustering algorithm is a cluster analysis in which k clusters are formed with n observations. The similar observations are clustered determining the centroid. Here the similar heart rates are clustered and the patterns are determined.



2. Apriori Algorithm:

The Apriori algorithm is an algorithm for mining frequent datasets. Since the heart rate of the user when collected it produces similar data and frequent datasets are formed. This enables the use of this algorithm to determine the patterns.



DATASETS:

The datasets in the Heartfit application consists of heart rate data, the steps walked for the day, the timing, the geolocation where it is captured. These datasets are analyzed with the machine learning algorithms and the corresponding patterns are generated.

It would appear as Step Count, Heart rate, time stamp, geolocation. Few more features can be added.

IMPLEMENTATION:

Mobile Client Implementation:

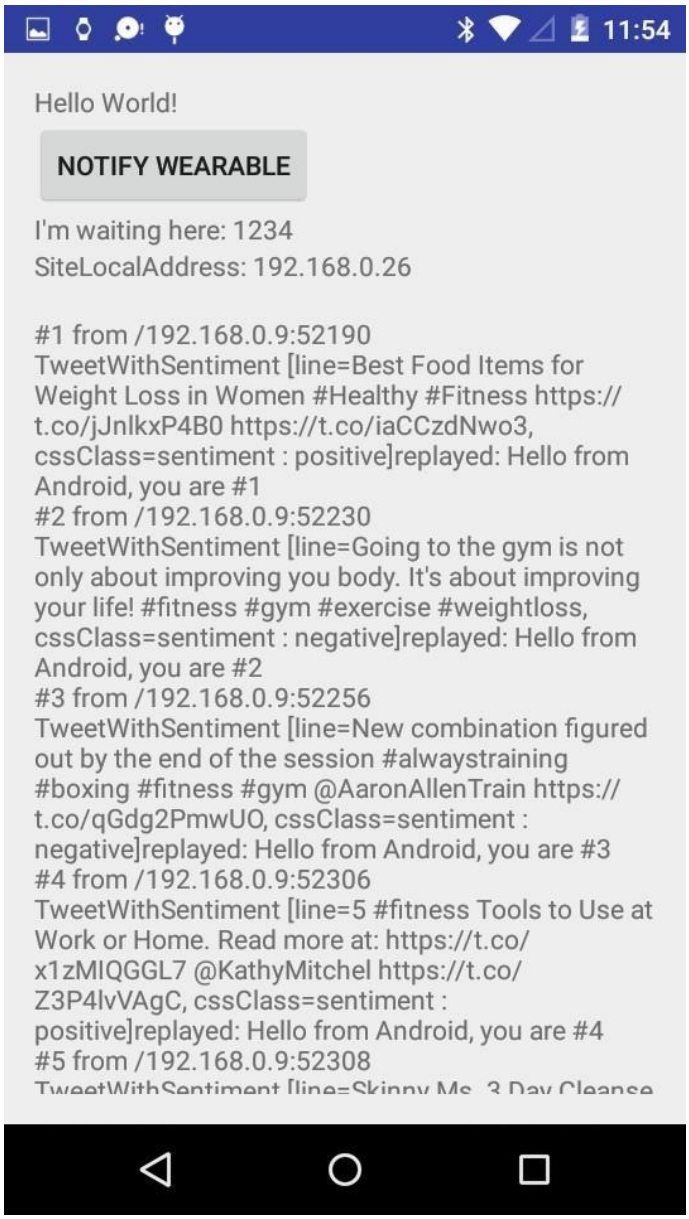
This is smartphone-smartwatch application in which the smart watch senses the data and the data is collected, stored in cloud database. The analysis is performed on the collected data and the results are sent as an email or notification the smartphone. The Spark Mlib and machine learning algorithms are used to perform analysis and determine the patterns from the user health conditions.

Machine Learning Application:

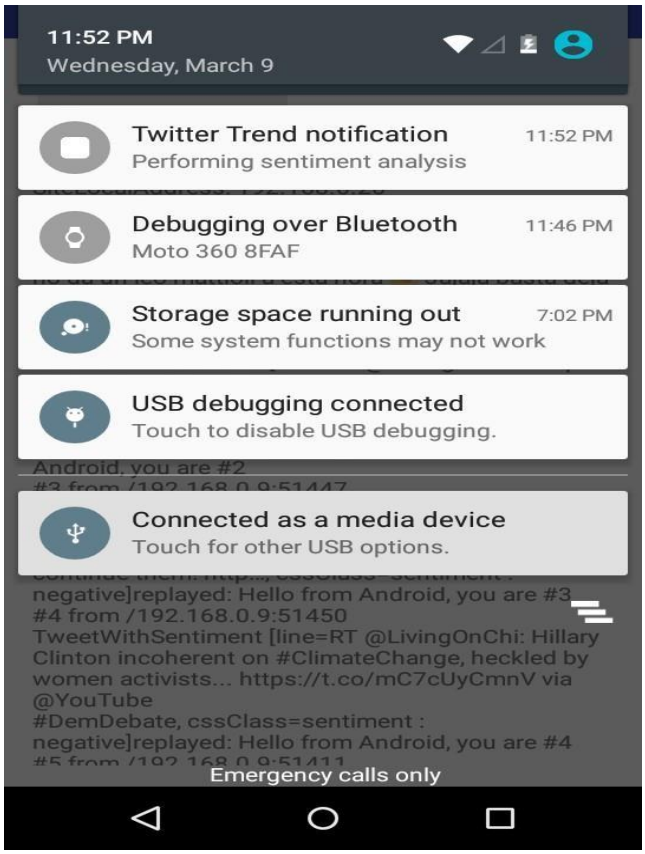
This is the main part of the application, where the machine analyzes and sends the suggests the patterns to user via mail. The machine learning algorithms provide high accuracy of data mining and results. It also results in different patterns that humans cannot determine at the same time. This is an application which is available in hand with the user and keeps a track of the medical history. This medical history can be used in medical field for research purposes as well.

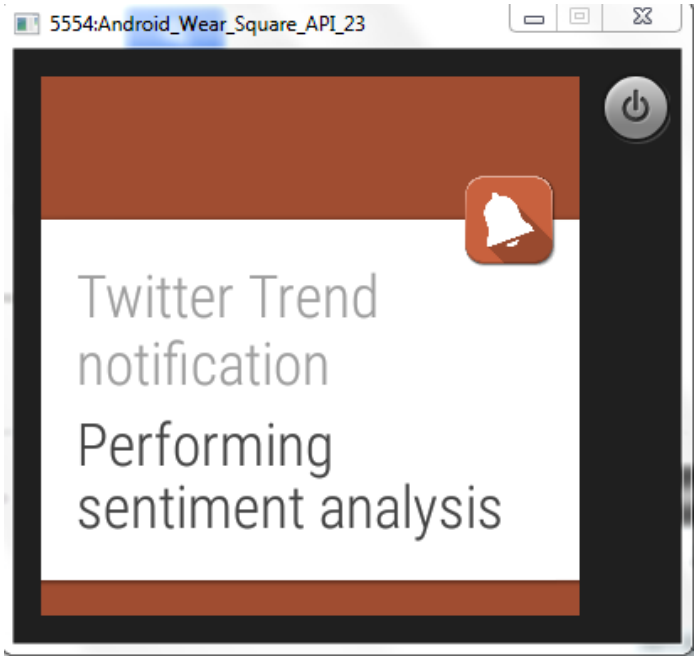
Sentimental Analysis:

The sentimental analysis is performed on the twitter live streaming data and the output is sent to the mobile through the socket connection. This would give us an idea of how the twitter tweets are being posted related to our project.



It is also sent as notification to the smart watch and also to the smartphone. The screenshots are placed below.



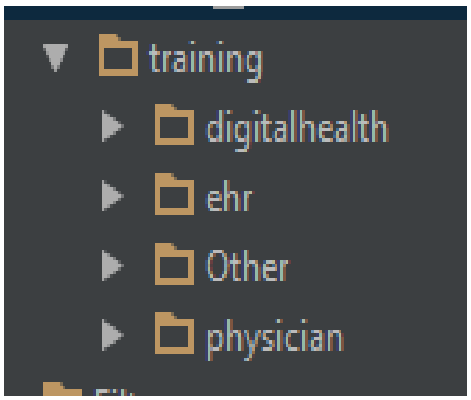


CLASSIFICATION:

We are trying to make recommendation system to recommend user some important tweets on basis of some famous medical hashtags. We have predefined our filter hashtags and filtering tweets in streaming. Below is the filter file.

allfilter.txt

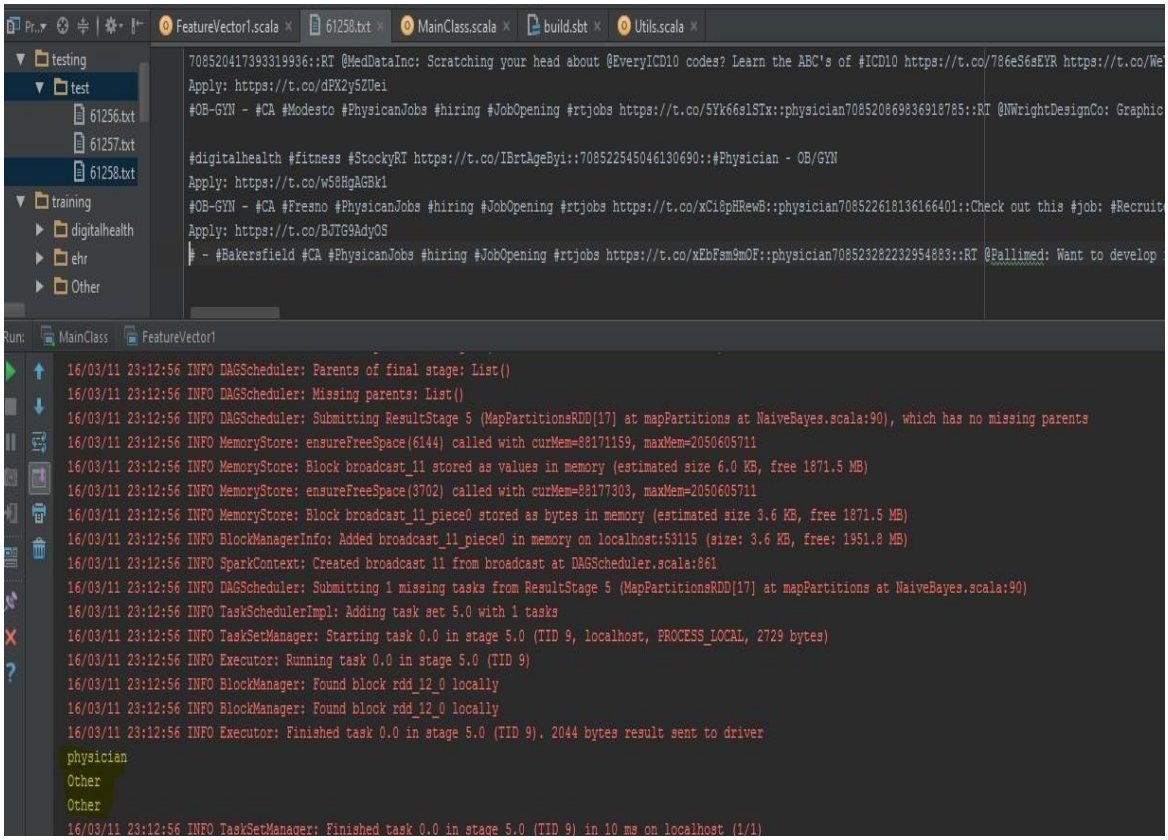
For now we have divided it into below mentioned 4 categories. These categories are on basis of hashtags:



We are training the data for this 4 categories and will test them against the future tweets. For now its just 4 categories but we will include more and plan is to ask user for his interest of tweet and on basis of that we will find appropriate tweet. The selection criteria for choosing tweet from streaming will be on basis of ratings. Program will decide ratings on basis of user's input and how influenced that tweet is to others people so far. We will include sentiment analysis as well for making sure that positive tweets will reach to user.
Below is the sample predicted results for few tweets.

61257.txt 61258.txt 61256.txt

Above three files are the collected tweets during streaming and below is the predicted output:


FeatureVector1.scala
61258.txt
MainClass.scala
build.sbt
Utils.scala
testing
test
61256.txt
61257.txt
61258.txt
training
digitalhealth
ehr
Other
708520417393319936::RT @MedDataInc: Scratching your head about @EveryICD10 codes? Learn the ABC's of #ICD10 https://t.co/786eS6sEYR https://t.co/We
Apply: https://t.co/dPX2y5ZUei
#OB-GYN - #CA #Modesto #PhysicanJobs #hiring #JobOpening #rtjobs https://t.co/5Yk66slSTx::physician708520869836918785::RT @NWrightDesignCo: Graphic
#digitalhealth #fitness #StockyRT https://t.co/IBrtAgeByi::708522545046130690::#Physician - OB/GYN
Apply: https://t.co/w58HgAGBk1
#OB-GYN - #CA #Fresno #PhysicanJobs #hiring #JobOpening #rtjobs https://t.co/xCi8pHRewB::physician708522618136166401::Check out this #job: #Recruit
Apply: https://t.co/BJTG9AdyOS
- #Bakersfield #CA #PhysicanJobs #hiring #JobOpening #rtjobs https://t.co/xEbFsm9mOF::physician708523282232954883::RT @Pallimed: Want to develop
Run:
MainClass
FeatureVector1
16/03/11 23:12:56 INFO DAGScheduler: Parents of final stage: List()
16/03/11 23:12:56 INFO DAGScheduler: Missing parents: List()
16/03/11 23:12:56 INFO DAGScheduler: Submitting ResultStage 5 (MapPartitionsRDD[17] at mapPartitions at NaiveBayes.scala:90), which has no missing parents
16/03/11 23:12:56 INFO MemoryStore: ensureFreeSpace(6144) called with curMem=88171159, maxMem=2050605711
16/03/11 23:12:56 INFO MemoryStore: Block broadcast_11 stored as values in memory (estimated size 6.0 KB, free 1871.5 MB)
16/03/11 23:12:56 INFO MemoryStore: ensureFreeSpace(3702) called with curMem=88177303, maxMem=2050605711
16/03/11 23:12:56 INFO MemoryStore: Block broadcast_11_piece0 stored as bytes in memory (estimated size 3.6 KB, free 1871.5 MB)
16/03/11 23:12:56 INFO BlockManagerInfo: Added broadcast_11_piece0 in memory on localhost:53115 (size: 3.6 KB, free: 1951.8 MB)
16/03/11 23:12:56 INFO SparkContext: Created broadcast 11 from broadcast at DAGScheduler.scala:861
16/03/11 23:12:56 INFO DAGScheduler: Submitting 1 missing tasks from ResultStage 5 (MapPartitionsRDD[17] at mapPartitions at NaiveBayes.scala:90)
16/03/11 23:12:56 INFO TaskSchedulerImpl: Adding task set 5.0 with 1 tasks
16/03/11 23:12:56 INFO TaskSetManager: Starting task 0.0 in stage 5.0 (TID 9, localhost, PROCESS_LOCAL, 2729 bytes)
16/03/11 23:12:56 INFO Executor: Running task 0.0 in stage 5.0 (TID 9)
16/03/11 23:12:56 INFO BlockManager: Found block rdd_12_0 locally
16/03/11 23:12:56 INFO BlockManager: Found block rdd_12_0 locally
16/03/11 23:12:56 INFO Executor: Finished task 0.0 in stage 5.0 (TID 9). 2044 bytes result sent to driver
physician
Other
Other
16/03/11 23:12:56 INFO TaskSetManager: Finished task 0.0 in stage 5.0 (TID 9) in 10 ms on localhost (1/1)

Food recommendation according to nutrients

For recommendation use case we are planning to recommend user food items as per nutrition he is following or meal plan he is taking.
We have collected data from USDA national nutrient data and made it in required format after some clean up. We dumped it to mysql as structured format. We have over 9,000 food items and 25 different nutrients.
We are using cosine similarity function for finding the similarity between users' selected or consumed item and the other items available to the database. We compare individual item with other item to make pair of two rows. We calculate cosine similarity between these two rows and store result as (key, pair) value where key is id of two food items and value is cosine similarity which lies between 0 to 1. Here, we don't have any negative values so it lies between 0 to 1 else it would be between -1 to 1.
Below is the simple example of cosine similarity.

$$cos(\vec{t_1}, \vec{t_2}) = \frac{\vec{t_1} \cdot \vec{t_2}}{\|\vec{t_1}\| \|\vec{t_2}\|}$$

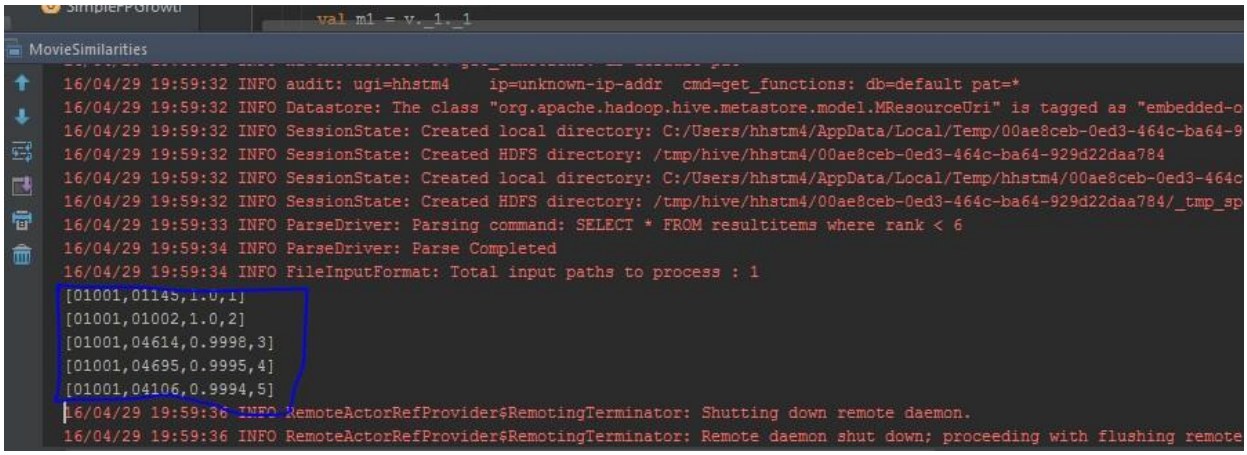
To calculate cosine similarity between two texts t1 and t2, they are transformed in vectors as shown in the Table 1.

For example, a cosine similarity can be computed as below for two texts

$$\frac{1 \cdot 2 + 1 \cdot 0 + 0 \cdot 1 + 1 \cdot 1}{\sqrt{1^2 + 1^2 + 0^2 + 1^2}\sqrt{2^2 + 0^2 + 1^2 + 1^2}} \simeq 0.72$$

	glutathione	homocystine	coa	transhydrogenase
$\vec{t_1}$	1	1	0	1
$\vec{t_2}$	2	0	1	1

We ran this using apache spark core and spark SQL. We used JDBC connecter for java to store result back to the mysql database. Below is the snap shot for one item with its most similar 5 items.



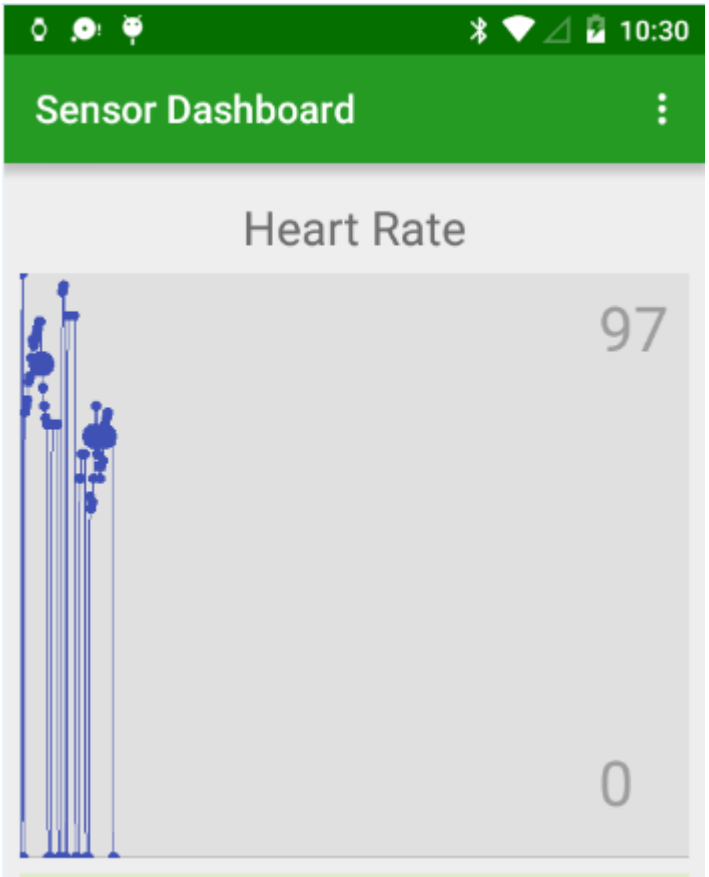
In result, first column is the ID of item for which we are finding the most similar items. Second column is the Id of matching item, 3rd column is similarity and 4th column is rank.

The main idea is that its huge database with bunch of items. User is not able to go through each item and check nutrient contains inside it. So this is the way of providing him matching items of his interest of nutrients to make him healthy.

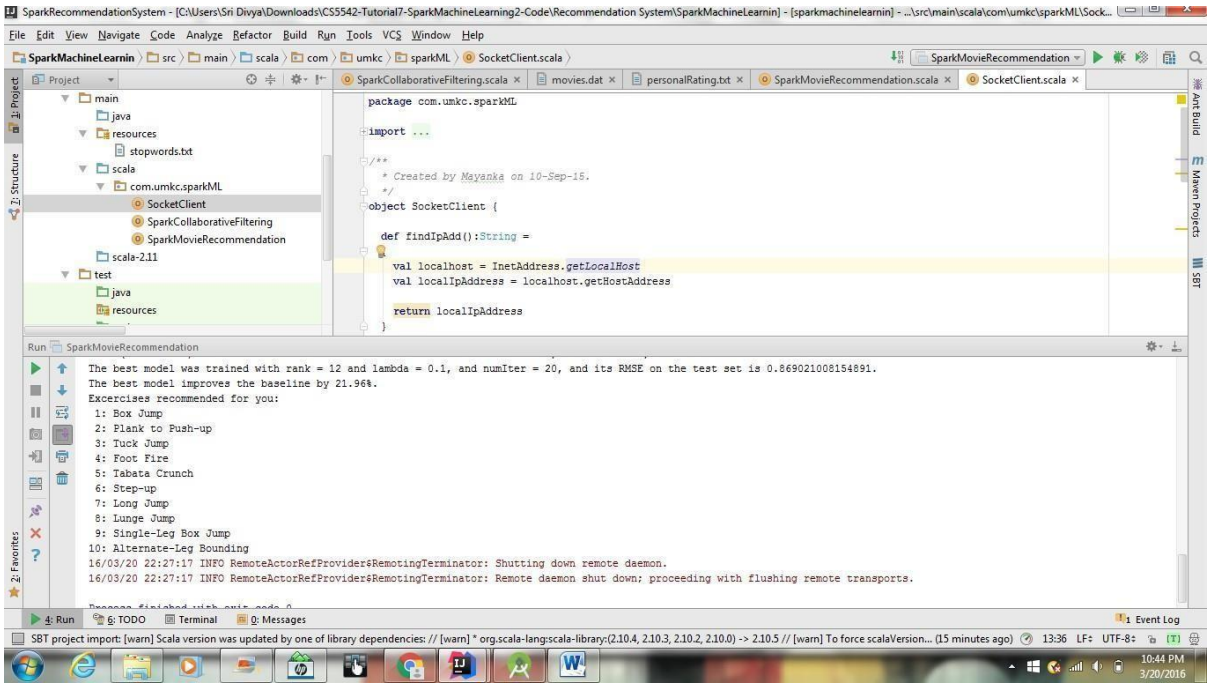
DEPLOYMENT:

HeartFit application

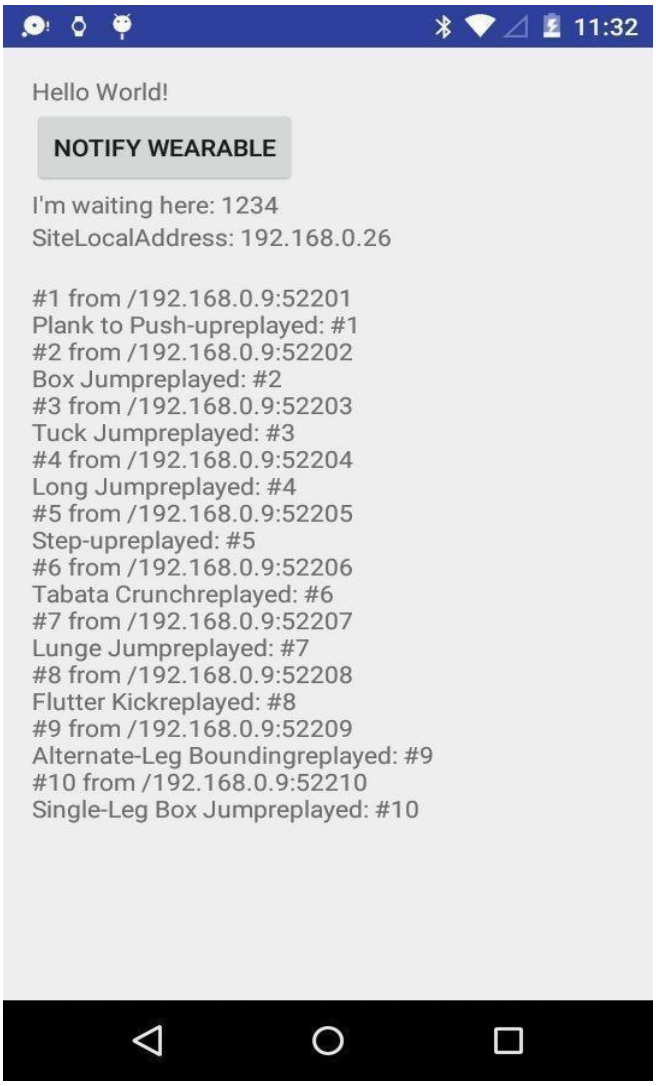

Steps : 113.0
HeartRate : 82.0


10:30
Sensor Dashboard
Heart Rate
97
0

In our project, we are recommending the users some physical and heart exercises based on their health condition and their daily routine. Based on the personal ratings and ratings of other users followed the recommendations are given.



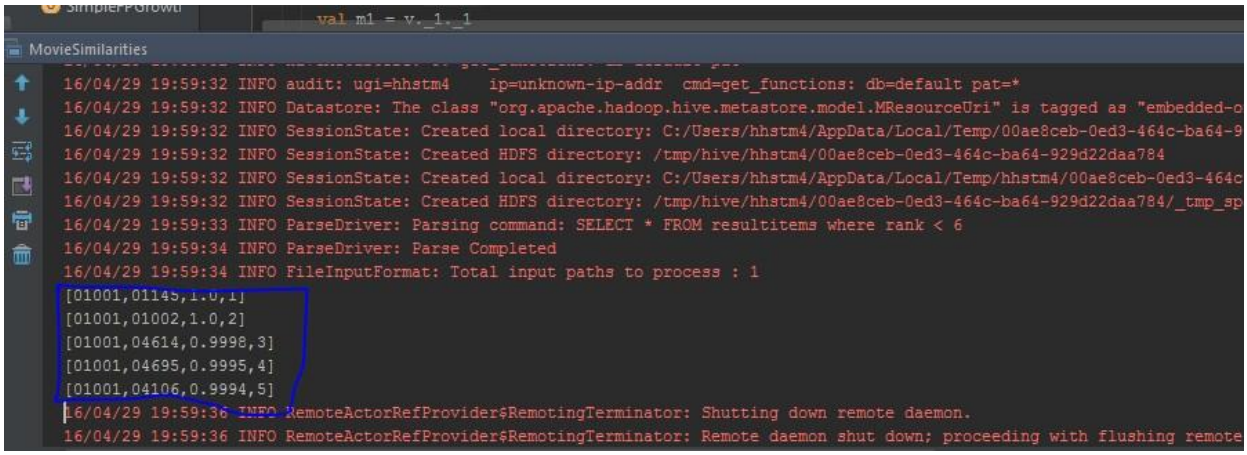
The same is sent to smartwatch/ smart phone.


11:32
Hello World!
NOTIFY WEARABLE
I'm waiting here: 1234
SiteLocalAddress: 192.168.0.26
#1 from /192.168.0.9:52201
Plank to Push-upreplayed: #1
#2 from /192.168.0.9:52202
Box Jumpreplayed: #2
#3 from /192.168.0.9:52203
Tuck Jumpreplayed: #3
#4 from /192.168.0.9:52204
Long Jumpreplayed: #4
#5 from /192.168.0.9:52205
Step-upreplayed: #5
#6 from /192.168.0.9:52206
Tabata Crunchreplayed: #6
#7 from /192.168.0.9:52207
Lunge Jumpreplayed: #7
#8 from /192.168.0.9:52208
Flutter Kickreplayed: #8
#9 from /192.168.0.9:52209
Alternate-Leg Boundingreplayed: #9
#10 from /192.168.0.9:52210
Single-Leg Box Jumpreplayed: #10

The recommendation system we built from the nutrients database. Here the user can select either lunch, breakfast or dinner. If he tells his preference then we would make a recommendation system on spark and then recommend the user about the foods that has same protein and calories he can take. In this way, this recommendation would benefit the user for intake of various healthy foods with same proteins and nutrients. But we assume that the user goes with the healthy food.

We would also suggest him that a particular food is not healthy and he can change his preference. This helps in maintaining body fitness as well as his heart fit, staying healthy.

The output looks like this when the user searches for an item.



Frequent Pattern Mining – Spark - MLib

For matching the frequent patterns , we have used FP growth alogorithm.

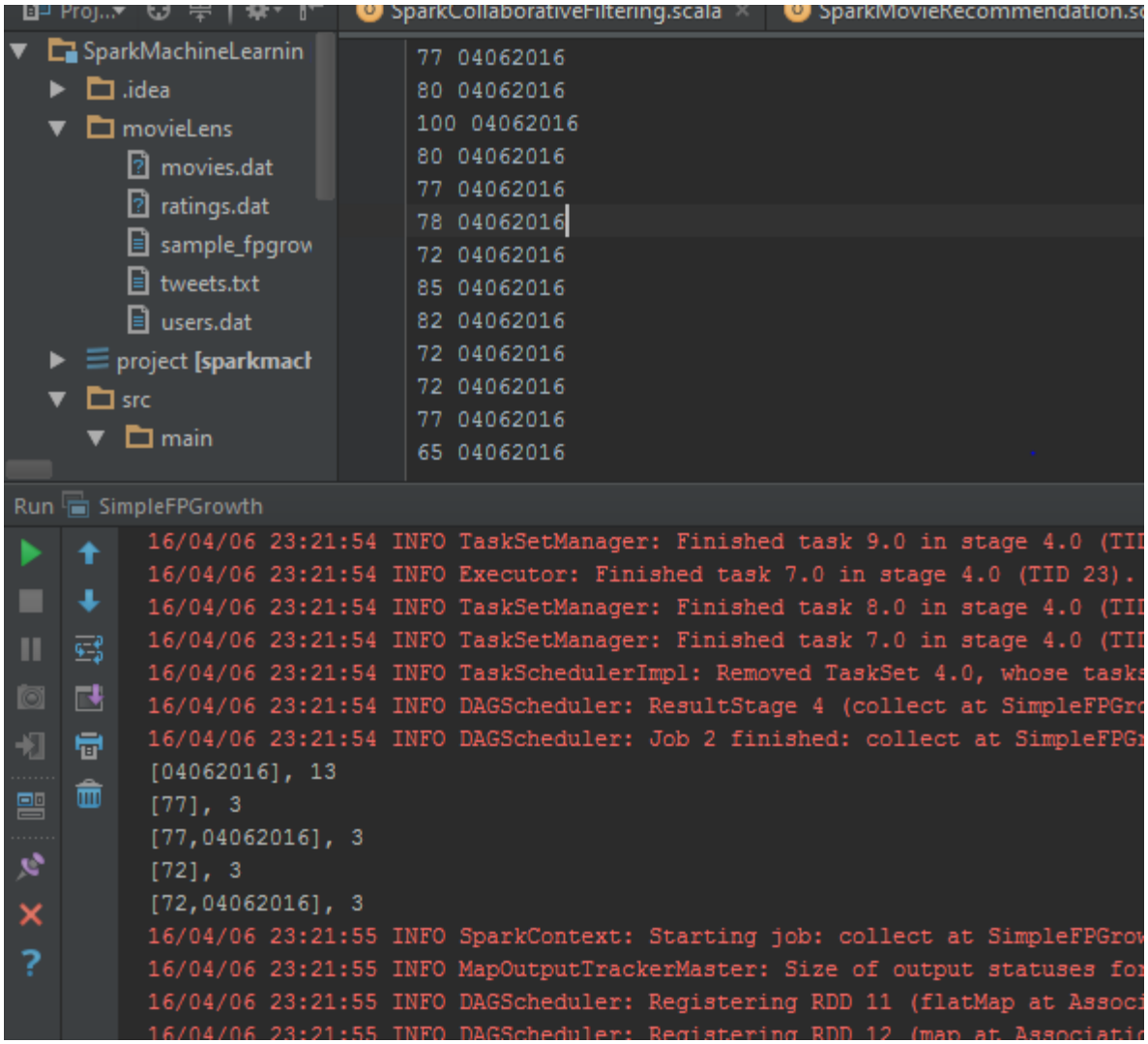
FP-growth

spark.mllib's FP-growth implementation takes the following (hyper-)parameters:

- minSupport: the minimum support for an itemset to be identified as frequent. For example, if an item appears 3 out of 4 transactions, it has a support of 3/4=0.75.
- numPartitions: the number of partitions that are used to distribute the work.

Below is the implementation of algorithm for our heart bit data to find out the pattern on particular day to check working of heart bit, whether its behaving normal or not. The output for our sample file is included in output file.

```scala
object SimpleFPGrowth {

  def main(args: Array[String]) {
    System.setProperty("hadoop.home.dir","c:\\winutils")

    val conf =new SparkConf().setMaster("local[*]").setAppName("SparkNaiveBayes").set("spark.driver.memory", "3g").set("spark.executor.mem
    val sc = new SparkContext(conf)
   // val conf = new SparkConf().setAppName("SimpleFPGrowth")
    //val sc = new SparkContext(conf)

    // $example on$
    val data = sc.textFile("movieLens/sample_fpgrowth.txt")

    val transactions: RDD[Array[String]] = data.map(s => s.trim.split(' '))

    val fpg = new FPGrowth()
      .setMinSupport(0.2)
      .setNumPartitions(10)
    val model = fpg.run(transactions)

    model.freqItemsets.collect().foreach { itemset =>
      println(itemset.items.mkString("[", ",", "]") + ", " + itemset.freq)
    }

    val minConfidence = 0.8
    model.generateAssociationRules(minConfidence).collect().foreach { rule =>
      println(
        rule.antecedent.mkString("[", ",", "]")
          + " => " + rule.consequent .mkString("[", ",", "]")
          + ", " + rule.confidence)
    }
```



Github link: https://github.com/hirenshah7390/Bigdata_Project/tree/master/Hiren

PROJECT MANAGEMENT:

Planning

We as a team discussed about the project idea, project flow , features that are to be implemented. Roles and responsibilities are being discussed and given below.

Time: 16 hours

Members Participated: Abhiram, Dinesh Reddy, HirenShah, Harshini

Implementation

The step counter and heart sensor data is collected continuously using the sensors in the smart watch.

The data is sent to the smartphone and graphs are plotted on phone. The collected data is classified and working on recommendation systems.

The machine learning algorithms were implemented and the recommendation systems was implemented. Recommending the user regarding food he can consume and also observing patterns of the user based on his heart rate.

Responsibility: Data collection, Zenhub, FP growth algorithm, Recommendation system.

Time: 90 hours

Participants: Harshini, HirenShah, Abhiram, Dinesh Reddy

Testing

Test cases for all the above designed pages were implemented.

Responsibility: Tried to collect data at different times when sleeping, walking,etc

Time: 20 hours

Participants: HirenShah, Dinesh Reddy, Abhiram, Harshini

BIBILIOGRAPHY:

http://www.r-bloggers.com/association-rule-learning-and-the-apriori-algorithm/

http://www.dreamincode.net/forums/topic/324137-periodically-collect-accelerometer-data-in-android/

https://github.com/pocmo/SensorDashboard

http://www.wareable.com/fitbit/fitbit-70-of-people-ignore-heart-rate-data-1523

https://dev.fitbit.com/docs/heart-rate/

http://www.livescience.com/42132-heart-rate-activity-tracker-useful.html

http://spark.apache.org/docs/latest/mllib-guide.html

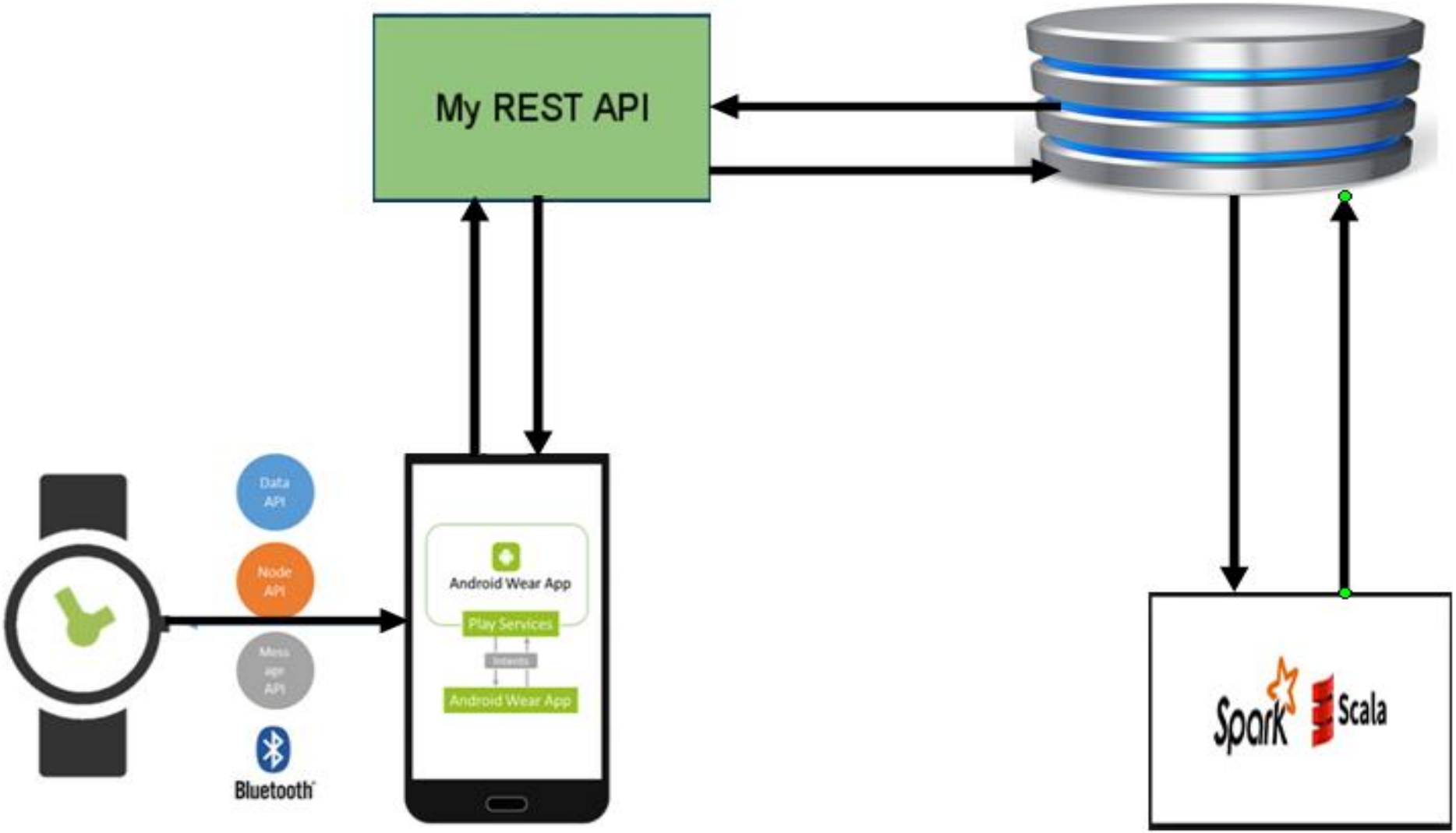
HeartFit

Abhiram (ClassId 1)
Hiren Shah (ClassID 27)
Harshini (ClassID 14)
Dinesh Paduru (ClassID 19)

Features

- Monitoring Heart rate per hour to indicate any abnormal behavior
- Sleeping pattern Mining, to monitor how well user is sleeping by collecting accelerometer events
- Recommending matching food item having similar nutrient

Architecture



Data Collection

- Two types: Real time and Static
- Real Time Sensorial data : Heart rate and accelerometer sensors
- National Nutrient Database for Standard Reference : for matching nutrient food recommendation.
- Its Static database for now. Need to update when their library gets updated.

ML Algorithms

- Spark MLlib Apriori for frequent pattern : FP growth inbuild algoritham in Spark Mllib.

- For finding the frequent heart pattern for previous hour heart rate data and representing them as a chart.

- The purpose is to provide number of occurrence of particular heart bit in an hour cycle.

ML Algorithms

Cosine Similarity : Content/feature based collaborative filtering for recommending food items having similar nutrition.

$$cos(\vec{t_1}, \vec{t_2}) = \frac{\vec{t_1} \cdot \vec{t_2}}{\|\vec{t_1}\| \|\vec{t_2}\|}$$

	glutathione	homocystine	coa	transhydrogenase
$\vec{t_1}$	1	1	0	1
$\vec{t_2}$	2	0	1	1

$$\frac{1 \cdot 2 + 1 \cdot 0 + 0 \cdot 1 + 1 \cdot 1}{\sqrt{1^2 + 1^2 + 0^2 + 1^2}\sqrt{2^2 + 0^2 + 1^2 + 1^2}} \simeq 0.72$$

References

- http://www.ars.usda.gov/Services/docs.htm?docid=8964
- ftp://ftp.tik.ee.ethz.ch/pub/students/2010-HS/SA-2010-26.pdf
- http://www.ceng.metu.edu.tr/~e1395557/foodRecSys.pdf
- https://bioinformatics.oxfordjournals.org/content/suppl/2009/10/24/btp613.DC1/bioinf-2008-1835-File004.pdf
- http://blog.echen.me/2012/02/09/movie-recommendations-and-more-via-mapreduce-and-scalding/

GITHUB:

https://github.com/SCE-UMKC/BigData-Spring-2016-HeartFit

YOUTUBE URL:

https://www.youtube.com/watch?v=1F5P2QErePk&feature=youtu.be

CS5542 BIG DATA ANALYTICS AND APPS

Summary Report (05/11/2016)

Project Group -7

By

Harshini Medikonda (14)

Abhiram Ampabathina (1)

Hirenbhai Harshadbhai Shah(27)

Dinesh Reddy (19)

I.INTRODUCTION:

The heart rate of a person depends on age, gender, daily physical activity, mental stress and many other activities/conditions. Furthermore, there is no proper equipment that can keep a track of heart beat rate. We intend to do a system that can collect the person's daily heart rate activity, store it in a database, analyze the heart rate and the activity the person is performing. Moreover, the application can analyze the data and recommend mental or physical activities to be performed by the user to keep the heart rate optimal. It can also suggest the timings of the abnormal heart rate. All these would give a clear idea of the medical condition of the user and the better usage of it can help in a longer life.

II.PROJECT GOAL AND OBJECTIVES:

OVERALL GOAL:

The goal of the project is to build a system that can take care of the user's health. This heart rate system is an android application which he can view even through the smart watch. This application works with the heart rate sensor embedded in the smart watch. It can observe the patterns of the heart rate and determine the health condition. It recommends the user with the necessary physical and mental activity.

SPECIFIC OBJECTIVE:

The objectives that would be achieved are as follows:

- Collect the heart rate and step count of the user
- Store the heart rate in regular intervals
- Get the heart rate onto HDFS per day basis
- Analyze it using machine learning algorithms.
- Notifying the health conditions using smart watch and smart phone
- Recommend the activities to be done by the user.
- Have a medical record, convenient and cost efficient.
- Suggest users items with items the has a particular nutrition.
- Recommend user with the other related items having same nutritional values

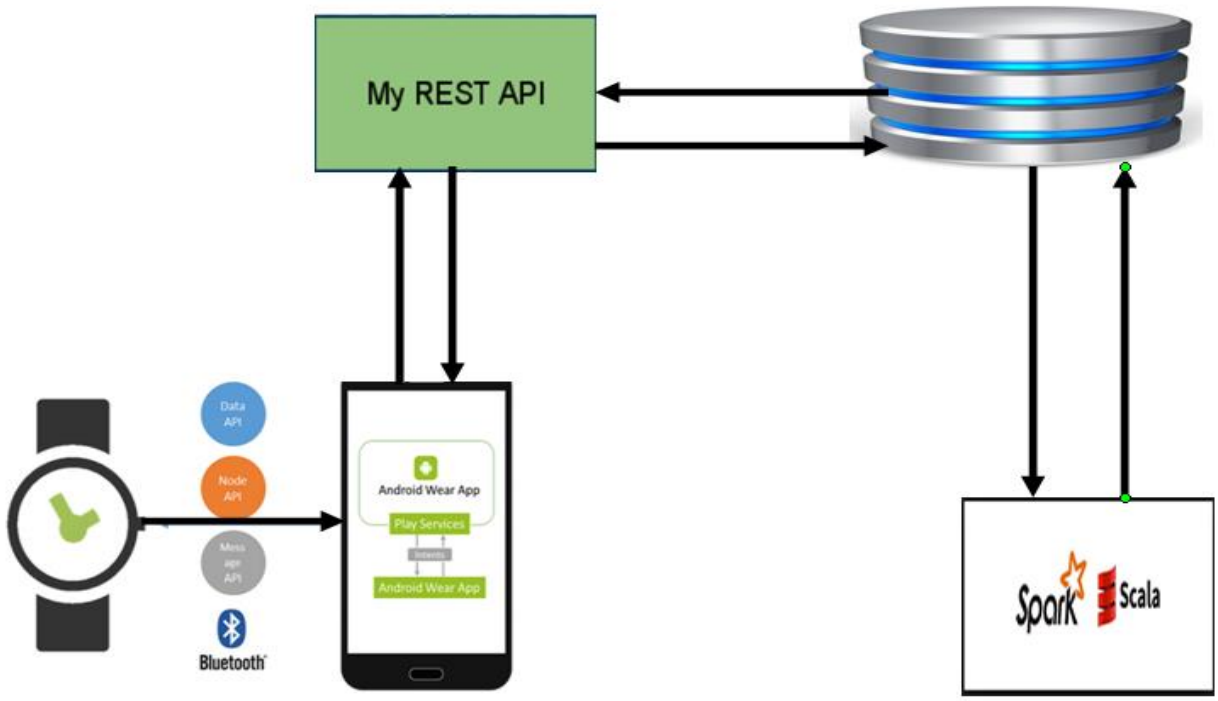
SPECIFIC FEATURES:

The specific features designed in the project are:

- Heart beat analysis
- Sleep pattern analysis
- Notification of current health condition
- Recommendation of health care
- Recommendation of products of good nutritional value
- Suggesting user with the products having a particular nutrition
- Select any date and view the corresponding day patterns

II. OUR SOLUTIONS:

ARCHITECTURE:



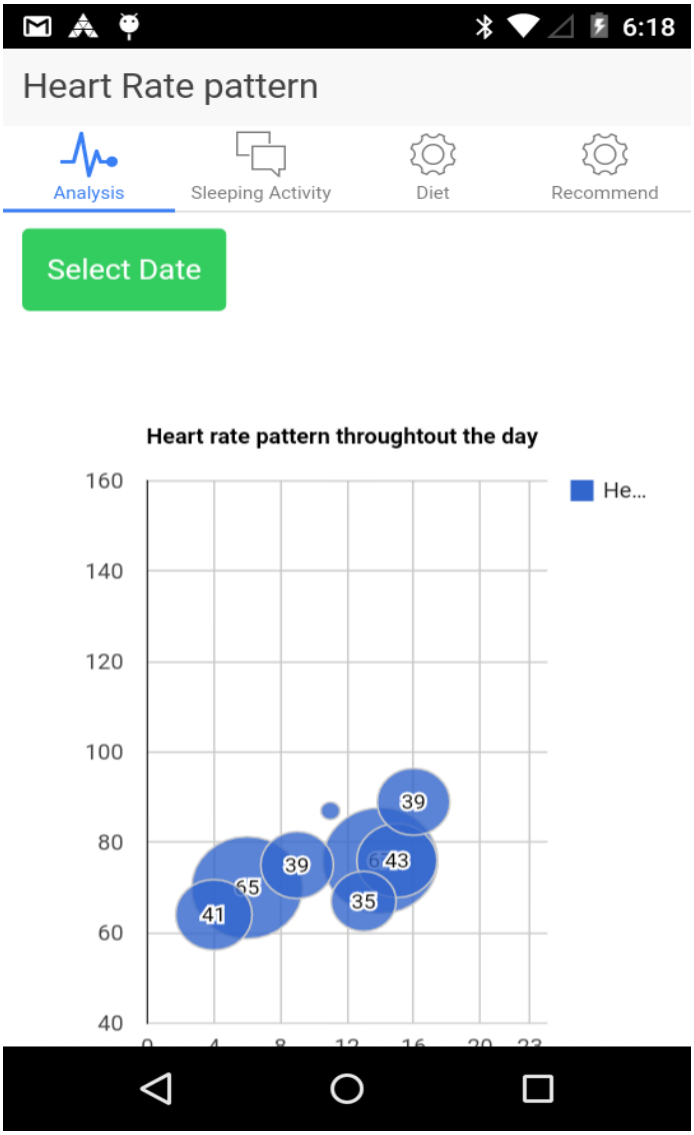
APPLICATION:

The application consists of the feature that tells the heart rate pattern of the day. It analyzes the heart beat collected throughout the day. This is done using Apriori algorithm in Machine Learning. For this application to run, two devices are required:

1. Andriod wear
2. Android mobile

where you can visualize the results.

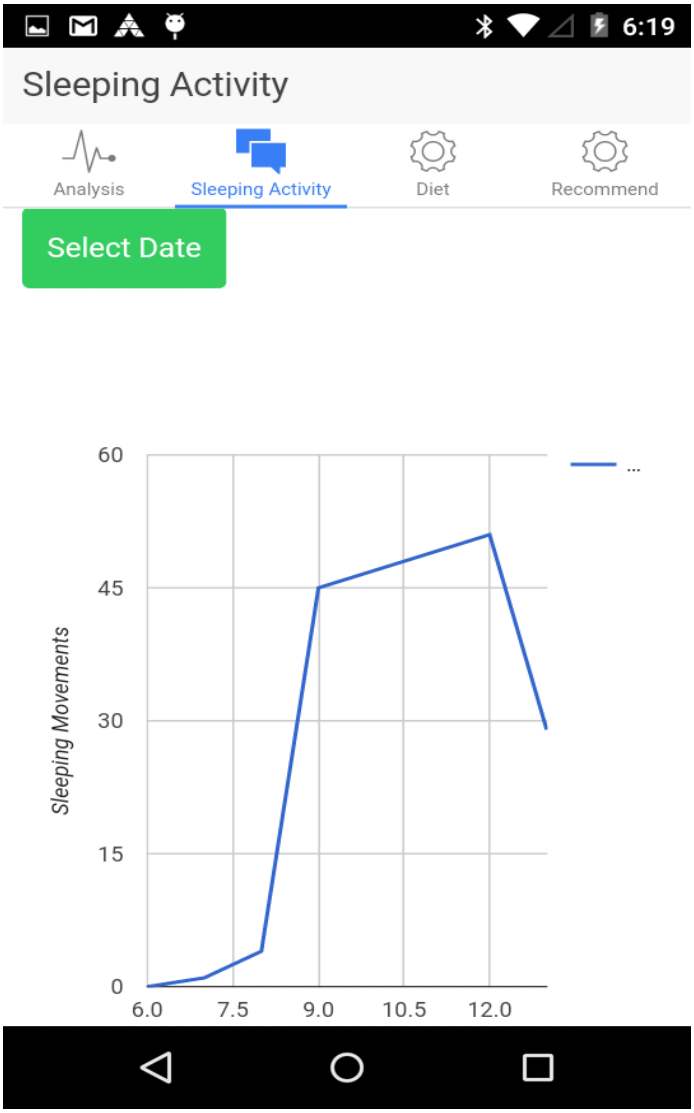
From this visualization, one can get to know during which hour the heat pattern went extremely high and how many times this happened and the location of it. So, this would caution the user and he can take extra care.



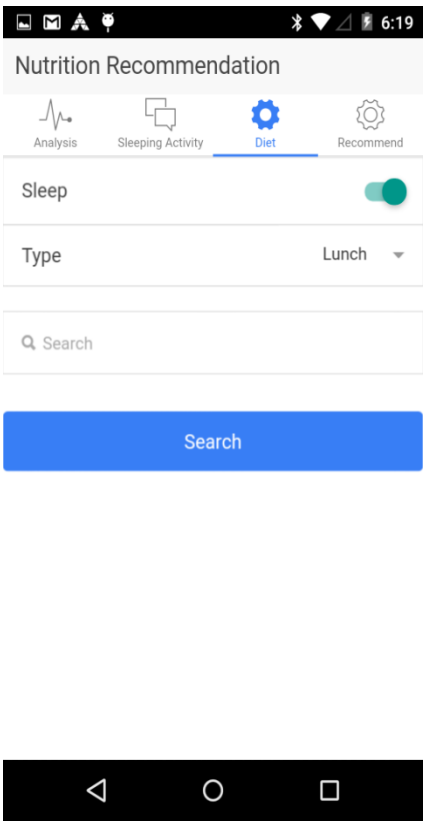
Sleeping Activity:

There is one more feature in the application where the user can the change the date and view that particular day's pattern accordingly. This graph gives the user about the idea of how well he slept last night. The user has to turn on the toggle when he is about to sleep and turn it off once he wakes up.

The analysis is done between those timings. A Spark Job is run that analyzes the movements of the user, whether he was continuously moving or not. This data is collected from the accelerometer sensor in the watch that he wears each night.

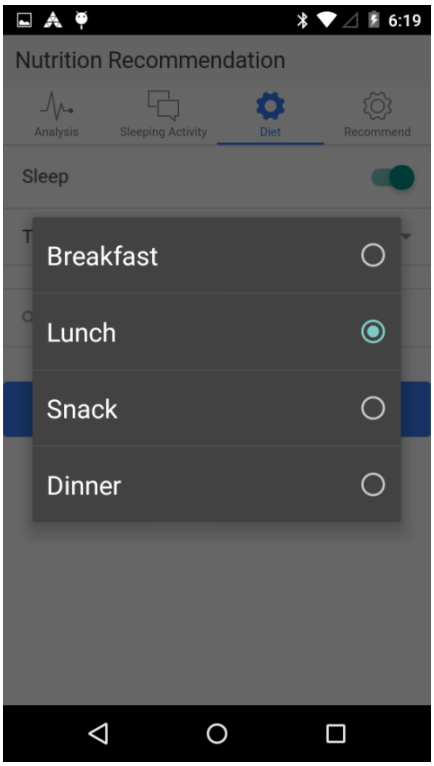


The screenshot of toggle button is given below:



DIET:

The user can prefer the meal type as shown in the below screenshot.
It helps in recommending the user. Taking into consideration the nutritional values.



RECOMMENDATIONS:

In recommendations tab, we have 2 features:

1. User can choose what item has to be present in his diet

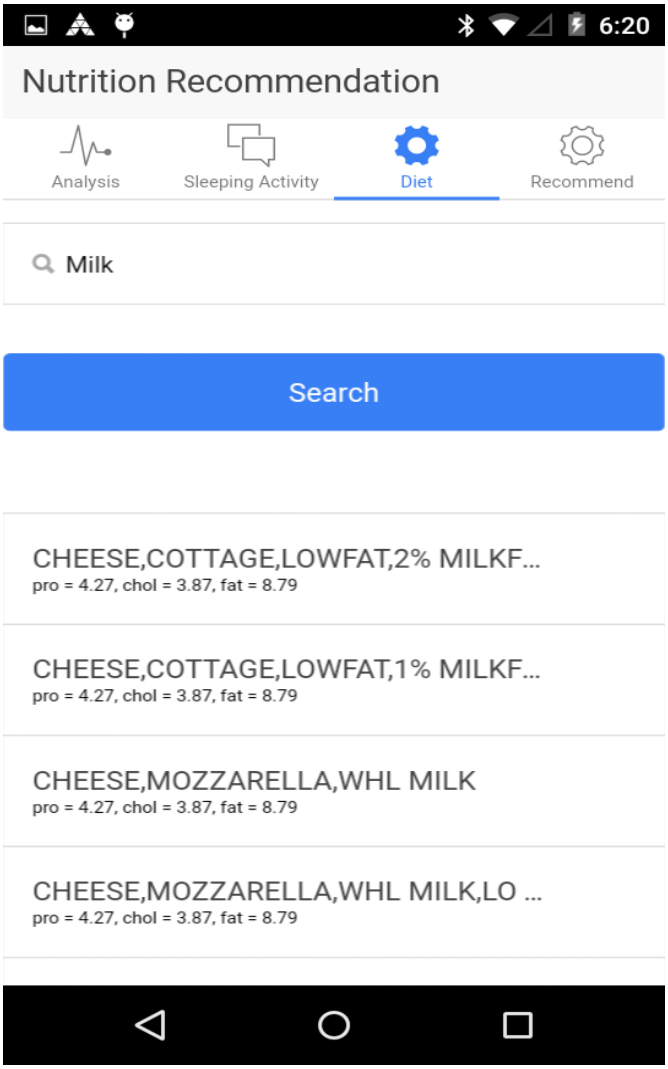
   Example : milk

2. We give the user the items containing milk. Then the user can select the items based on the nutritional values mentioned. Then we recommend similar items based on the nutritional values of the user preferred item.

Motivation behind this is:

Everyday, we think too much select an item what to eat. Moreover we do not know the nutritional values of that particular item.

The items database was collected from National Nutrition Database which was available online. Got access to it after requesting for permission and it was so helpful.


6:20
Nutrition Recommendation
Analysis
Sleeping Activity
Diet
Recommend
Milk
Search
CHEESE,COTTAGE,LOWFAT,2% MILKF...
pro = 4.27, chol = 3.87, fat = 8.79
CHEESE,COTTAGE,LOWFAT,1% MILKF...
pro = 4.27, chol = 3.87, fat = 8.79
CHEESE,MOZZARELLA,WHL MILK
pro = 4.27, chol = 3.87, fat = 8.79
CHEESE,MOZZARELLA,WHL MILK,LO ...
pro = 4.27, chol = 3.87, fat = 8.79

Recommended Items

MILK SUBSTITUTES,FLUID,W/LAURIC ACID OIL
pro = 4.27, chol = 3.87, fat = 8.79

SALAD DRSNG,HOME RECIPE,CKD
pro = 4.36, chol = 3.8, fat = 8.84

BABYFOOD,DINNER,CHICK SOUP,STR
pro = 4.27, chol = 3.84, fat = 9.02

SOUR CREAM,REDUCED FAT
pro = 0, chol = 0, fat = 0

BABYFOOD,VEG,CARROTS,STR
pro = 2.78, chol = 3.84, fat = 8.37

MACHINE LEARNING ALGORITHMS:

We used 2 machine learning algorithms

1. Apriori Algorithm:

The Apriori algorithm is an algorithm for mining frequent datasets. Since the heart rate of the user when collected it produces similar data and frequent datasets are formed. This enables the use of this algorithm to determine the patterns.

The FP-growth algorithm is described in the paper Han et al., Mining frequent patterns without candidate generation, where "FP" stands for frequent pattern. Given a dataset of transactions, the first step of FP-growth is to calculate item frequencies and identify frequent items. Different from Apriori-like algorithms designed for the same purpose, the second step of FP-growth uses a suffix tree (FP-tree) structure to encode transactions without generating candidate sets explicitly, which are usually expensive to generate. After the second step, the frequent itemsets can be extracted from the FP-tree. Inspark.mllib, its been implemented a parallel version of FP-growth called PFP, as described in Li et al., PFP: Parallel FP-growth for query recommendation. PFP distributes the work of growing FP-trees based on the suffices of transactions, and hence more scalable than a single-machine implementation. We refer users to the papers for more details.

spark.mllib's FP-growth implementation takes the following (hyper-)parameters:

- minSupport: the minimum support for an itemset to be identified as frequent. For example, if an item appears 3 out of 5 transactions, it has a support of 3/5=0.6.
- numPartitions: the number of partitions used to distribute the work.

In our project folder, more information is available about this algorithm which helped us to implement this.

2. Food recommendation according to nutrients:

For recommendation use case we are planning to recommend user food items as per nutrition he is following or meal plan he is taking.
We have collected data from USDA national nutrient data and made it in required format after some clean up. We dumped it to mysql as structured format. We have over 9,000 food items and 25 different nutrients.
We are using cosine similarity function for finding the similarity between users' selected or consumed item and the other items available to the database. We compare individual item with

other item to make pair of two rows. We calculate cosine similarity between these two rows and store result as (key, pair) value where key is id of two food items and value is cosine similarity which lies between 0 to 1. Here, we don't have any negative values so it lies between 0 to 1 else it would be between -1 to 1.
Below is the simple example of cosine similarity.

$$cos(\vec{t_1}, \vec{t_2}) = \frac{\vec{t_1} \cdot \vec{t_2}}{\|\vec{t_1}\| \|\vec{t_2}\|}$$

To calculate cosine similarity between two texts t1 and t2, they are transformed in vectors as shown in the Table 1.

For example, a cosine similarity can be computed as below for two texts

$$\frac{1 \cdot 2 + 1 \cdot 0 + 0 \cdot 1 + 1 \cdot 1}{\sqrt{1^2 + 1^2 + 0^2 + 1^2}\sqrt{2^2 + 0^2 + 1^2 + 1^2}} \simeq 0.72$$

	glutathione	homocystine	coa	transhydrogenase
$\vec{t_1}$	1	1	0	1
$\vec{t_2}$	2	0	1	1

We ran this using apache spark core and spark SQL. We used JDBC connecter for java to store result back to the mysql database. Below is the snap shot for one item with its most similar 5 items.

DATA:

Stored data in Spark SQL and accessed them as RDD's. The structure was simple to understand, and easy to consume data from it, so we preferred this.

We have continuous real time data where we collected heart rate, accelerometer, and the information of nutrients was already available.

In android studio, we formatted the data in the way we require it so we can directly process it on Spark.

EVALUATION:

This application was evaluated and tested several times among the members of the team and it worked perfectly fine as expected. We tested with extreme values as well and it showed perfect results.

ACCURACY:

The values of heart rate and accelerometer were so accurate and we can see the real time values on the screen and we had a meta data field in the heart rate which tells us how accurate the values are.

More over, our testing of recommendation system with different lambda values helped in understanding the nutritional accuracy of the system.

At times, the sensor used to behave exceptionally that it showed zeros even when the person is wearing, in such situations we eliminated that case where it showed zeros to get good results in patterns.

RUNTIME PERFORMANCE:

We tested the HeartFit application several times among the members of the team and it worked perfectly fine as expected. We tested with extreme values as well and it showed perfect results.

Point to Note: We tested the application by wearing the application while sleeping to observe the sleeping pattern and the application worked well. It tracked the movements correctly and plotted the graph accurately.

While running the application, you have the option to go a previous date and view the heart and sleeping patterns of it. This gives us to keep a track of our health history.

RELATED WORK:

1. We referred several documents to find what patterns could be useful for a use and also as TA's suggested we went through ARGUS application which gave us an idea of sleeping pattern. A special thank you for their support as we were able to improve in every increment.

   Mentioning few of the links that we referred:

ftp://ftp.tik.ee.ethz.ch/pub/students/2010-HS/SA-2010-26.pdf

http://www.ceng.metu.edu.tr/~e1395557/foodRecSys.pdf

https://bioinformatics.oxfordjournals.org/content/suppl/2009/10/24/btp613.DC1/bioinf-2008-1835-File004.pdf

http://blog.echen.me/2012/02/09/movie-recommendations-and-more-via-mapreduce-and-scalding

https://github.com/pocmo/SensorDashboard

FUTURE WORK:

We implemented the features that we wanted to implement, but in future we want to alert the user with some emergency if some extreme heart patterns are observed.
This could help in the betterment of the project.

We referred to several documents to find out what patterns could be useful for a user and also as TA's suggested we went through ARGUS application which gave us an idea of sleeping pattern.
A special thank you for their support because of whom were able to improve in every increment.

PROJECT MANAGEMENT REPORT

HEARTFIT

Project Group -7 (05/11/2016)

By

Harshini Medikonda (14)

Abhiram Ampabathina (1)

Hirenbhai Harshadbhai Shah(27)

Dinesh Reddy (19)

Project Management :

The project management of our project was smooth as everyone in the team were enthusiastic and willing to work. The lab sessions helped us a lot in completing the project especially the android studio and Spark Machine Learning labs.

We shared the work equally in our team. Evaluating the contributions of the team per 100 points.

Most of the time we worked as a group on a feature and met at least twice or thrice in a week to work on the project and worked for more than 180 hours for its completion.

Team Member 1: Harshini Medikonda

Points: 25

Comments: Worked on Android studio application to collect heart rate and accelerometer data, sending it to database, Spark Apriori algorithm to find heart rate patterns, recommendation system, visualization,testing.

Team Member 2: Abhiram Ampabathina (1)

Points: 25

Comments: Worked on Android studio application to collect heart rate and accelerometer data, sending it to database, Spark Apriori algorithm to find heart rate patterns, recommendation system, visualization, testing.

Team Member 3: Hirenbhai Harshadbhai Shah (27)

Points: 25

Comments: Worked on Android studio application to collect heart rate and accelerometer data, sending it to database, Spark Apriori algorithm to find heart rate patterns, recommendation system, visualization, testing.

Team Member 4: Dinesh Reddy (19)

Points: 25

Comments: Worked on Android studio application to collect heart rate and accelerometer data, sending it to database, Spark Apriori algorithm to find heart rate patterns, recommendation system, visualization, testing.

FINAL PROJECT EVALUATION:

This project helped us manage the work through Zenhub. The Agile process was good and we were able to assign the tasks and contribute to the project. Helped us in learning several technologies.

Our project satisfied all of our original requirement specifications and we were able to do the features beyond our original requirements. We are absolutely satisfied with the design process and we would like to extend it more to utilize it in an effective manner. The agile process was helpful in attaining the tasks on time and we sticked to our project plan schedule. That was the reason we were able to complete the specifications on time.