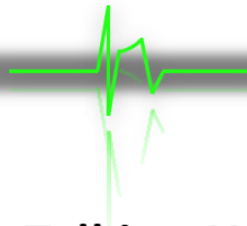


Report No. 1
Statement of Work, Functional Requirements
&
User Interface Specification



The Talking Heart

What's your heart saying?

A Personal Health Monitoring & Diagnosis System

Software Engineering I

10/14/2012

Development Team #2

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Individual Contributions

“All team members contributed equally”

1 Customer Statement of Requirements:

As mentioned in the individual contribution section, we enacted a customer representative v/s user conversation and noted down the problems and expectation. The problem statement and following paragraphs are thus written from the perspective of a customer to get a feel of problems faced by them and their expectations from a product.

1.1 The sudden need for a Personal System

The most widely accepted way of maintaining our body has been regular checkups with the doctor. Our vital statistics like heart rate, calories burned, pulse rate were taken onto various machines. The nurses would convert these signals into comprehensible format and the doctors would study them. Later these were monitored daily or at regular intervals and doctors would review them and give there diagnosis. This has been a traditional process, but being always on the move and working a hectic schedule does not give everyone a lot of options as far as taking appointments with doctors is concerned. It would be so much better if people could have a doctor at home whenever they come back from home, or a doctor who can tell them their body's progress anytime they want.

The other factor that has started taking priority in today's internet era is global accessibility to a common place where people can store their records. As a patient or an athlete people's health records are scattered across many different providers and facilities. Keeping updates and easily accessible health records means people can play a more active role in their own and their family's healthcare concerns. It also gives a clear picture of their health history, anytime anywhere.

To make the requirements about the system more specific, following is a high level description of the features a modern day health monitoring system should have from an end user perspective:

1.1.1 Global Accessibility

Every working individual has to travel to different states and sometimes to a different country as part of their job. If they were to take care of their health and thus keep a record of their check-ups, they would have to carry a paper diary everywhere. This will not only be cumbersome but also a very approximate way of keeping records. We would like to provide customers with a 24x7 access to their medical records from wherever they need it, whenever they need it.



Figure 1: Our system's architecture for personal health monitoring.

We plan to build an online system that will store, process and diagnose a person's heart rate and calories burned readings from a heart rate sensor and pedometer device. Providing a web based system will permit users to access their data from any location.

Figure 1 shows the architecture of how our system would work. Our system will comprise of two parts: the health monitoring device, a Garmin FR 70 wrist display with a heart rate sensor and the other part would be an online software system that is connected to a server to store and retrieve customer records.

Let us see how the customer would have to record their data. The user has to fix the chest strap with the mounted sensor on their ribcage. Next wear their wrist display which accepts continuous heart rate readings transmitted by the chest strap. The user can look at instantaneous heart ratings on the wrist display.

As far as the optimum time for recording heart rate is concerned, the heart rate changes with posture, varying by around 3 beats/min in the sitting compared with the supine position [10]. A recent consensus meeting recommended measurement of the heart rate by pulse palpation during two 30-s periods, performed in a sitting position, after 5 min sitting in a quiet room [10]. For our system to provide accurate diagnosis, we recommend our users to record their heart rate using the heart rate strap for at least one minute. Once the chest strap has transmitted readings to the watch for one whole minute, the user can transfer data to the computer wirelessly from the watch. Now the data is on the computer and ready to tell you about your health.

1.1.2 Scalability to Numerous Users

When it comes to health care of the entire family, either of the parents keep a record of the whole family's medical history. This should also be applied to a framework wherein an electronic device records body statistics and transfers to a computer for storage. Instead of buying multiple heart rate sensors and wrist displays one for every family member, it would be economical to buy just one heart rate sensor and wrist display for the whole family. The whole family can use the sensor and wrist display in turns.

We will build our systems on the above points by letting users create their profiles. This way a user can record their data on the wrist device, transfer it to the computer, login to their profile through our system and upload their data. Now that their data has been saved in our server, some other member of the family can use the device to record and upload their data to their profile in the same way.

The system will also allow the user to edit personal profile for e.g. weight or height, which would be necessary for processing and diagnosing their data.

1.1.3 Ease of Uploading Data

Once a user records their body readings using the sensors and devices, they would really like to save all the records till date. This will help them to see if there are any drastic changes in their body's behavior. Although today's sensors come with wrist displays that have memory to store recorded data, they can at the most store 10-20 work out worth of records at a time. Once above the limit, the data has to be cleared for new data to be recorded by the sensors.

Users also want to store all the data at one place that can be accessed later. Although this is possible by manually typing in the information from the wrist display into a computer, it will take time and will definitely act as a deterrent to anyone who feels this is too much work. What would be really lucrative is a system that can store data by simply selecting a file from the computer.

Our proposed system will give this option to the user for easy data loading. The Garmin FR 70 gives an option to store a workout or reading data in a single file in the computer. Using our software system users can log into their profile, select this file and their data will be uploaded. Just before uploading, our system will prompt the user to specify whether this file is for resting heart rate (which would be for a minute as mentioned in section 1.1.1) or if it is for an exercise or run (which can be for a longer duration).

1.1.4 Ease of Finding and Viewing Records

If people go to get checked up at the hospital, body readings for different days are kept in different files or at least recorded on separate papers. The obvious advantage to this is that people can look at their records for each day in detail, separately.

Our system will have a similar property, something similar to a diary. Through our proposed design users will be able to look for their medical records for a particular day. The advantage of this design is that people can see if there were multiple uploads for a day and they can also add their own comments or reminders. Each user can upload more than one activity everyday to their profile. As we have mentioned in section 1.1.3, the user would have to specify if the data file being uploaded is for resting heart rate or for an exercise.

Thus by giving this feature of multiple file uploads for a day, the user can store data for exercise and heart rate on the same day. In addition they can add multiple exercise data files in one day and write a comment specifying whether it is weight lifting, running etc. Then, if a user wants to see a graph of that day's personal readings, they would just have to click on the day and our system will display readings in a graph format.

1.1.5 Graphical View of Progress

People say 'a picture is worth a thousand words' and that is exactly what we want our customers to experience from our system. Instead of just showing a couple of numbers our system would show readings like heart rate, calories burned, stress levels against time in form of a graph. A graphical view will definitely show how their heart rate, stress or calories burned vary over time.

But we would like to provide more to our customers by giving an option to see an overview of say every week or month of readings in the form of graphs. This could help them know how their health conditions differ for different months. Showing the data in form of a graph makes it easy to comprehend what the numbers mean. In the second iteration of system development we would try to add an interpretation of the graph in form of text. For example if a user's heart rate is increasing over a month, we would add a text saying "Heart rate increased".

1.1.6 What your Heart wants to tell

With the amount of work load stacking up everyday people rarely get to eat proper lunch, let alone taking a break and going out for a walk. People just feel the stress building up but don't really know if it is detrimental or if it is going to cause long term problems. They don't know if this hectic schedule is causing any damage to the way their heart should work. Even if people use a wrist display and heart sensor, it just shows them their heart rate for that instance. We would like to show our customers two things, first of all how their readings progress over a time interval and then what it means for them, health wise.

In a future document about implementation during the second iteration of system development, we will discuss and explain in detail how we plan to implement in our software system the different methods for heart disease diagnosis, but in the following paragraphs we give an idea of how we plan to use heart rate readings to diagnose specifically three heart conditions and stress levels.

Various epidemiological papers have studied the importance of heart rate for healthy living [2]. The relationship between resting heart rate and mortality of patients with coronary artery disease, hypertension and in the elderly has been observed by a lot of scientists [3][4][5][6][7]. Resting heart rate is a very simple but important measurement of the health of a person's heart. The resting heart rate is measured while a patient is awake but not taking part in any kind of strenuous activity. We discuss some very serious implications of different resting heart rates for different kind of people.

Tachycardia:

Tachycardia refers to a heart rate that is over the normal range for a particular age group. When the heart beats at a faster rate, it works inefficiently to provide blood to the rest of the body, thus providing less blood at a given time [8].

We will have a table of normal heart rate range for every age group coded in our system. Thus we will compare a person's resting heart rate reading with their age (from their user profile) and compare with the table to assess if they are suffering from Tachycardia.

Bradycardia:

When the resting heart rate is lower than usual for a person (less than 50bpm for adults), the heart problem is called as bradycardia [9]. The heart rate going below this level may cause a cardiac arrest in some people, since a lower heart rate means less blood and oxygen being pumped to the heart.

We will implement the above mentioned fact to compare a person's averaged resting heart rate with the threshold of 50bpm to infer if they might be suffering from Bradycardia.

Cardiovascular mortality:

Recent studies have confirmed the fact that resting heart rate is an independent predictor of cardiovascular mortality in men and women with and without any diagnosed chronic disease [10]. In a study of 25,000 patients with cardiac diseases, resting heart rate has been found to be a strong indicator of a person's cardiac health [11]. It was found that patients with a resting heart rate of greater than 83bpm are prone to rehospitalization as compared with patients with a resting heart rate of less than 62bpm.

We plan to implement this feature specially for users who have had a heart attack in past. While filling the user profile, we can provide a check box for “Experienced Cardiac Attack in past”. If the user check’s this box, we will make sure that their hear rate readings are cross checked against the 62bpm to 83bpm range, as studied in the [11].

For all the three cases of tachycardia, bradycardia and cardiovascular mortality, we plan to provide a single button in our software system, which users can click to get results (more details in design document). When the user clicks this button, the system will compare their resting heart rate readings for the above mentioned criteria and display on the screen whether the user’s heart is normal or whether it is suffering from tachycardia, bradycardia or cardiovascular mortality. This will be displayed in the form of simple text so that it is easy for the user to comprehend. Users do not need any special knowledge or skills about heart rate variations, our system will do all the calculations for them.

Stress:

The autonomic nervous system (ANS) is part of the nervous system whose task is to maintain the body by acting like a controlling mechanism. The ANS is made up of two functional components: the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). The SNS, accompanied by an increase in heart rate helps the body to combat potential threats by maintaining the body (while exercising). The PNS branch on the other hand helps in bringing the body back to recovery state with a reduced heart rate (while sleeping). Both these components and in turn the brain, simulates the sinoatrial node which is the primary pacemaker of the heart. So we can use the heart rate to estimate the activation level of both the components. But not the direct heart rate, we are more interested in the R-R interval or the inverse of the heart rate, also called as the heart rate variability (HRV). For a healthy human, the HRV should be chaotic, varying randomly over time [12]. Scientists have thus found the heart rate and heart rate variability recordings as good indicators to measure stress levels and guide preventive measures to reduce stress in a person [13].

Thus by calculating the inverse of a user’s heart rate, our system will scan this quantity for a time interval to make sure it is random, as studied in [12][13]. This inverse heart rate for a user also known as Heart Rate Variability, can be viewed as a graph in a similar fashion as in figure 3.

In summary from the above studies we can conclude that a whole lot of information about the condition of our body can be gained from just the resting heart rate.

2 Glossary of Terms

TERM	DESCRIPTION
Heart rate	It is the number of heartbeats per unit of time, typically expressed as beats per minute (bpm).
Diagnose	It is the identification of the nature and cause of anything
Resting heart rate	It is measured while a patient is awake but not taking part in any kind of strenuous activity
Tachycardia	It refers to a heart rate that is over the normal range for a particular age group.
Bradycardia	The heart condition when the resting heart rate is lower than usual for a person (less than 50bpm for adults)
Autonomic Nervous System (ANS)	It is part of the nervous system whose task is to maintain the body by acting like a controlling mechanism.
Sympathetic Nervous System (SNS)	It is a component of ANS, accompanied by an increase in heart rate helps the body to combat potential threats by maintaining the body.
Parasympathetic Nervous System (PNS)	It is a component of ANS which helps in bringing the body back to recovery state with a reduced heart rate.
Heart Rate Variability (HRV)	Inverse of the heart rate.

3 System Requirements

3.1 Enumerated Functional Requirements:

Requirements	PW	Description
REQ - 1	4	The system shall allow the user to register using a unique user id and password.
REQ - 2	5	The system shall allow any user to load their data from any computer having the data file.
REQ - 3	4	The system shall allow any user to modify their personal profile.
REQ - 4	3	The system shall prompt for security questions if the user forgets their password.
REQ - 5	5	The system shall allow the user to see their daily and monthly heart rate, calories burnt and stress level.
REQ - 6	5	The system should allow the user to see their heart condition in the form of text.

3.2 Extended Functional Requirements:

Requirements	Description
REQ - 2a	The system shall allow the user to upload only .csv file produced by the Garmin FR70.
REQ - 2b	The system will allow user to upload a file either as an exercise entry or a resting heart entry.
REQ - 4a	The system shall allow only the user with correct login Id and password to access their profile.
REQ - 4b	The system shall logout from a session if there is inactivity for more than ten minutes.
REQ - 4c	The system shall lock the profile if the user enters wrong password more than 3 times in a row. The user will need to send a mail to the administrator to ask him to unlock his profile.
REQ - 4d	The system shall give a security question option to the user if they forget their password. If the user gives the correct answer they will be able to see his password.
REQ - 4e	The system shall allow the user to delete their profile.

REQ – 5a	The system shall allow the user to view all entries for a day and individual graphs will be shown for calories burnt, heart rate and stress level.
REQ – 5b	If there is more than one entry for a day, the system shall the display graphs of all entries.
REQ – 5c	When requested, the system shall display the monthly graph for any of the parameters mentioned above (i.e. calories burnt, heart rate and stress level).
REQ – 6a	The system shall display the history of heart condition in the form of text for past 6 months if they are registered before 6 months.
REQ – 6b	The system shall display the heart condition as text, which represent the condition of the heart for the selected month.

3.3 Non-functional Requirements:

Requirements	PW	Description
REQ – 7	3	Web pages shall have simple design for easy navigation.
REQ – 8	2	System shall have a single link on every page to navigate back to Calendar View.
REQ – 9	4	The user shall not be able to see other person's data or make any changes to it.
REQ - 10	3	Graphs shall be labeled properly and extensively.

3.4 On-Screen Appearance Requirement

Figure 2 shows the initial sketch of the user interface expectation sent by the customer. The user interface will show the 'personal information' on every page. The 'viewing options' pane will change according to the current graph being viewed. The customer asked for easy navigation for which we have suggested a calendar style display (shown in the User Interface section).

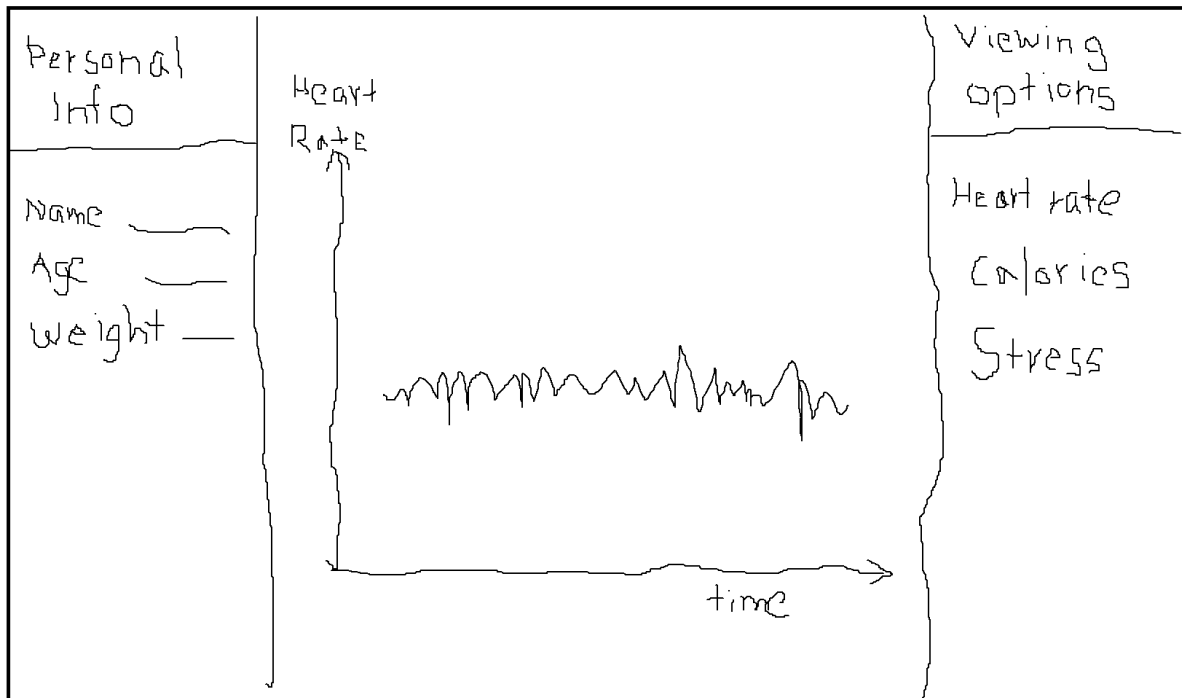


Figure 2: Sketch provided by customer.

3.5 Acceptance Tests

Acceptance Test case for REQ1

ATC1.01- Create a profile of a user who is not in the system. (Pass)

ATC1.02- Create a profile of a user who is already in the system. (Fail)

Acceptance Test case for REQ2

ATC2.01 – Upload a .csv file (Pass)

ATC2.02 – Upload any other file extension (Fail)

Acceptance Test case for REQ3

ATC3.01- Update the personal information of a user. (Pass)

Acceptance Test case for REQ4

ATC4.01- Access the user profile who is not currently logged in. (Fail)

ATC4.02- User accesses his own profile. (Pass)

ATC4.03- The system logs out after being idle for 10 minutes. (Pass)

ATC4.04- The user enters the system after 3 consecutive failed attempts to login. (Fail)

ATC4.05 The user retrieves his password by answering the secret question (Pass)

ATC4.06- The user deactivates his profile. (Pass)

ATC4.07- The user tries to login with a wrong user id or password. (Fail)

Acceptance Test case for REQ5

ATC5.01- The system tries to display a graph from a future date. (Fail)

ATC5.02- The system tries to display a graph from a particular date in the past. (Pass)

Acceptance Test case for REQ6

ATC6.01- The system displays "heart condition" for a week or a day. (Fail)

ATC6.02- The system displays "heart condition" for a month or 6 months. (Pass)

4 Functional Requirements Specification:

A personal health monitoring & diagnosis system can be very useful, though the creation of such a system requires good effort. Though this system is designed with patients in mind, it can be used by everybody who wants to keep track of their health condition. Anyone with proper credentials can access this system.

4.1 Stakeholders

Our system being a health monitoring system there can be a lot of stakeholders. Everyone is interested in knowing their health. We have enumerated stakeholders for our system on the basis of how often someone might use the system.

1. Patients

The motivation for building this system was to provide patients conclusions or diagnosis of their health recording. Thus we feel and hope that patients would be the large group of stakeholders using our system.

2. Athletes

We know that performance enhancement for an athlete requires tuning their body. Using our system athletes can store the whole history of their heart rate and calories burned. Because our system will display these quantities graphically, they can view their readings in form of a progress curve (telling them whether their heart rate/calories burned is going up or down as time progresses). Athletes can also check if they suffer from either Tachycardia or bradycardia.

3. Coaches

A sports team coach has to keep track of every individual's health in that team. Our system could be a perfect solution for such a need. The coach would have a direct access to each player's records.

4. Doctors

Doctors can use our system as a spot to store and access data for different patients. Although we feel this could be cumbersome for the doctor since he/she would have to create a user profile for each patient.

4.2 Actors and Goals

We have identified three actors interacting in the working of our system.

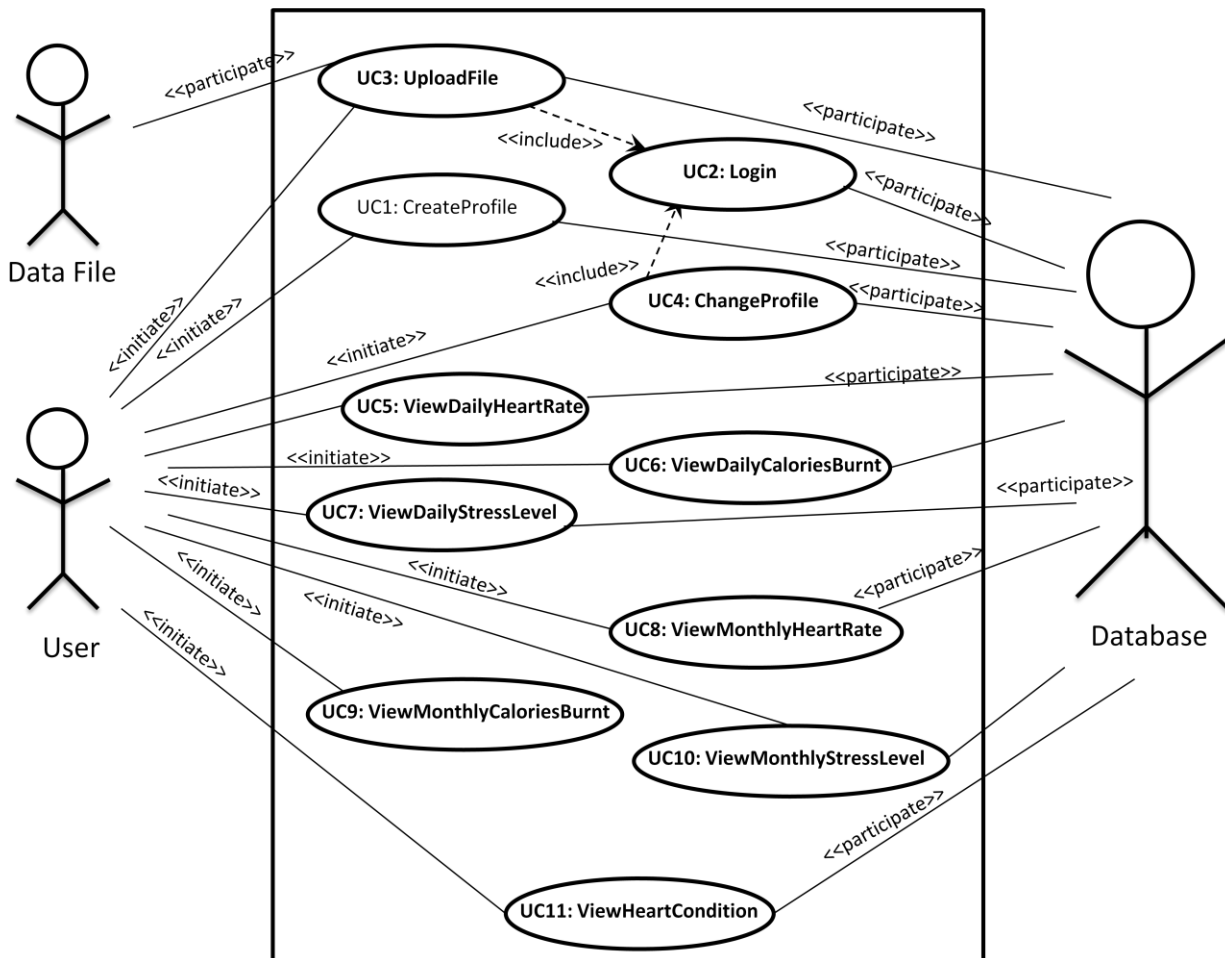
Actor	Goals
User	The user's goal is to access the personal health monitoring system to keep track of health condition. Includes all the people especially patients, athletes who require regular health check-ups.

DataFile	The goal of datafile is to interact with the system to upload data.
Database	The goal of a database is to store all the readings of each user separately. All the data collected is stored in the database and the user interface has to access the database to retrieve the required information.

4.3 Use Cases Casual Description

Use Case	Name	Description
UC1	CreateProfile	Allows a user to create a new profile
UC2	Login	Allows the user to access the system.
UC3	UploadFile	Allows the user to upload a data file to system from a computer.
UC4	ChangeProfile	Allows the user to modify their personal information.
UC5	ViewDailyHeartRate	Allows the user to view the heart rate readings for a day in the form of a line graph.
UC6	ViewDailyCaloriesBurnt	Allows the user to view the calories burnt in a day in the form of a bar graph.
UC7	ViewDailyStressLevel	Allows the user to view the stress levels for a day in the form of a line graph.
UC8	ViewMonthlyHeartRate	Allows the user to view the heart rate readings for a month in the form of a line graph.
UC9	ViewMonthlyCaloriesBurnt	Allows the user to view the calories burnt in a month in the form of a bar graph.
UC10	ViewMonthlyStressLevel	Allows the user to view the stress levels for a month in the form of a line graph.
UC11	ViewHeartCondition	Allows the user to view whether their heart condition is normal, Tachycardia, Bradycardia or cardiac mortality in the form of text.
UC12	CalculateDailyAverageHeartRate	Allows the user to view the average values of heart rate for a day in the form of text.

4.4 Use Case Diagram



4.5 Fully Dressed Description

UC1 CreateProfile

Initiating Actor: User

Actor's Goal: To create a new profile.

Participating Actor: Database.

Pre-conditions: User is viewing the login screen of the system

Post-conditions: System displays the user's current month home screen

Flow of Events for Main Success Scenario:

-> 1. User enters the name, age, weight, height, if previously had heart attack, user id, password and presses submit button.

<- 2. System checks if similar user id already exists in database, stores the user information in the database.

->3. System creates a new page with user's information and displays user's home page on screen.

Flow of Events for Extension (Alternate Scenario):

-> 1. User enters the name, age, weight, height, user id, password and presses submit button.

<- 2. System checks if similar user id already exists in database, finds a match.

<- 3. System gives a message "Use different User ID" on screen.

UC2 Login

Initiating Actor: User

Actor's Goal: To gain access to the system

Participating Actor: Database.

Pre-conditions: System displays login screen of the system

Post-conditions: System displays the user's current month home screen

Flow of Events for Main Success Scenario:

-> 1. User enters his id and password.

<- 2. System checks if user id and password match, finds a match.

<- 3. System loads the user's home page on screen.

Flow of Events for Extension (Alternate Scenario):

-> 1 User enters the id and password.

<- 2. System checks for the id and password, finds that there is no such id and password in the database.

<- 3. System gives a message "Wrong User ID or Password" on screen.

UC3 UploadFile

Initiating Actor: User

Actor's Goal: To upload a data file to the system from a computer.

Participating Actors: Data file and Database.

Pre-conditions: System displays the user's current month home screen.

Post-conditions: Data for the user specified day is stored in the database.

Flow of Events for Main Success Scenario:

-> 1. User selects a day by clicking on a day, selects whether it is exercise or resting data and then clicks on "Upload" button to upload data file.

<- 2. System displays a pop-up window with windows browser and asks user to select a data file.

-> 3. User selects the data file and presses "OK" on pop-up window.

<- 4. System reads data file and stores data in data base under the user's profile.

<- 5. System displays an entry on the day on the screen.

UC4 ChangeProfile

Initiating Actor: User

Actor's Goal: To modify their personal information.

Participating Actor: Database

Pre-conditions: System displays the user's current month home screen with existing user information.

Post-conditions: System displays the user's current month home screen with updated user information.

Flow of Events for Main Success Scenario:

- > 1. User clicks on “Edit info”.
- <- 2. System checks for user information with database.
- > 3. Database sends user information to system.
- <- 4. System displays user information with editing option.
- > 5. User types new information and clicks “Save”.
- <- 6. System sends new information to database.
- > 7. Database updates information.
- <- 8. System displays new information.

UC5 ViewDailyHeartRate

Initiating Actor: User

Actor’s Goal: To view the heart rate readings for a day in the form of a line graph.

Participating Actor: Database

Pre-conditions: System displays the user’s current month home screen.

Post-conditions: System displays the heart rate data for a day in form of a line graph.

Flow of Events for Main Success Scenario:

- > 1. User clicks on a day and then clicks on “View Daily Heart Graph”.
- <- 2. System sends request to database for the data.
- > 3. Database searches for user’s data for the day and sends data to system.
- <- 4. System converts data to line graph and displays on the screen.

Flow of Events for Extension (Alternate Scenario):

- > 1. User clicks on a day and then clicks on “View Daily Heart Graph”.
- <- 2. System sends request to database for the data.
- > 3. Database searches for user’s data for the day but does not find data.
- <- 4. System displays message “No data uploaded”.

UC6 ViewDailyCaloriesBurnt

Initiating Actor: User

Actor’s Goal: To view the calories burnt in a day in the form of a bar graph.

Participating Actor: Database

Pre-conditions: System displays the user’s current month home screen

Post-conditions: System displays the calories burned data for a day in form of a bar graph.

Flow of Events for Main Success Scenario:

- > 1. User clicks on a day and then clicks on “View Daily Calories Burned”.
- <- 2. System sends request to database for the data.
- > 3. Database searches for user’s data for the day and sends data to system.
- <- 4. System converts data to bar graph and displays on the screen.

Flow of Events for Extension (Alternate Scenario):

- > 1. User clicks on a day and then clicks on “View Daily Heart Graph”.
- <- 2. System sends request to database for the data.

- >3. Database searches for user's data for the day but does not find data.
- <-4. System displays message "No data uploaded".

UC7 ViewDailyStressLevel

Initiating Actor: User

Actor's Goal: To view the stress levels for a day in the form of a line graph.

Participating Actor: Database

Pre-conditions: System displays the user's current month home screen.

Post-conditions: System displays the stress levels for a day in form of a line graph.

Flow of Events for Main Success Scenario:

- > 1. User clicks on a day and then clicks on "View Daily Stress Levels".
- <- 2. System sends request to database for the data.
- >3. Database searches for user's data for the day and sends data to system.
- <-4. System converts data to line graph and displays on the screen.

Flow of Events for Extension (Alternate Scenario):

- > 1. User clicks on a day and then clicks on "View Daily Stress Levels".
- <- 2. System sends request to database for the data.
- >3. Database searches for user's data for the day but does not find data.
- <-4. System displays message "No data uploaded".

UC8 ViewMonthlyHeartRate

Initiating Actor: User

Actor's Goal: To view the heart rate readings for a month in the form of a line graph.

Participating Actor: Database

Pre-conditions: System displays the user's current month home screen.

Post-conditions: System displays the heart rate data for a month in form of a line graph.

Flow of Events for Main Success Scenario:

- > 1. User clicks on "View Monthly Heart Rate".
- <- 2. System sends request to database for the data.
- >3. Database searches for user's data for the month and sends data to system.
- <-4. System converts data to line graph and displays on the screen.

Flow of Events for Extension (Alternate Scenario):

- > 1. User clicks on "View Monthly Heart Rate".
- <- 2. System sends request to database for the data.
- >3. Database searches for user's data for the month but does not find data.
- <-4. System displays message "No data uploaded".

UC9 ViewMonthlyCaloriesBurnt

Initiating Actor: User

Actor's Goal: To view the calories burnt in a month in the form of a bar graph.

Participating Actor: Database

Pre-conditions: System displays the user's current month home screen.

Post-conditions: System displays the calories burned for a month in form of a bar graph.

Flow of Events for Main Success Scenario:

- > 1. User clicks on "View Monthly Calories Burned".
- <- 2. System sends request to database for the data.
- >3. Database searches for user's data for the month and sends data to system.
- <-4. System converts data to bar graph and displays on the screen.

Flow of Events for Extension (Alternate Scenario):

- > 1. User clicks on "View Monthly Calories Burned".
- <- 2. System sends request to database for the data.
- >3. Database searches for user's data for the month but does not find data.
- <-4. System displays message "No data uploaded".

UC10 ViewMonthlyStressLevel

Initiating Actor: User

Actor's Goal: To view the stress levels for a month in the form of a line graph.

Participating Actor: Database

Pre-conditions: System displays the user's current month home screen.

Post-conditions: System displays the stress levels for a month in form of a line graph.

Flow of Events for Main Success Scenario:

- > 1. User clicks on "View Monthly Stress Levels".
- <- 2. System sends request to database for the data.
- >3. Database searches for user's data for the month and sends data to system.
- <-4. System converts data to line graph and displays on the screen.

Flow of Events for Extension (Alternate Scenario):

- > 1. User clicks on "View Monthly Stress Levels".
- <- 2. System sends request to database for the data.
- >3. Database searches for user's data for the month but does not find data.
- <-4. System displays message "No data uploaded".

UC11 ViewHeartCondition

Initiating Actor: User

Actor's Goal: To view whether their heart condition is normal, Tachycardia, Bradycardia or cardiac mortality in the form of text.

Participating Actor: Database

Pre-conditions: System displays the user's current month home screen.

Post-conditions: System displays heart condition in form of text.

Flow of Events for Main Success Scenario:

- > 1. User clicks on "View Heart Condition".
- <- 2. System sends request to database for the data.
- >3. Database searches for user's data for the month and sends data to system.
- <-4. System calculates average monthly heart rate, matches with normal heart rate for user's age and displays appropriate condition on the screen.

Flow of Events for Extension (Alternate Scenario):

- > 1. User clicks on “View Heart Condition”.
- <- 2. System sends request to database for the data.
- >3. Database searches for user’s data for the month but does not find data.
- <-4. System displays message “No data uploaded”.

UC12 CalculateDailyAverageHeartRate

Initiating Actor: User

Actor’s Goal: To view the average values of heart rate for a day in the form of text.

Participating Actor: Database

Pre-conditions: System displays the user’s current month home screen.

Post-conditions: System displays average heart rate for a day in form of text.

Flow of Events for Main Success Scenario:

- > 1. User clicks on a day and then clicks on “View Average Daily Heart Rate”.
- <- 2. System sends request to database for the data.
- >3. Database searches for user’s data for the day and sends data to system.
- <-4. System calculates average of data and displays on the screen in form of text.

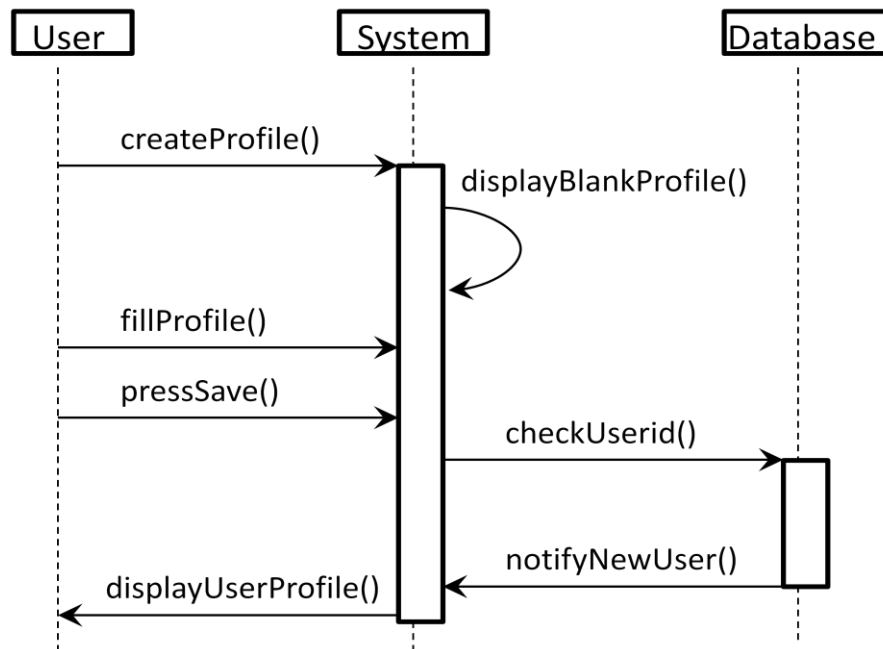
Flow of Events for Extension (Alternate Scenario):

- > 1. User clicks on a day and then clicks on “View Average Daily Heart Rate”.
- <- 2. System sends request to database for the data.
- >3. Database searches for user’s data for the day but does not find data.
- <-4. System displays message “No data uploaded”.

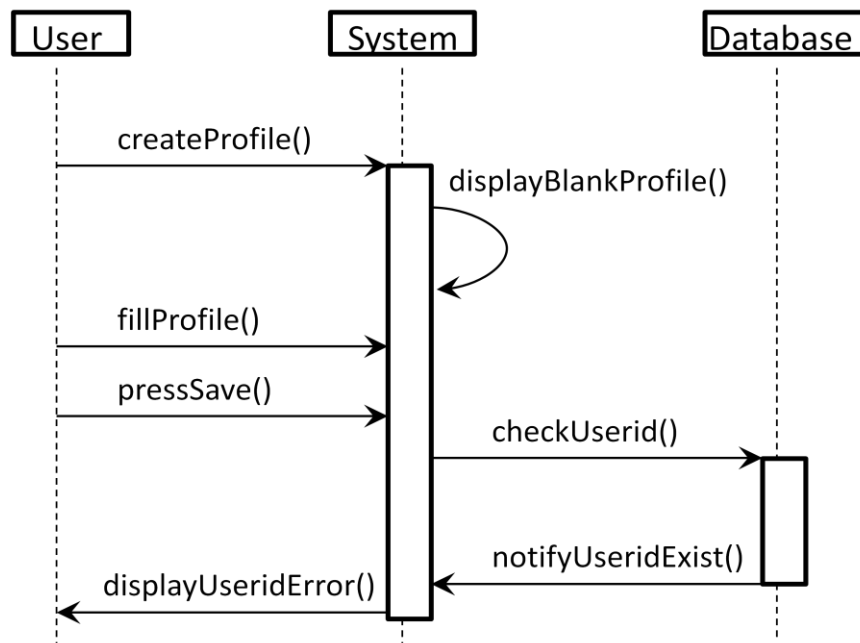
4.6 System Sequence Diagrams

UC1 CreateProfile

Success Case:

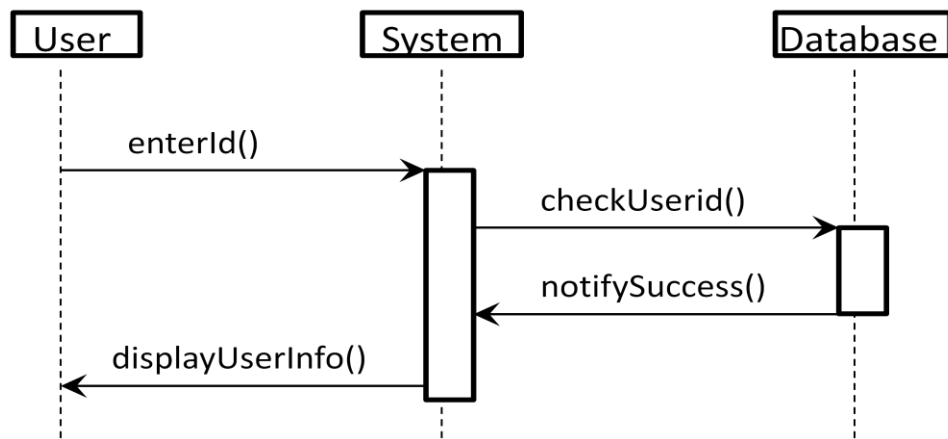


Alternate Case:

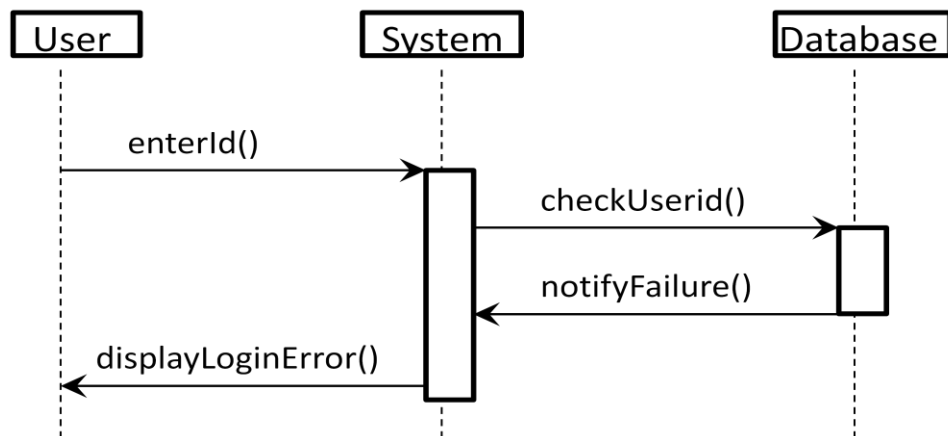


UC2 Login

Success Case:

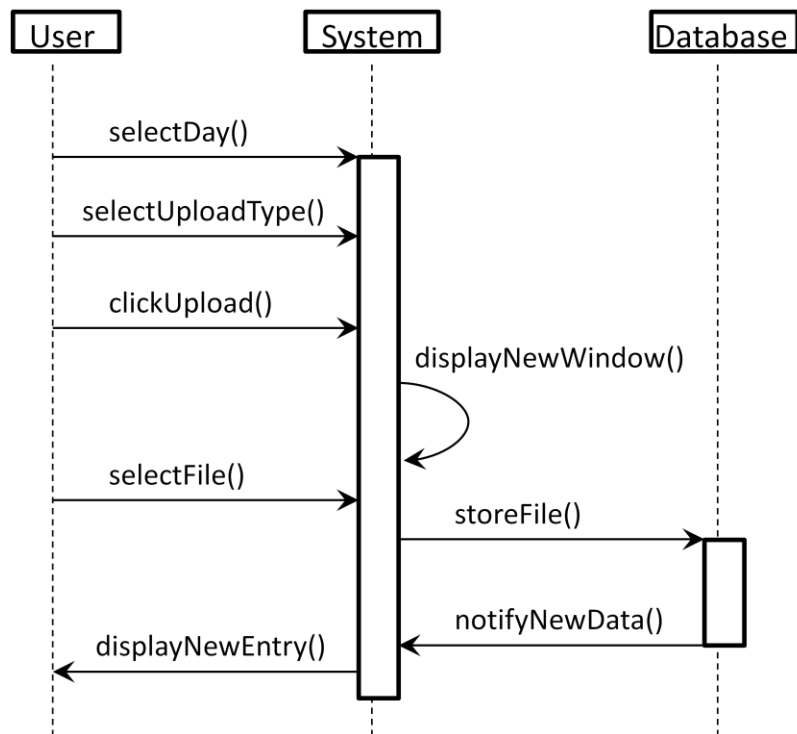


Alternate Case:

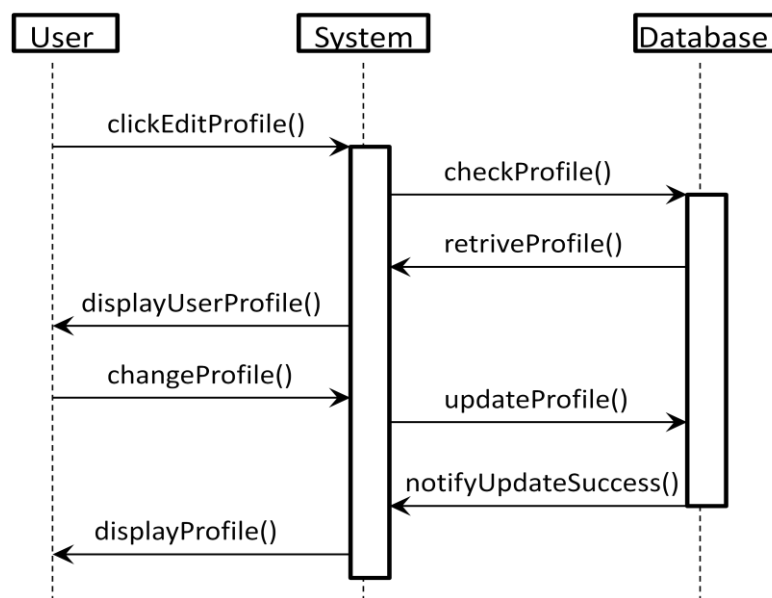


UC3 UploadFile

Success Case:

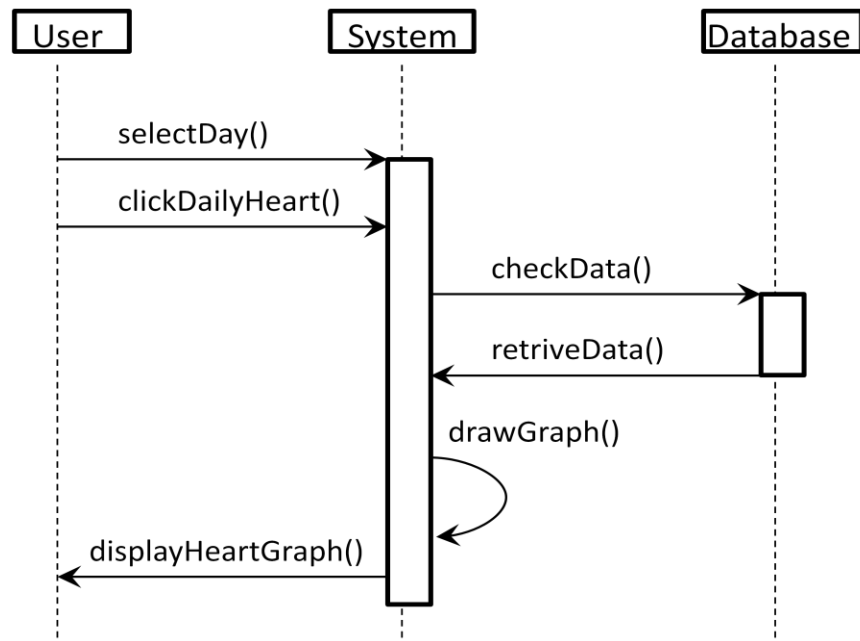
**UC4 ChangeProfile**

Success Case:

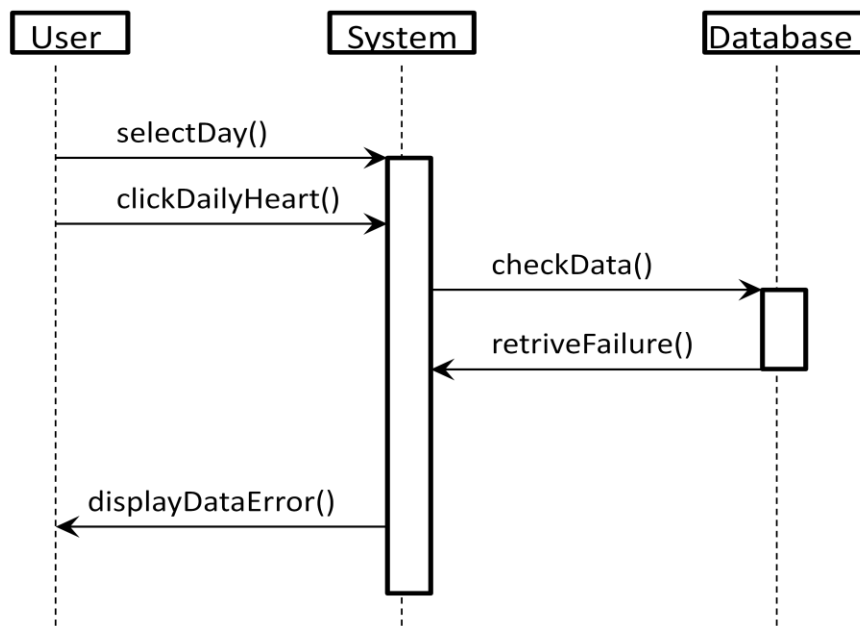


UC5 ViewDailyHeartRate

Success Case:

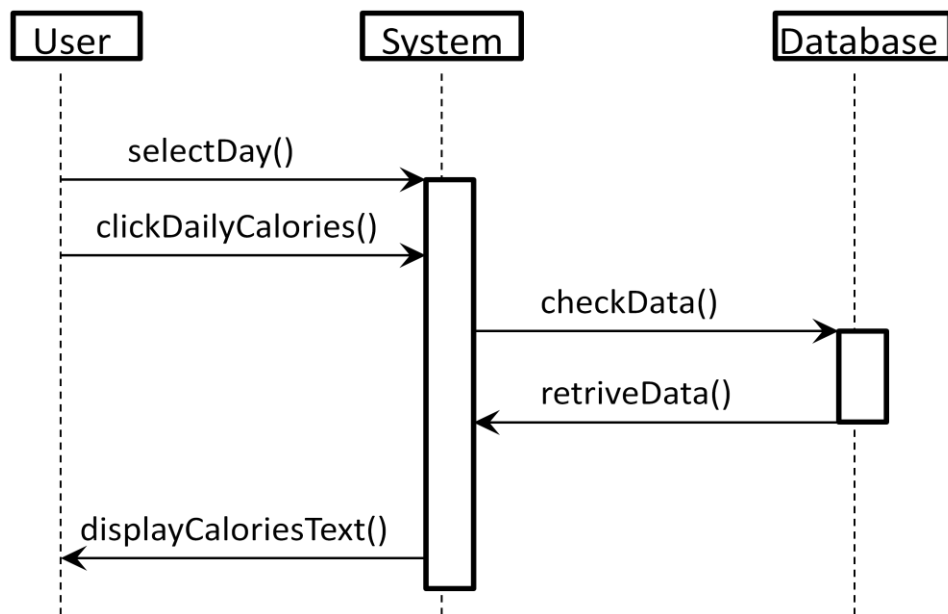


Alternate Case:

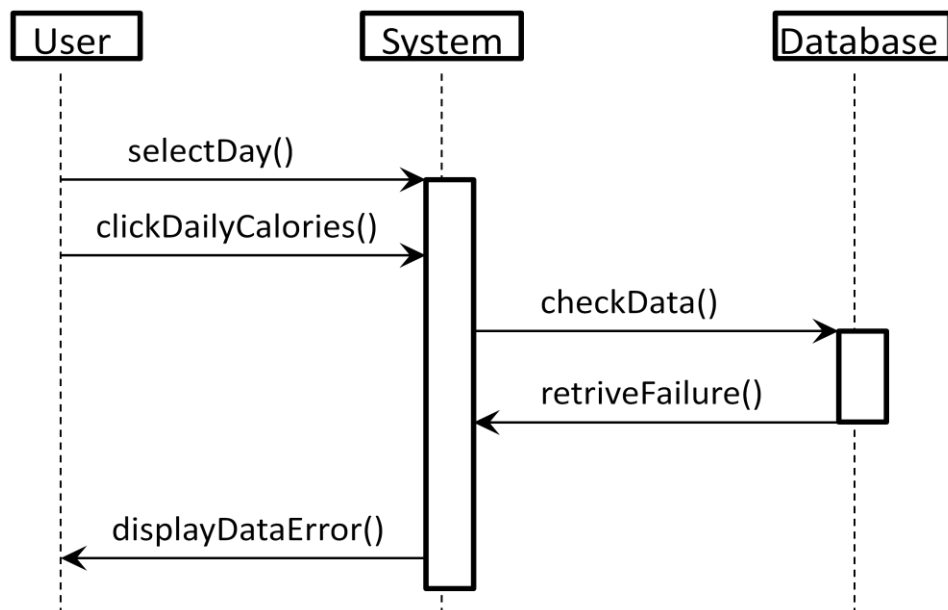


UC6 ViewDailyCaloriesBurnt

Success Case:

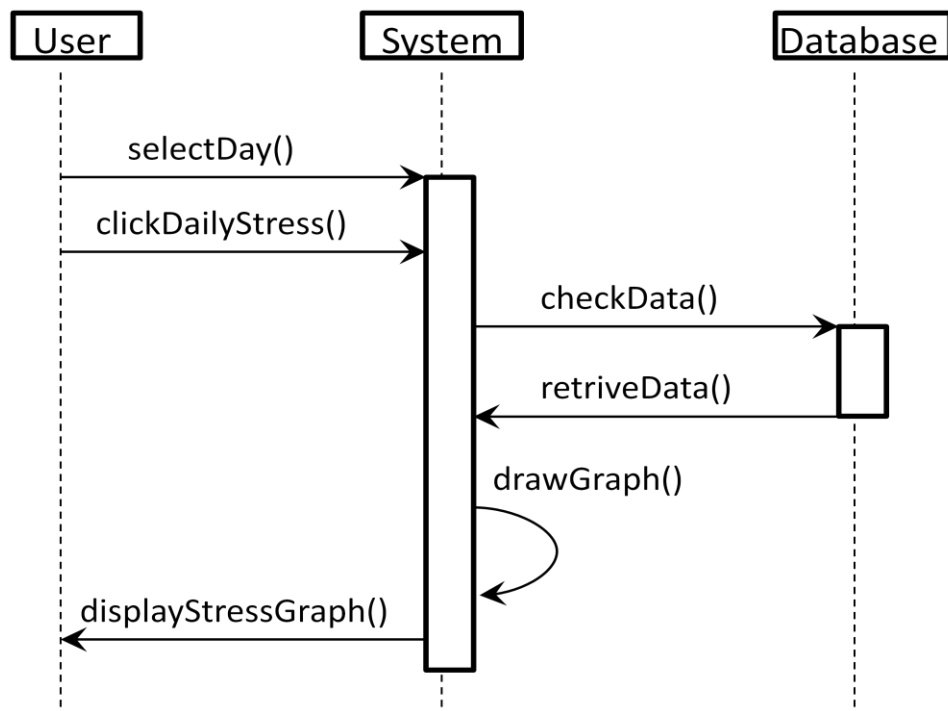


Alternate Case:

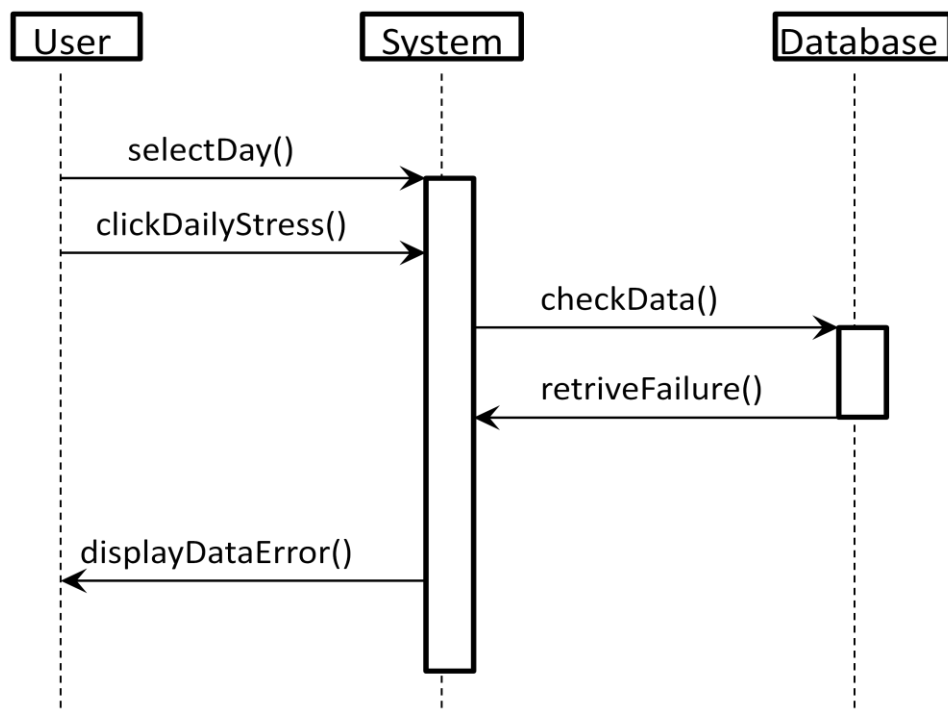


UC7 ViewDailyStressLevel

Success Case:

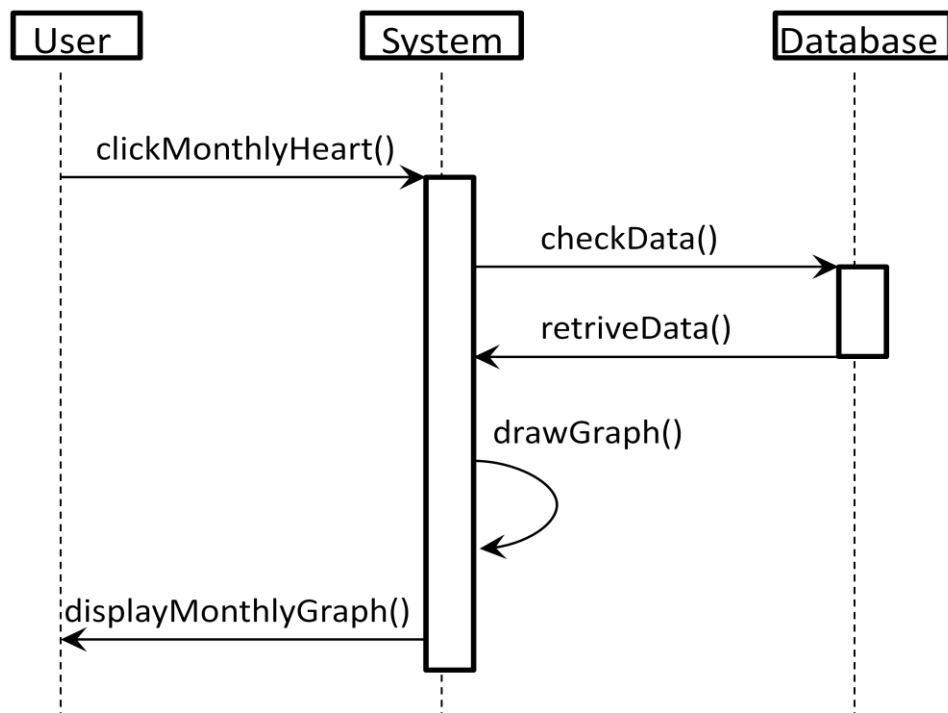


Alternate Case:

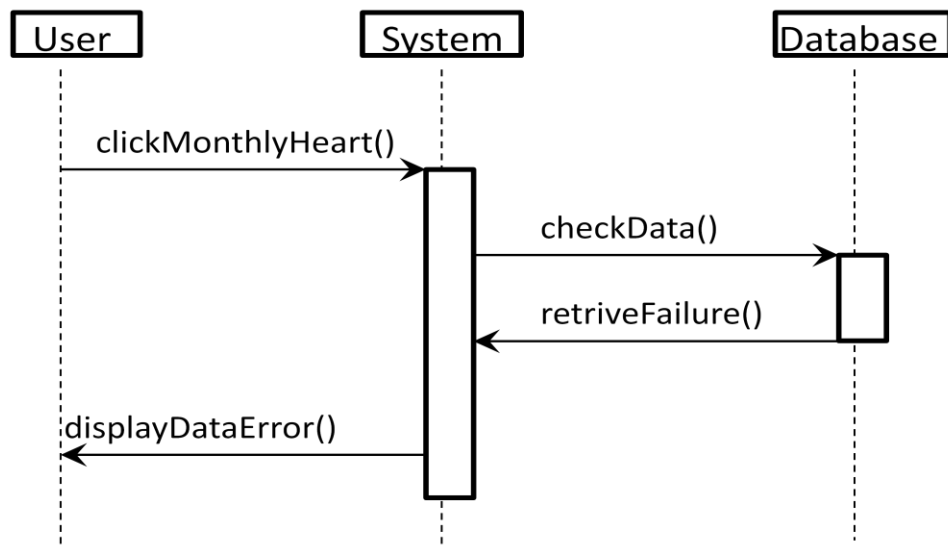


UC8 ViewMonthlyHeartRate

Success Case:

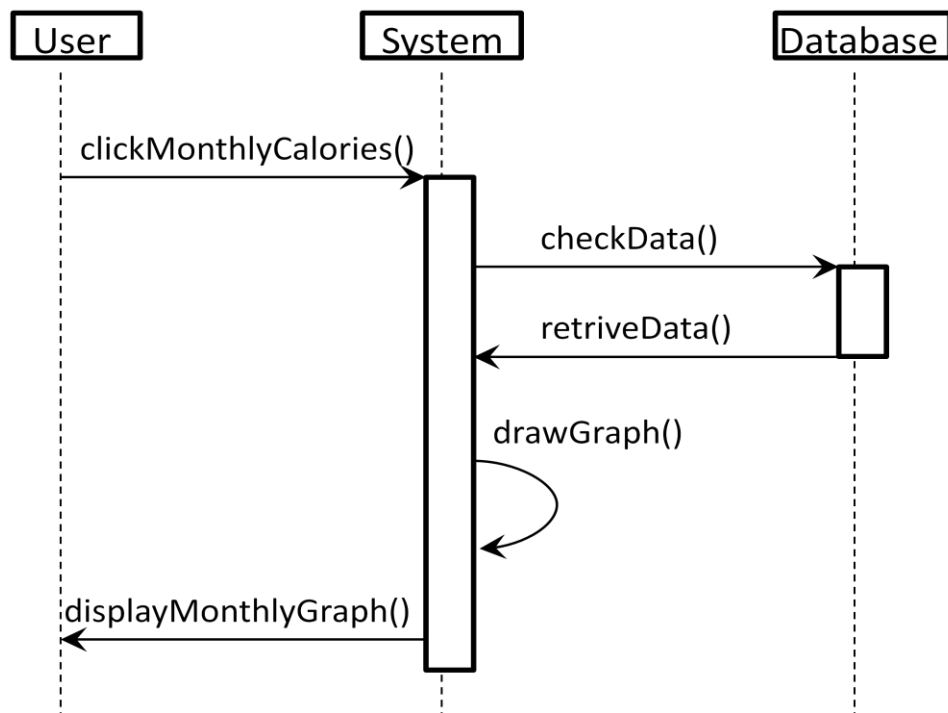


Alternate Case:

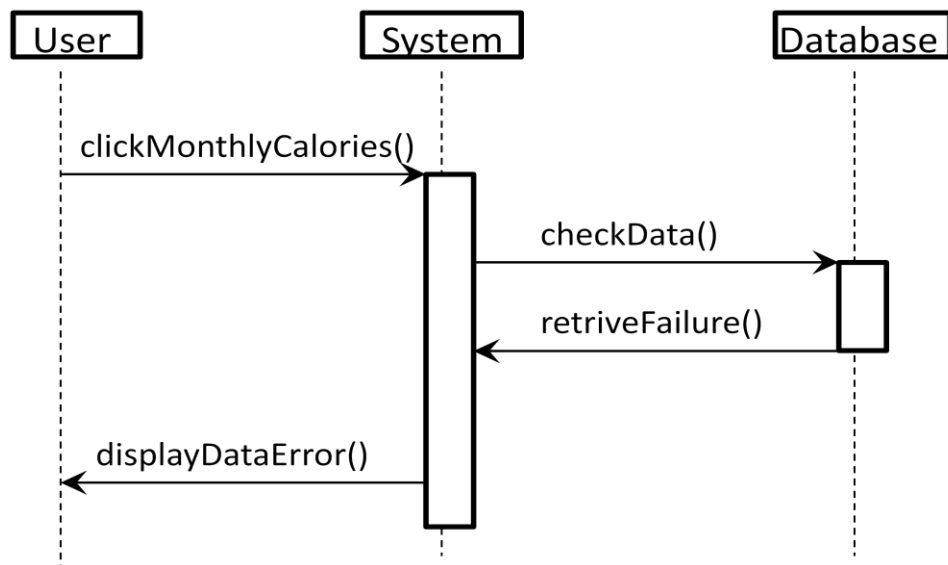


UC9 ViewMonthlyCaloriesBurnt

Success Case:

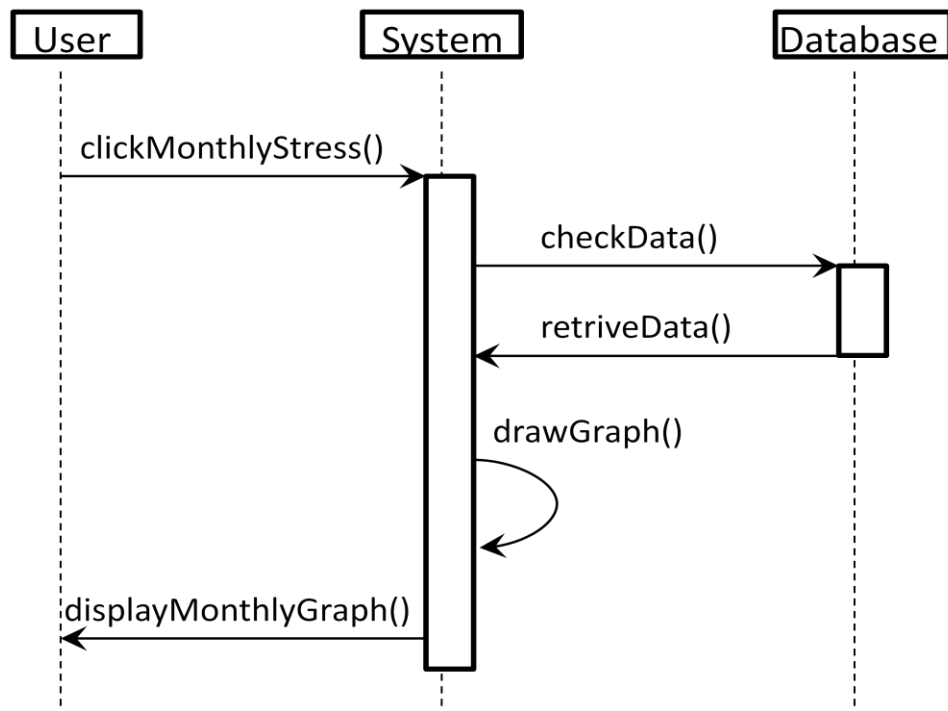


Alternate Case:

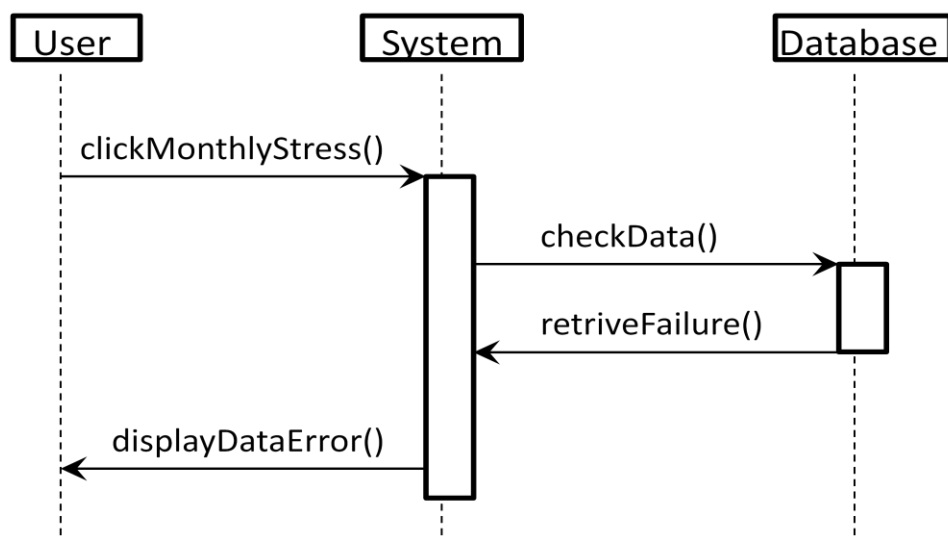


UC10 ViewMonthlyStressLevel

Success Case:

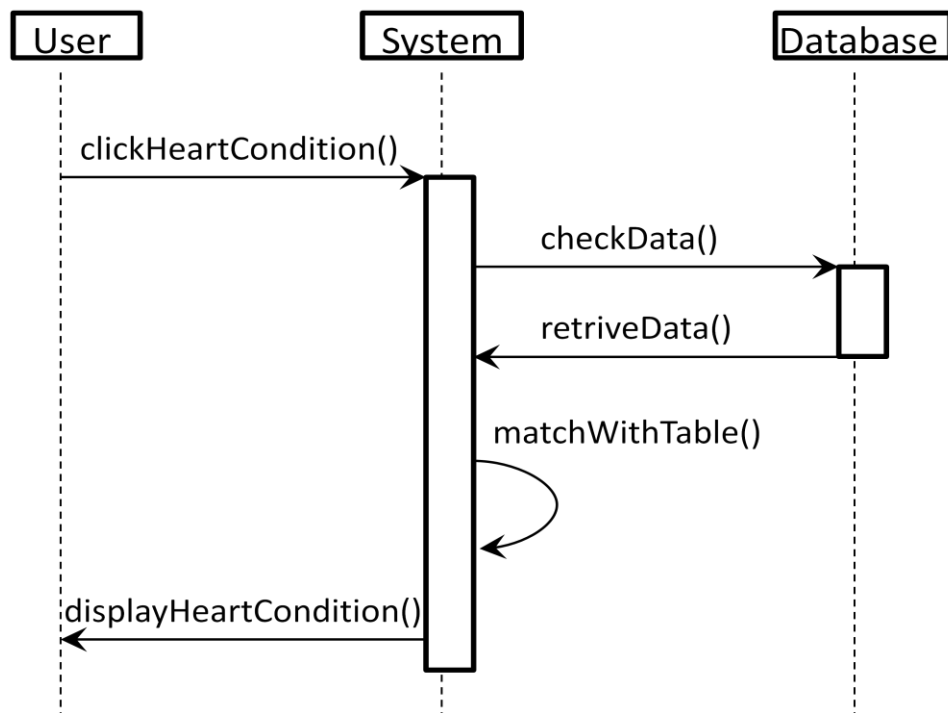


Alternate Case:

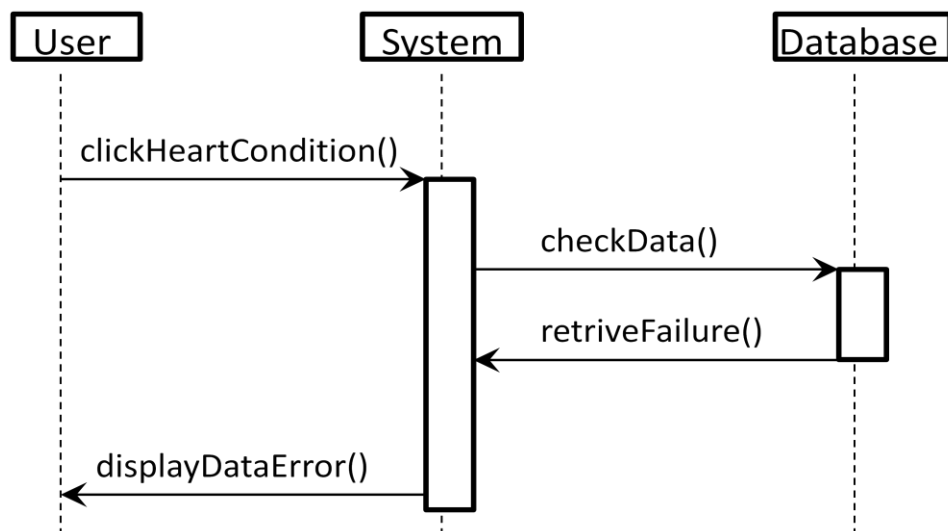


UC11 ViewHeartCondition

Success Case:

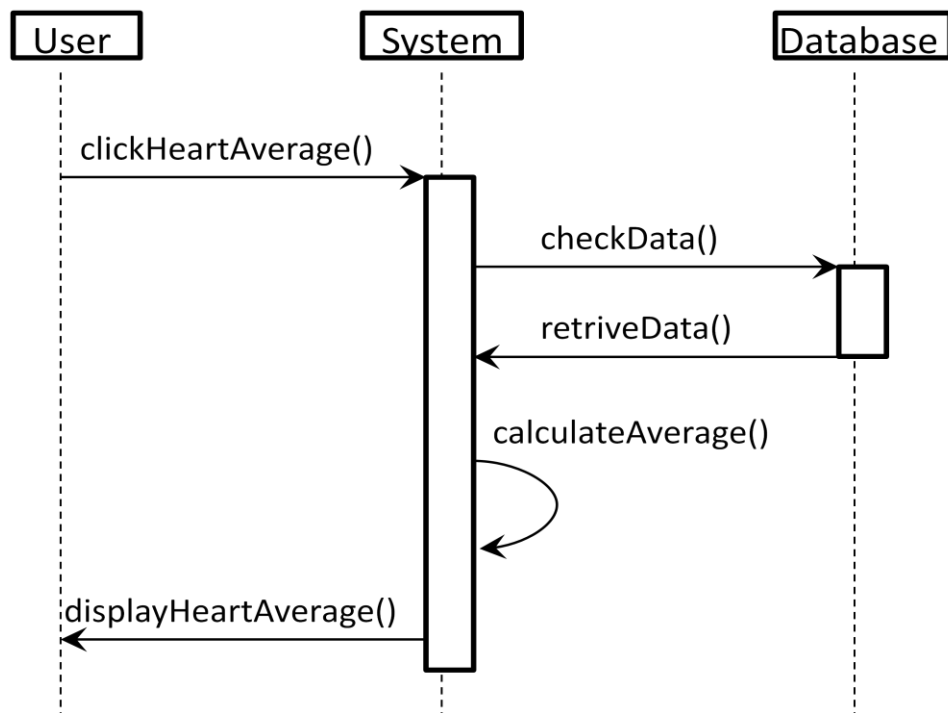


Alternate Case:

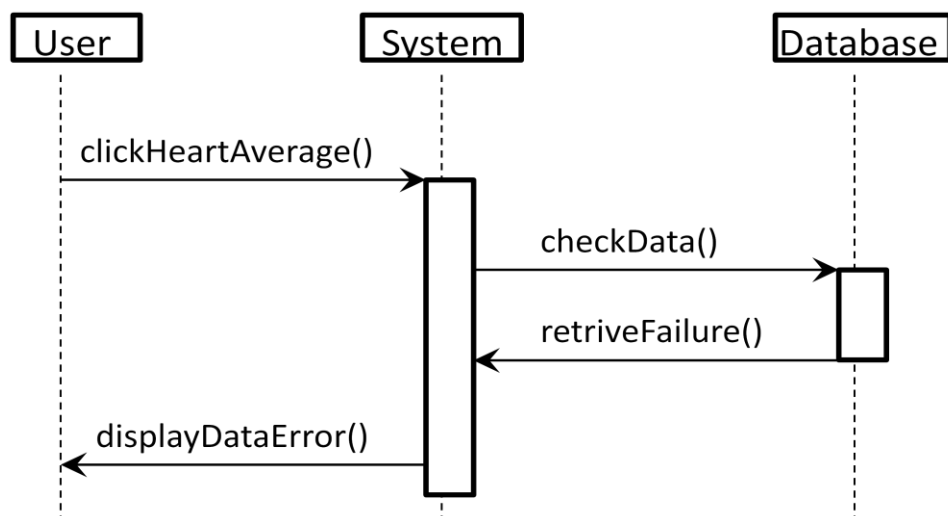


UC12 CalculateDailyAverageHeartRate

Success Case:



Alternate Case:



5 User Interface Specification

Figure 2 represents the initial sketch sent by our customer. Through the sketch it is clear that the customer wants the central area of the user interface to display the various graphs. We also see that it needs to be big. We have tried to meet the customer's expectations by developing an initial user interface as shown in the following figures.



Figure 3: The Calendar Style Navigation System

This design has a feature similar to a diary. Users will be able to look for their medical records for a particular day from a monthly view. Since each user can upload more than one activity everyday to their profile, either resting heart rate or for an exercise, this design will help users to see which type of uploads were made for a day and they can also add their own comments or reminders.

Thus by giving this feature of multiple file uploads for a day, the user can store data for exercise and heart rate on the same day. If a user wants to see a graph of that day's personal readings, they would just have to click on the day and our system will display readings in a graph format.

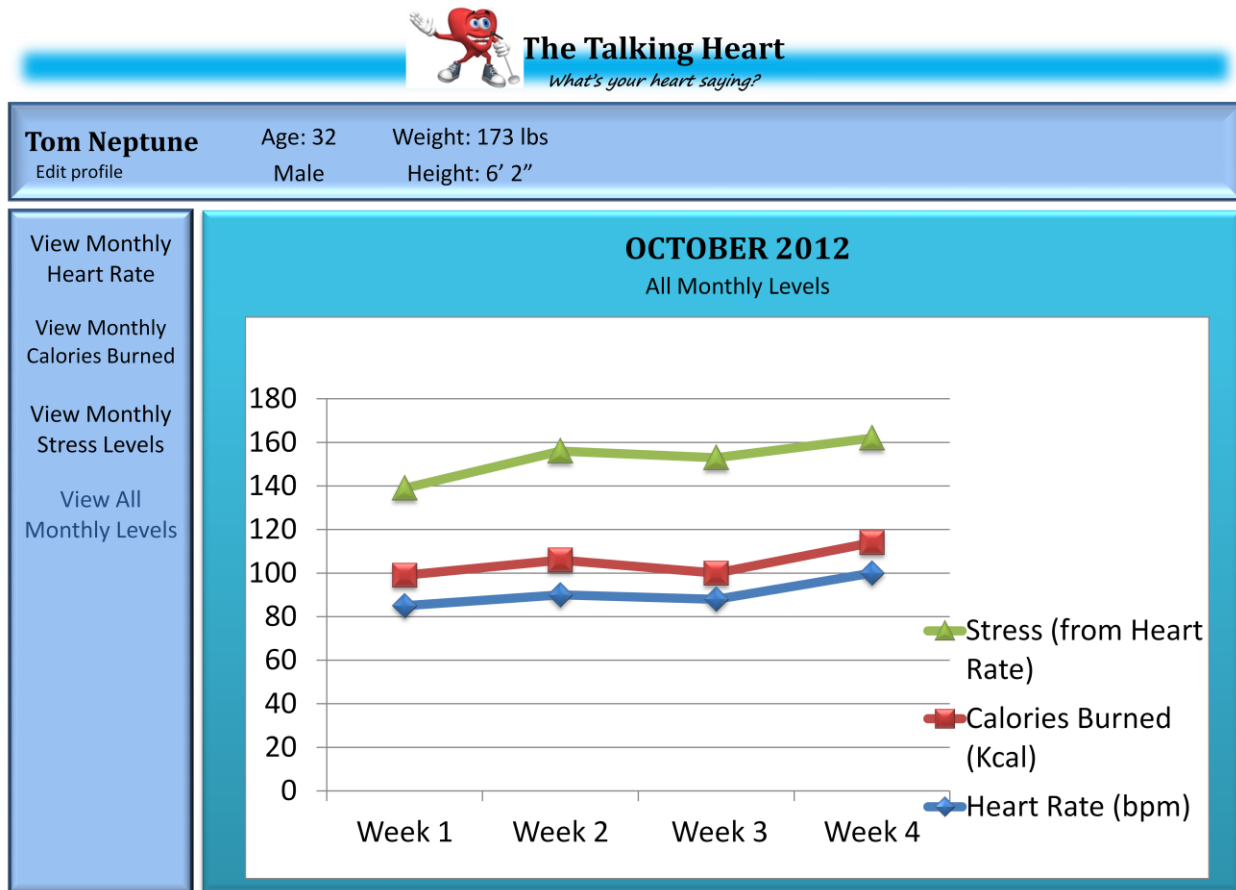


Figure 4: Viewing monthly parameters

Figure 4 shows our initial design for plotting the graph of monthly values (stress, heart rate and calories burned) for a person. Since this would be the first prototype, we will seek feedback from the customers as to how they would prefer their heart rate, stress or calories burned data to be plotted by our system.

Figure 5 shows how we plan to display a person's heart condition. We expect that our system will be used by naïve customers who might not have knowledge about the heart rate and its meaning. Thus the heart condition will be specified as text.

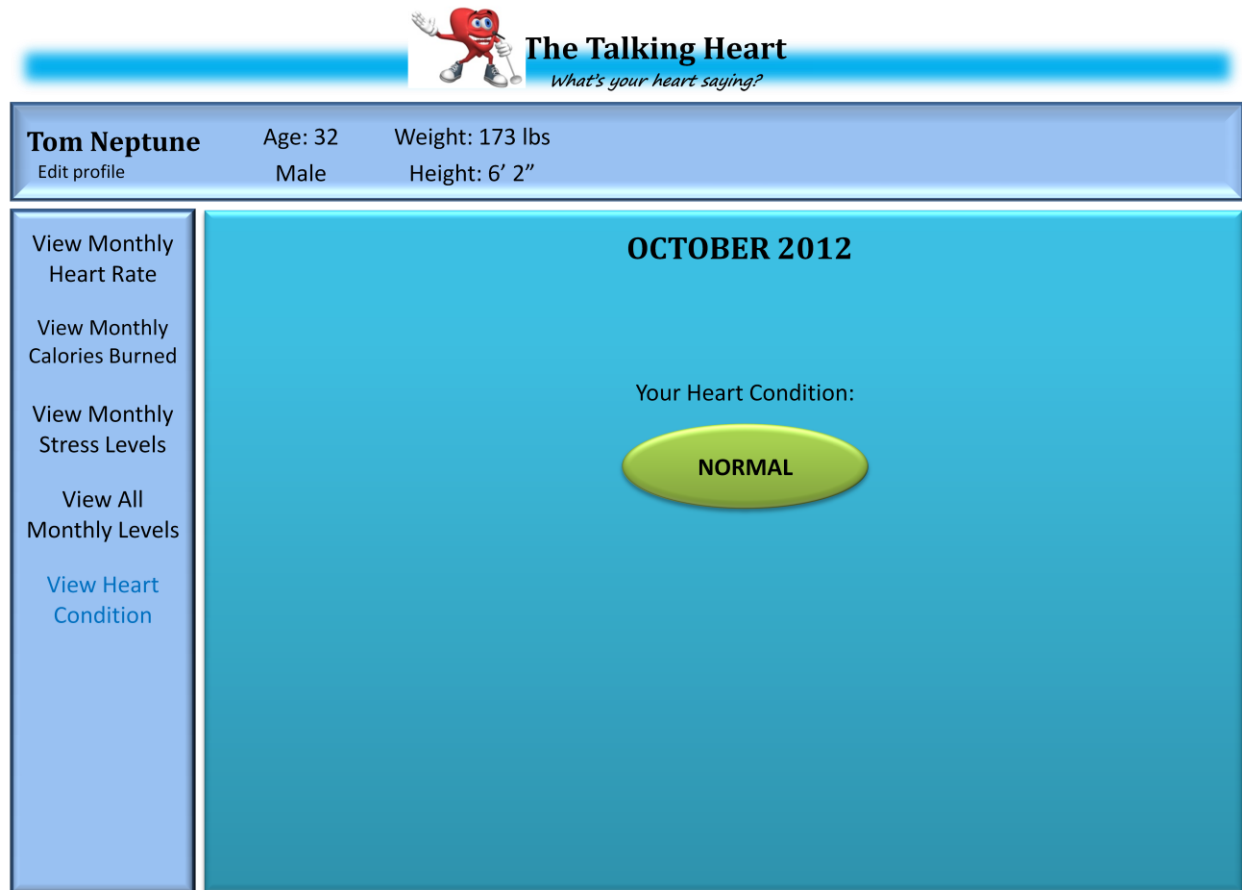


Figure 5: Viewing Heart Condition

How We Did It & Plan of Work

What we did for Statement of Work and Requirements:

Our team had a meeting and discussion about probable features of the system. In the meeting one individual was selected to act as a customer representative and the other team members were asked to act as either patients or athletes. The patients and athletes were asked a number of questions by the customer representative about what they would like their personal health monitoring software to do. We wrote down all the points and then categorized them to be a bit more specific. This part of the report was product of a brainstorming meeting and discussion which we think worked well.

What we did for Functional Requirements Specifications, Use Case and User Interface:

This was the most complex part of the report to write, since everything was needed in detail. Initially we tried to go by the way suggested by the professor and asked each team member to come up with two use cases each and draw their sequence diagrams. But what we found was that there was at least one use case common between two team members or sometimes three. Thus working entirely independently proved to be less productive. Therefore we had a strong five hour meeting and analyzed 12 unique use cases. After the use cases were finalized, each team member was assigned two unique use cases and was responsible for writing the fully dressed description along with the respective diagrams. This proved to be very efficient.

The user interface design was evolved from the proposal and by taking inspiration from the internet for aesthetic and feature rich user interfaces.

Revision of the Statement of Work and Requirements:

After the professor gave us his views and comments on the first part of the report, four team members were assigned to re-structure the first part, write the missing sections (acceptance tests & customer draft for user interface) and analyze the requirements. The other two team members continued work on the second part (Functional Requirements Specifications, Use Case and User Interface).

Coding for first demo:

For the first demo, we plan to implement 4-5 use cases. We will start with a conservative plan and as suggested by the professor in class, every two team members would work on one use case. As soon as that use case is complete, they would try to implement one more.

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