SOEN 7761

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Project: Final Report

MyPHR

# Introduction

The purpose of this project is to improve the myPHR project by adding an *intelligence* to the user interface. The problem we decided to attack for this project is human error, we can say that most people make mistakes. This is certainly true with the elderly handling new computer based technology. It has been proven that senior citizens make more mistakes entering data on a touch screen than the usual population. In order to fix this problem, a smart error handling *validator* will be implemented in the myPHR android application.

If time allows, we would also add a notification system. This would remind the user to enter their data if they haven't done so already.

# Motivation

In our case, the users would have higher chances entering wrong data about their health in their applications’ record. This can be explained that the users are not used to handling a touch screen. This occurs at data entry as the users are not familiar using devices without a physical keyboard. The users would be tapping on a virtual keyboard and the buttons happen to be very small and the user might have big fingers. Also, the user might not double check their input and rely on the device. By implementing a solution, this would make myPHR more efficient and accurate.

Our solution would be create a smart error handling that will compare the input entered with the previous ones. If the data is not near the others, it will ask the user to validate its answer. I.e.: The user enters 255 and his previous entries were 55, 58 and 60. The user will see the prompt and corrects his answer from 255 to 55. Else, he would confirm it if it is accurate. Also, the system will check if it’s in the healthy range and if not, advise the patient to see his doctor.

Another case is that our users have higher probability of having and developing memory problems. They might forget to enter their data. The solution would be to create a notification (sound or vibration) to remind the user to enter their data.

# Project summary

This project will hopefully create a more reliable application by correcting input mistakes and reminding the user to use the application daily. Also, it will be a self mini check to see if it compares to previous entries. It will create some kind of comfort for the users to know every time that they are healthy.

# Project Details Revised

The purpose of this project is to implement “Smart Alerts” which will be based on the user entries and thresholds that are setup by us in the application. With the information gathered from the user and the thresholds we have setup, we will display an alert in case if the data entered seems wrong.

In our case, our relevant properties would be the each type of measurement provided by the application (Blood Pressure, Weight, O2 Saturation, Temperature and Blood Sugar). Each of them we will retrieve previous entries and analyze them to set the thresholds. From there we will be able to determine the user’s trends after gathering data and set a range for being **normal for the user**. This will allow us to know if the user’s entry is incorrect or is it simply an input that doesn’t follow the user’s “normal” inputs, in that case if this starts to happen often a notification will be shown to the user.

Our proposed way of collecting data from the user would simply be after each entry per day, after seven days of collecting the data, the newer entries will be monitored for unexpected entries or changes in the user’s entries. We will also use the entries gathered to create dynamic notifications based on the previous time entries. Seven days will be taken to study the user's pattern of their daily inputs and then try to send reliable daily reminders to the user's lifestyles.

# Implementation

There will be **no** major changes to the UI. We will mostly make the changes in the back-end. First off, we have created a new validation process when the data is entered. If the data entered seems exaggerated, a popup would appear to ask the user to confirm their choice or give a chance to correct it (yes/no buttons). Second of all, a system of notification will be created to remind the user to enter the data for the next day. However, a notification system already exists in the myPHR application but it is a manual process so we just created a new function for it to be dynamic.

In order to develop these new functionalities, we will use the pre-existing vital signs data the user has entered along with the days. In order to validate, we will do the average of the last 7 days and see if it's within a specified difference depending on the vital sign. If it's over or under, there might be an error and a popup will appear to ask the user if it should continue to save or the user wants to edit. As for the notification, there needs to be seven days that the user has used it to know their routine. The system will check on average how many entries he has done per day and around what time.

For blood pressure, there are 3 ranges Low Blood Pressure, Normal and High Blood Pressure. When at Low Blood Pressure, Systolic is less than 90 mmHG or Diastolic is less than 60, or at High Blood Pressure, Systolic is greater than 120 or Diastolic is greater than 80, a message will be shown to the user. If the Systolic changes by more than 30 or the Diastolic by more than 20 the user will be asked to confirm the entry.

For blood sugar, only data within the range of 80 and 160mg/dL will be accepted with a fluctuation of 40 mg/dL. These are the healthy range for a person. Note must be also taken that it depends if the user the data was registered before or after a meal or even a bedtime.

For temperature, only temperature rates of 36.5C, 37C and 37.5C will be accepted as each human is different but it is usual to be around of 37C.

For oxygen saturation, the usual normal readings should be within 95% and 100%. If there is anything lower or higher, it is an abnormal.

For weight, we have considered that a person wouldn't a daily weight change more than 0.68kg.

A SQL query has been written to select the last data in the past seven days. This will be used in both the validation and the dynamic datas.

For the validation part, we have only modified the class *BloodPressureActivity*. More specifically, the method submit where it would call a new method called *validateData*. The same as been done for these classes: *BloodSugarActivity*, *O2Activity*, *TemperatureActivity* and *WeightActivity*. Their respective mapper and TDG's have also been modified for the query.

For the notification section, currently, we have just modified *VitalSignsActivity*. We modified the method *onCreate* to also call a new method we created, *initializeTimeReminders*.

We have used the following algorithm:

1. Divide the number of entries by the number representing the different days. This will be called the number of reminders.
2. Divide 24 hours by number of reminders. This will represent the number of time blocks
3. Time entries are put into the time blocks and the average of each time is calculated
4. Based on average time for each time block, reminders are created.

Finally, the reminders are created for future dates when the application launches.

# Evaluation

We have tested the application on a tablet with two elderly ladies. The youngest one is in her late sixties uses a computer and a tablet to go on Facebook, Skype, play with games (Sudoku), watch YouTube videos and reads the news. She has learned through someone and memorized the English action keywords i.e. Search, Back, Ok. The second participant is in her late eighties has never used a computer nor a tablet. The closest technological device she has used is the television and a CD player. The test has been conducted with a tablet as they have never used a cellphone and the screen is too small for them. Both users do not speak nor read English.

We have asked both user to enter data by showing them how. If they have any questions outside of entering data, we have answered them as testing the other UI and functionality is outside our scope. The test start from the entry page for all vital signs. We have asked and gave them 7 data for each vital sign for different days. We have explained the general idea of what we were testing so they could understand the future error popup message and would tell them where to enter the data as they don't communicate in English. They were told to think out loud in order for us to understand their walkthrough. However, since there were few problems and they lost the interest and they would try to make conversation, we have stopped after two tests. Hence, the reminders were not tested.

## Participant 1

"Ok, I see text. Has the date already been set? Do I need to enter data here? What will I need to enter? Where is the next button?" She enters the data with no problem what so ever. “Something appeared and disappear. I don't know what it was. It was too small and too fast to see. What do I do know? I clicked on it, what do I do here? I changed the date to 6 days ago, I click the button to confirm as you asked me. What do I type this time?" I gave her all good data except for temperature. She enters the last data and the popup appeared. "Something happened, what am I supposed to do? I am pretty sure I typed everything you asked me to." I translate the message and asked what she thought of it. "I typed it correctly, I'm sure. Where is temperature here?" She reads 45°C. "That doesn't seem right. A human can't have that kind of temperature. Should I correct it to 37°C?" I tell her yes and quickly took the initiative to click on no without any hesitation and corrected it. These two tests were done in a total of 2 minutes. The duration for test 1 was 75 seconds and test 2, 45 seconds.

Observation: Somewhat fast learner. Positive feedback from the two test we have seen.

Feedback: You should make something to remind the owner to take their daily pills.

Overall experience: Pleasant

## Participant 2

She was completely lost and did not have any interest in using the application by herself and wanted someone to do it for her. She was afraid of breaking or doing something that would completely damage the device. She thought the idea was interesting. We have assumed she wasn't interested because she couldn't see well because of her eye problems, she couldn't read the language and was dependent on someone and it dealt with something that didn't affect her personally. However, after much encouragement, she agreed. It took her 5 minutes to do the first test. The kind of errors she had were omission and mistyped. On multiple occasions she thought the hit the keypad but she didn't. On other cases, she hit the wrong keypad because, we assume, she can't see properly. Because of these errors, she had the popup for the errors. For oxygen saturation, she typed "977" when she was supposed to type 95%. When the popup appeared, she had no idea what it was and thought it was some kind of normal feedback. When I explained, she had no idea what she did wrong because she couldn't read the numbers. She didn't understand she mistyped the numbers.

Observation: Not interested, no patience and no "self-confidence".

Feedback: She can't see

Overall experience: Not Applicable.

# Interface Problems

1.1. Verbalizations show evidence of dissatisfaction about an aspect of the interface.

1.2. Verbalization show evidence of confusion/uncertainty about an aspect of the interface.

1.3. Verbalization show evidence of confusion/surprise at the outcome of an action

1.4. Verbalization show evidence of physical discomfort.

1.5 Verbalizations show evidence of fatigue

1.6. Verbalizations show evidence of difficulty in seeing particular aspects of the interface.

1.7. Verbalizations show evidence that they are having problems achieving a goal that they have set themselves, or the overall task goal.

1.8. The participant makes a suggestion for redesign of the interface of the electronic texts.

# Content Problems

2.1. Verbalizations show evidence of dissatisfaction about aspects of the content of the electronic text.

2.2. Verbalizations show evidence of confusion/uncertainty about aspects of the content of the electronic text.

2.3. Verbalizations show evidence of a misunderstanding of the electronic text content (the user may not have noticed this immediately).

2.4. The participant makes a suggestion for re-writing the electronic text content.

# Challenges

We had multiple challenges during this whole project. First off, neither of us had any mobile development experience. Becoming familiar with the android code took us a while and a few free tutorials to follow.

Second of all, the short time frame was a challenge for us since we both work full-time. When the development was done, we had very little free time to test our project and very little participants to test it.

Finally, the biggest challenge we faced was the decision to take if we were going to accept null answers when the user decides (or accidentally) to enters in data vital sign at a time or multiple. We have decided to allow them to "enter" null data because it was most likely a typo or the just didn't know how to return behind and remove it. If we validate "too properly" and they keep hitting obstacles and don't know how to correct themselves, they would just get discouraged from using the product. The product should adapt to them and not them adapt to the software.

# Conclusion

In essence, the problem we are trying to solve is reducing the number of errors users can commit using the application by validating and using the data gathered by the user’s previous entries in the application. An alert will be displayed to the users informing them if an invalid entry is detected asking them to confirm. The system will also be smart enough to detect changes in the users’ entries informing them if it seems erroneous. It will also compile the data gathered based on the time of day entered to remind users if ever they forget to enter data on a particular day.

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