Blood Pressure Monitoring App:

Requirements and Teamwork Documentation

Table of Contents

1 Team Introduction....2
2 App Introduction....2
2.1 Aim of the app....2
2.2 Objectives of the app....3
3 Project Schedule....4
3.1 Work package and Schedule....4
4 Design Review....4
4.1 Overall description....4
4.1.1 Architecture....4
4.1.2 Workflow and use cases....5
4.1.3 Data dictionary....6
4.1.4 Paper Prototype....8
4.2 Component descriptions....8
4.2.1 User Interface....8
4.2.2.2 State Chart Diagram for Controller....10
4.2.3 Analyzer....11
4.2.4 Data Interface....15
5 Client Interview & Feedback....22
5.1 Client interview Q&A....22
5.2 Client feedback....24
6 Demo Video 27
7 Future of the App....28
8 Known Issues, Errror and Condition....28
9 Appendix....29
10 References....29

1. Team Introduction

Team Members (Alphabetically): Nick Brookes-Hocking, Kyle (Yifei) Liu, Leslie MacMillan

Primary Team Lead - Kyle
Secondary Team Lead – Nick & Leslie
Client Main Contact - Leslie
Background Researcher - Nick
Technology Researcher - Kyle
Systems Designer and Analyst - Kyle
Data Designer – Nick
UI Designer - Leslie
Documentation Lead - Nick
Primary Developer - Kyle
Secondary Developer – Leslie & Nick
Software Tester – Leslie lead (All contribute)
Device and Deployment Tester – Kyle

2. App Introduction

2.1 Aim of the app

The aim of the Blood Pressure (BP) app is to allow users to easily record their blood pressure outside of a hospital appointment or a visit to their Doctor (GP).

The current system for monitoring BP has two disadvantages. Currently blood pressure is initially measured during a GP appointment. A disadvantage of this system is that a number of factors can cause the GP measured BP to differ from the patient's true BP and thus result in an inaccurate measurement.

If clinic BP measurements are not conclusive then further investigation can be provided in a hospital appointment. Here the patient can be issued with a blood pressure monitoring device and given instructions on how to use the device to record their blood pressure. After enough records have been gathered over the necessary time period the patient then returns to the hospital and the records of their BP measurements are then retrieved from the device. This is the second disadvantage of the system. It requires the patient to attend 2 hospital appointments. This is a costly process. It costs the patient the time and expense of traveling to and attending the appointments and costs the hospital the expense of providing staff to issue the device and give instructions for its use.

2.2 Objectives of the app

A principal aim of the BP app is to allow users to take measurements of their own BP. In order to achieve this aim the BP app must allow patients to monitor their BP in two modes:

2.2.1 Automatic Blood Pressure Measurement

This mode will require a separate sensor with a Bluetooth transmitter. BP measurements could then be taken automatically by the sensor. The design of the app will make use of the Android API for Bluetooth communication with health devices. This API requires that the receiving device conforms to the IEEE 11073-xxxxx standard. We have chosen to use this API and IEEE standard as the most likely method to ensure greatest and easiest communication between the BP app and any possible Bluetooth equipped sensor.

2.2.2 Manual Blood Pressure Measurement

This mode will not require a separate sensor with Bluetooth transmitter. Instead the user will manually perform the BP measurement. Any device that measures and displays systolic and diastolic BP will be suitable. The BP app will allow the user to store and view BP measurements.

2.2.3 Remote dispatch of BP record to GP

Another of the aims of the BP app is to minimize the appointments that the user must attend in order to receive measurements of their BP. Consequently an objective of the app is that the user is able to send their BP measurements remotely to their GP. The user requirements for the BP app specify that the method of remote dispatch should be via email to the GP and the format should minimize editability by the patient.

2.2.4 Independent, easy and intuitive use of the BP app

Another aim of the BP app is that the user should be able to take BP measurements independently. As a result another objective is that it should be possible to use the app without needing to contact a GP or hospital. An additional objective is that it should be easy and intuitive to use the app.

3. Project Schedule

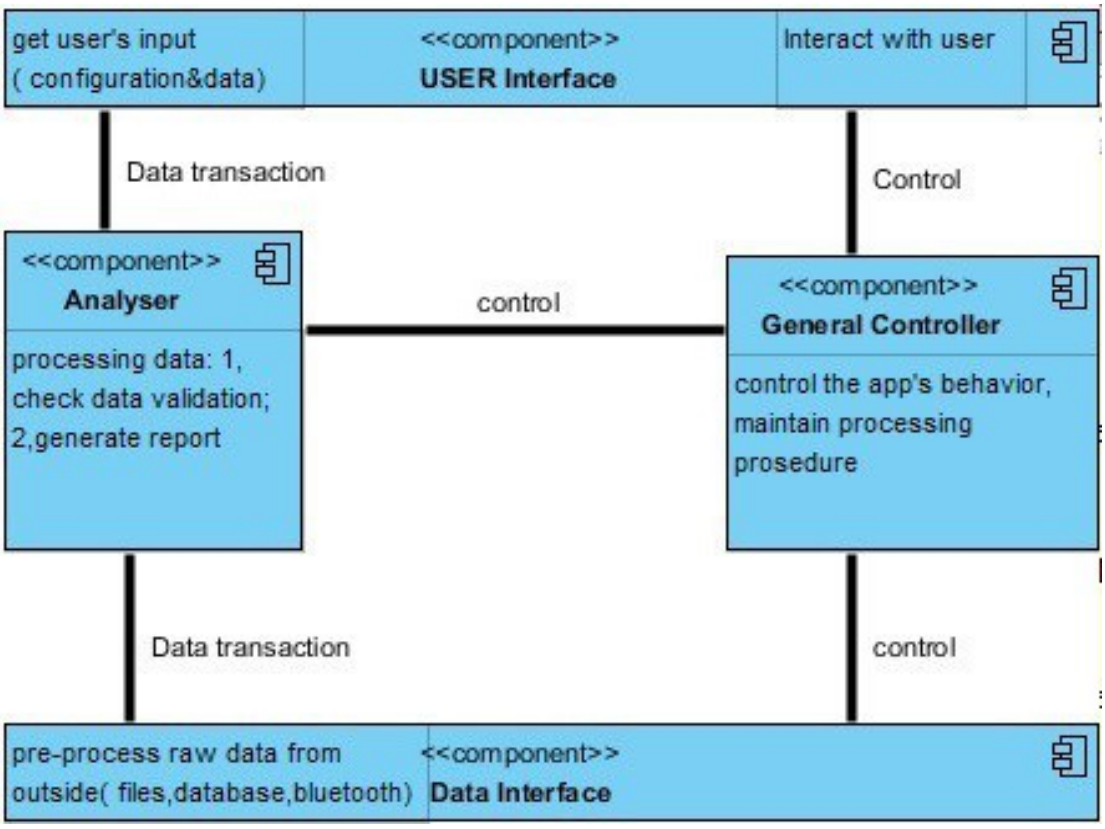
3.1 Work package and Schedule

Please see the appendix for a Gantt Chart of our work packages. There are two charts, one for GC01 and one for GC02.

4. Design Review

4.1 Overall description

4.1.1 Architecture



This app consists of four modules:

1 User Interface: Interact with user, capture user's input information and display processed results to user.
2 General Controller: The core control logic module.
3 Analyzer: The main processing module, dealing with user's input data, data transacted from Bluetooth and stored data.
4 Data Interface: Low-level module. Pre-process raw data from storage, and Bluetooth for upper level modules, such as Analyzer.

4.1.2 Workflow and Use Cases

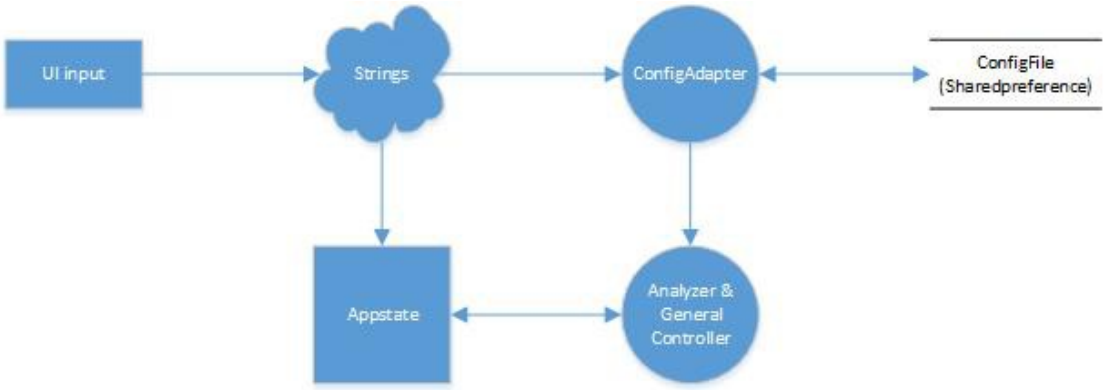
Use Case	Description of Workflow
New User Makes An Account	• User launches the app, Login screen appears. • User goes to Register because they haven't used the app before • User follows prompts, enters basic personal and medical data (Name, Medications) and saves this information. • User exits the app to return later, and app saves their information
User views previous data in a report	• User logs in using their username and password. • They select "Make a Report" and then select the time range of their previous data that they wish to view • Data from within that time range is selected and output in report form • The user views their report and then exits
User makes a report with the cuff and emails it to their doctor	• User logs in, selects "make a new measurement" • Selects "connect to the cuff". • An informational screen tells them how to connect to the cuff-sensor, and how the cuff will take their BP. • The Bluetooth controller assists in the sampling of the user's blood pressure. • When done, the user views their data, and clicks "OK" to make a report • The user views their report and then follows the prompts to email the report to their doctor
User enters data manually	• User logs in, selects "Make a New Measurement" • Selects "Enter Data Manually" and then they read directions. • The user looks at the viewscreen of the separate sensor, and copies those values into the Enter Reading screen of the app. • When they have entered all the readings, they select done and the app shows them a list of all their entries • The user notices that they entered the same thing twice by accident, so they click on that entry to edit it.

	• On the edit screen they delete it, and then approve the updated list • Then their report is shown to them. • Then they email that report to their doctor.

4.1.3 Data dictionary

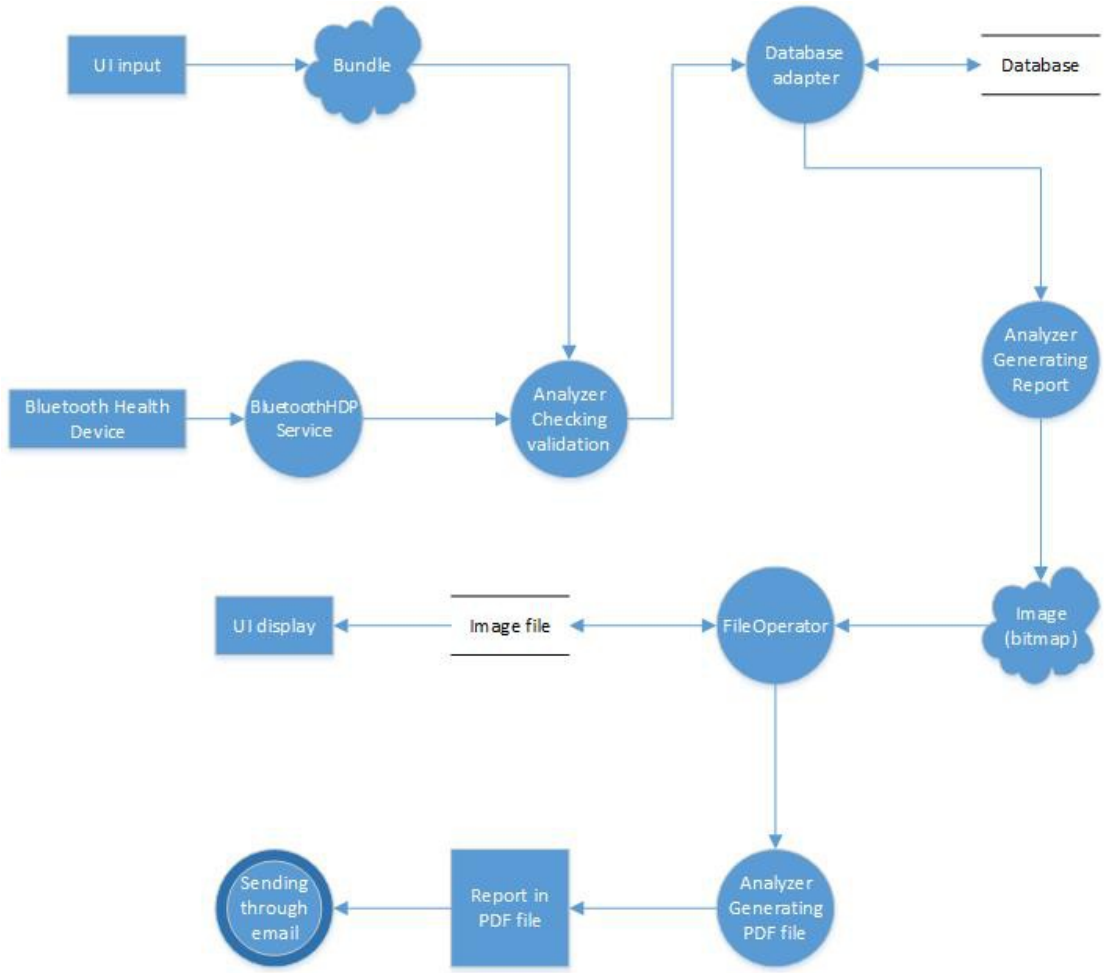
There are three data flows in this app:

- Configurations data (user account & report configuration)



Variable	Data Type	Possible Position	Statement
User configuration	String	1.UI 2.General Controller 3.Input of ConfigAdapter	Captured from UI, then passed to ConfigAdapter through General Controller.
Prefs	SharedPreferences	1. ConfigAdapter	Created by ConfigAdapter
	xml	1. storage	Automatically generated according to SharedPreference
user	userInfo (class)	1. Analyzer 2.General Controller	When Analyzer and GC need to use user Information, it will be loaded by ConfigAdapter from SharedPreference, and ConfigAdapter will translate it into userInfo class.
report_config	String int	1.UI 2.Appstate 3.Analyzer 4.General Controller	Report_config consists of two string values and one integer value. It's captured at UI, and stored in Appstate object which is global to the whole app. When a report is needed, GC will read this variable and pass it to Analyzer.

- Blood pressure data



Variable	Data Type	Possible Position	Statement
user_input	String Bundle	1.UI 2.General Controller 3.Analyzer	Captured in UI as strings. Then it will be packed into a Bundle Object by General Controller, and passed to Analyzer.
bp	numericBP (class)	1.Analyzer 2.Database Adapter 3.BluetoothHDPService	1. For input, Analyzer parses the bundle passed from GC into numericBP class, or gets it directly from BluetoothHDPService. After checking validation, valid data will be passed to Database Adapter. 2. For output, Database Adapter will load it from database, store it into numericBP and pass to Analyzer.
Bluetoothpacket	Byte[]	1. BluetoothHDPService	Bluetooth module will receive raw data from outside Bluetooth device. It's a byte stream.
Report_temp	bitmap	1.Analyzer 2.FileOperater	Analyzer will use bp data to paint a image for report, and pass it to FileOperator to store it
report	.png (file)	1.FileOperator 2.UI	Created by FileOperator, and can be displayed by UI

4.1.4 Paper Prototype

Please see Paper Prototype, and Client Feedback Approving Paper Prototype, in Appendix. This paper prototype has a Key on the third page explaining the data types of components.
Also included in the appendix are screenshots of the finished app, which differed from the original plan in some ways.

4.2 Component descriptions

4.2.1 User Interface

The UI/Controller module covers the logic behind all the screens the user sees. Our app is designed to have a simple workflow, where there are at most 2 branches from each activity. The user can't progress forward in the app, until they have gone through all of the screens that need to be addressed up to that point. Each activity is called by the controller, which in turn receives the message to call the new activity from a previous activity.

The UI/Controller module has two components- The User Interface Activities, and the Controller, which contains the logic behind transitions between activities. The Controller manages Intent and Bundle creating and passing between Activities. An important method of the Controller module (found in the generalCtrl class) is the Buttonhandler method. It accepts button id information, and calls methods according to this information, that control the workflow of the app.

The UI/Controller module communicates with the Analyzer module and the Data Interface module. It sends user-entered data to the Analyzer, and receives back organized, analyzed data.
Its interactions with the Data Interface module consist of sending commands to add or delete databases, all other data interactions occur via the mediating Analyzer module.
The Bluetooth Controller is considered part of the Data Interface module.

4.2.2 Controller

4.2.2 Class Description

- Public abstract class Controller

Class Variables	
Activity	act

Constructor
Controller(Activity act)

Creates a controller object with class variable Activity act Parameters act - Name of the current Activity

Public Method	
void	setCurrentActivity(Activity act) Provides another way to set the class variable Parameter The name of the current Activity
boolean	actOnCreate() Part of the set of activities mirroring the native Activity lifecycle methods.
void	ActOndestroy() Part of the set of activities mirroring the native Activity lifecycle methods.
void	ActOnstart() Part of the set of activities mirroring the native Activity lifecycle methods.
void	ActOnstop() Part of the set of activities mirroring the native Activity lifecycle methods.
void	ActOnResume() Part of the set of activities mirroring the native Activity lifecycle methods.
void	ActOnRestart() Part of the set of activities mirroring the native Activity lifecycle methods.

4.2.2.1 GeneralCtrl Class

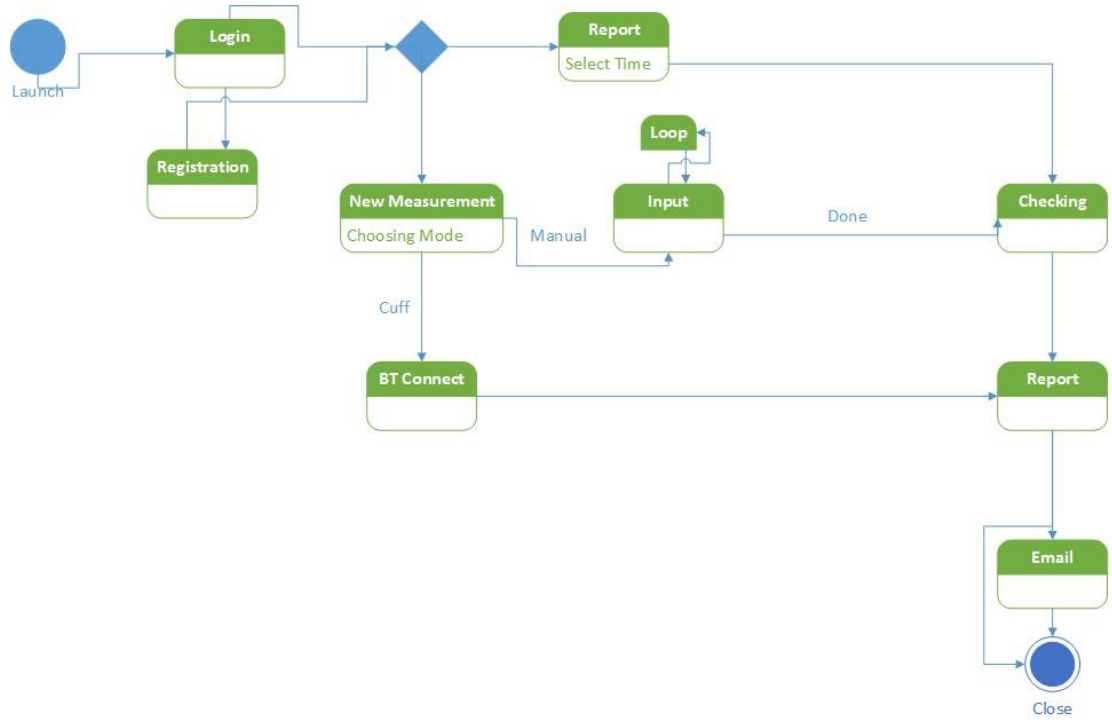
4.2.2.1 Class description

- public class GeneralCtrl extends Controller

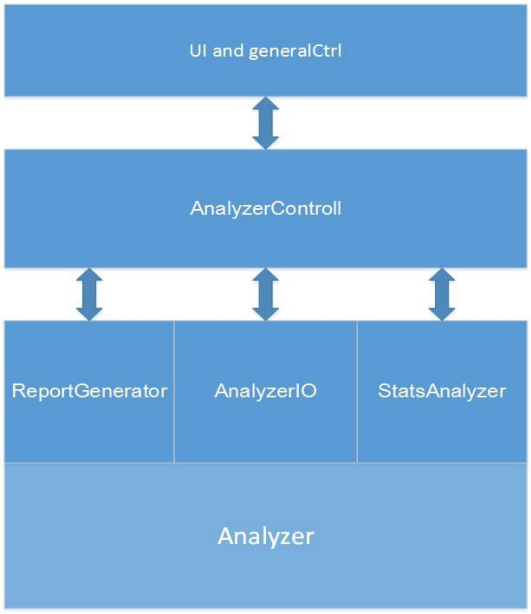
Constructor
GeneralCtrl(Activity act) Creates a controller object with class variable Activity act Parameters act - Name of the current Activity

Public Methods	
void	Buttonhandler(int id) Controls logic of app workflow Parameter id – identity (eg R.id.okbutton) of button that has been clicked in current activity

4.2.2.2 State Chart Diagram for Controller



4.2.3 Analyzer



4.2.3.1 AnalyzerControll Class

This is the interface of Analyzer module provided to upper level. It provides commands to upper level module to use the functionality of Analyzer.

- Class Description
- Public class AnalyzerControll

Constants	
final static int	CMD_REPORT_SIMPLE
final static int	CMD_REPORT_FULL
final static int	CMD_VALIDATION_CHECK_STORED
final static int	CMD_VALIDATION_CHECK_ONLY
final static int	RESULT_OK
final static int	ERROR

Constructor
AnalyzerControll()

Public Method	
int	analyzerCMD(int cmd, Activity act,numericBP bp) Analyzer's command method, get the command from upper level. Parameter cmd : the command for analyzer, only 4 values are acceptable. act: current activity bp: only valid in validation_check command, otherwise should be null. Returns Processing status of the command.

String	getCheckResult() return the result of validation check.

4.2.3.2 Analyzer Modules

4.2.3.2.1 AnalyzerIO

This sub-module of Analyzer is used for storing and loading data with database.

- Class description
- public class AnalyzerIO

Constants	

Constructor
AnalyzerIO(Activity act) Create an AnalyzerIO object, store current activity reference and load the current username from application class. Parameters act: current activity;

Public Methods	
int	storeInDatabase(numericBP bp) Store a BP data to the database Parameter bp: the data need to be store in database Returns result of this operation
numericBP	numericBP loadFromDatabase(String timestamp) load a piece of data specified by time stamp Parameters timestamp: the time stamp of the data need to be load Returns Return the loaded data. If failed, it would be null.
numericBP[]	loadFromDatabase(String timestart, String timestop) overload method of loadFromDatabase for load data in a period Parameters timestart: the start time of the period

	timestop: the end time of the period Returns An array of numericBP, it would be null if failed.

4.2.3.2.1 ReportGenerator

This sub-module is used to generate report. It will load the report configuration from application class, and load the data accordingly. Then it will invoke some methods to analyze data and draw the report. The report is in JPG format.

It introduced Achartengine API to help drawing chart. Also, two help class from the demo Achartengine are introduced and adjusted to fit the needs (AbstractDemoChart.java, SensorValuesChart.java).

- Class Description
- Public class ReportGenerator

Constants	
private final float	A4BmpSizeX, A4BmpSizeY, PARA_GAP, LINE_GAP, COL_GAP, CENTERX, LEFT_EDGE, SUMPARA, Y_1st_LINE

Constructor
ReportGenerator(Activity act) Create ReportGenerator Object Parameters act : current activity.

Publc Method	
int	drawFullReport() Create the full version of the report. The report will be stored in SD card. Returns The status of this operation
int	drawSimpleReport() Create the simple version of the report. The report will be stored in SD card. Returns The status of this operation

4.2.3.2.1 StatsAnalyzer

This is a library class to help analyzing BP data.

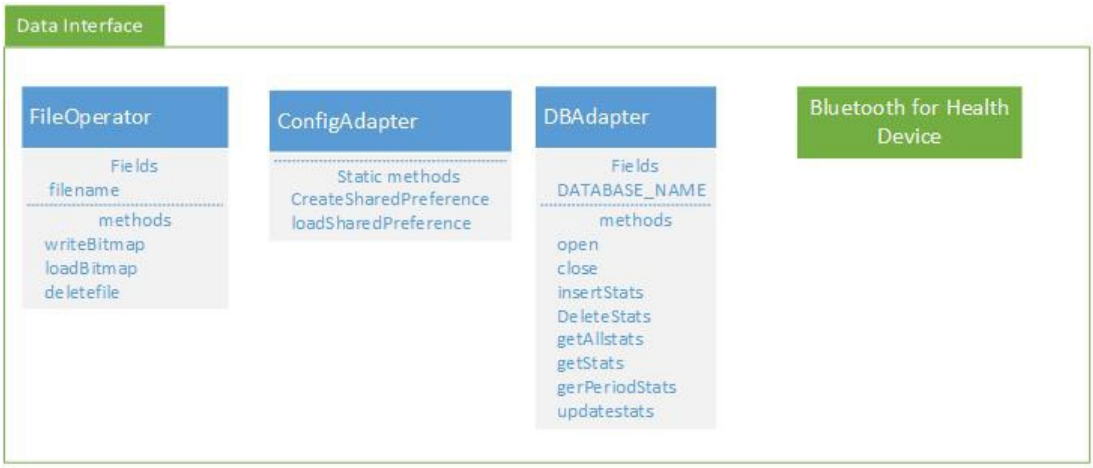
- Class Description
- Public class StatsAnalyzer

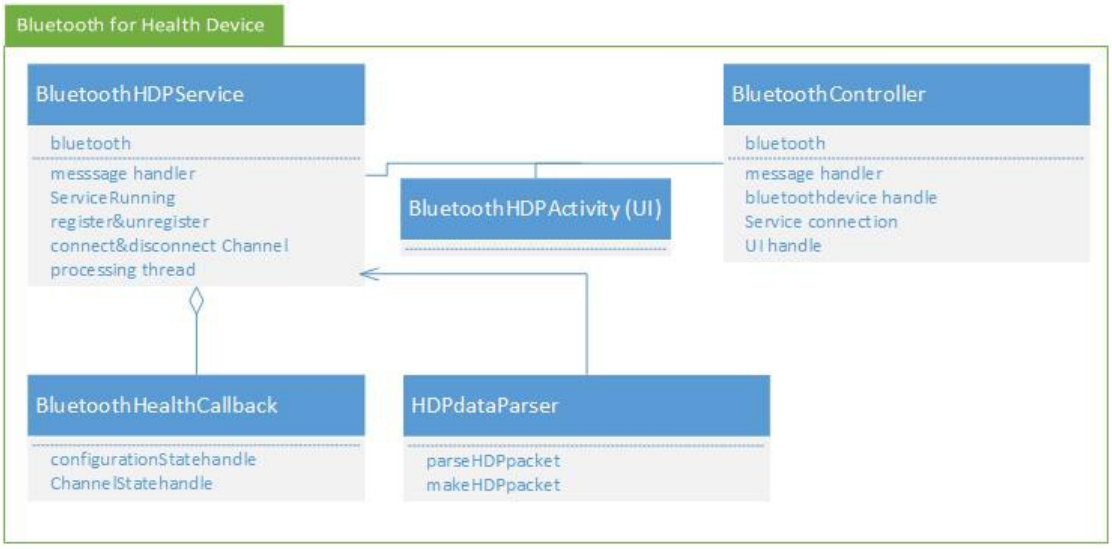
Constants	
final static String	KEY_MAX_SYS
final static String	KEY_MIN_SYS
final static String	KEY_MAX_DIA
final static String	KEY_MIN_DIA
final static String	KEY_MAX_MAP
final static String	KEY_MIN_MAP
final static String	KEY_MAX_PULSE
final static String	KEY_MIN_PULSE
final static String	KEY_AVE
final static String	KEY_SD

Publc Method	
static HashMap<String,numericBP>	mathAnalysisBP(final numericBP[] bp) calculate input array of BP data, find out maximum, minimum, average, and SD values. Parameters: bp: array of BP data Returns A Hashmap stored the result of analysis of the data
static Date	convertTimestamp(String timestamp) convert the timestamp in numericBP to Date object Parameters timestamp: time in string format that need to be transform to Date Returns Date object
static String	calcDuration(final String[] times) calculate duration of a period Parameters times: the sorted timestamps of the data in a period
static String	calcDayDuration(final String[] times) calculate day time duration of a period

static String	calcNightDuration(final String[] times) calculate night time duration of a period
static String	CheckDataValidation(final numericBP bp) Check the validation of the data, summary result will be stored in a string
static double[]	calcBPpercentage(final numericBP[] bp, double[] limit) calculate the percentage of data in the given limit Parameter bp: an array of BP data limit: limit value for systolic and diastolic

4.2.4 Data Interface





Data Interface module provides functions for upper-level modules of the app to transact data with storage or outside sources (Bluetooth).

4.2.4.1 File Operator

File Operator is used for manipulating files. In this case, file operator only handles image files.

- Class description
  - Public class FileOperator

Constants	
int	QUALITY_100

Constructor
FileOperator(String filename) Creat a FileOperator Object operate files Parameters filename of the file to be operated

Public Method	
Synchronized void	writeBitmap(Bitmap image, Bitmap.CompressFormat format) write a bitmap to a file Parameter Imgage the bitmap to be written in a file Format format of the file: JPG or PNG
Synchronized Bitmap	loadBitmap() load a file as a Bitmap
Synchronized boolean	deletefile() delete the file

4.2.4.2 ConfigAdapter

ConfigAdapter is used for storing or loading a user's configurations.

- Class description
  - public class ConfigAdapter

Constants	
String	KEY_USERNAME
String	KEY_PASSWORD
String	KEY_DATABASE

Public Method	
Static void	CreatSharedPref(userInfo user, Activity act) Create a SharedPreference for a certain user Parameter user user information object act use to create SharedPreference
Static userInfo	loadSharedPref(String username, Activity act) Load a SharedPreference for a certain user Parameter user user information object act use to create SharedPreference Returns The SharedPreference stored in userInfo Object

4.2.4.3 Database Adapter

Database adapter provides functions for upper-level modules to access the local database, including creating, updating and querying the database. This module is specialized for the data features of the app.

- Class description
  - Public class DBAdapter

Constants	
String	KEY_TIMESTAMP
String	KEY_SYSTOLIC
String	KEY_DIASTOLIC
String	KEY_MAP
String	TAG
String	DATABASE_TABLE
int	DATABASE_VERSION

Constructor
DBAdapter(Context ctx, String Database) Create a DBAdapter Object to operate database Parameters ctx to use to create or open database database the name of database

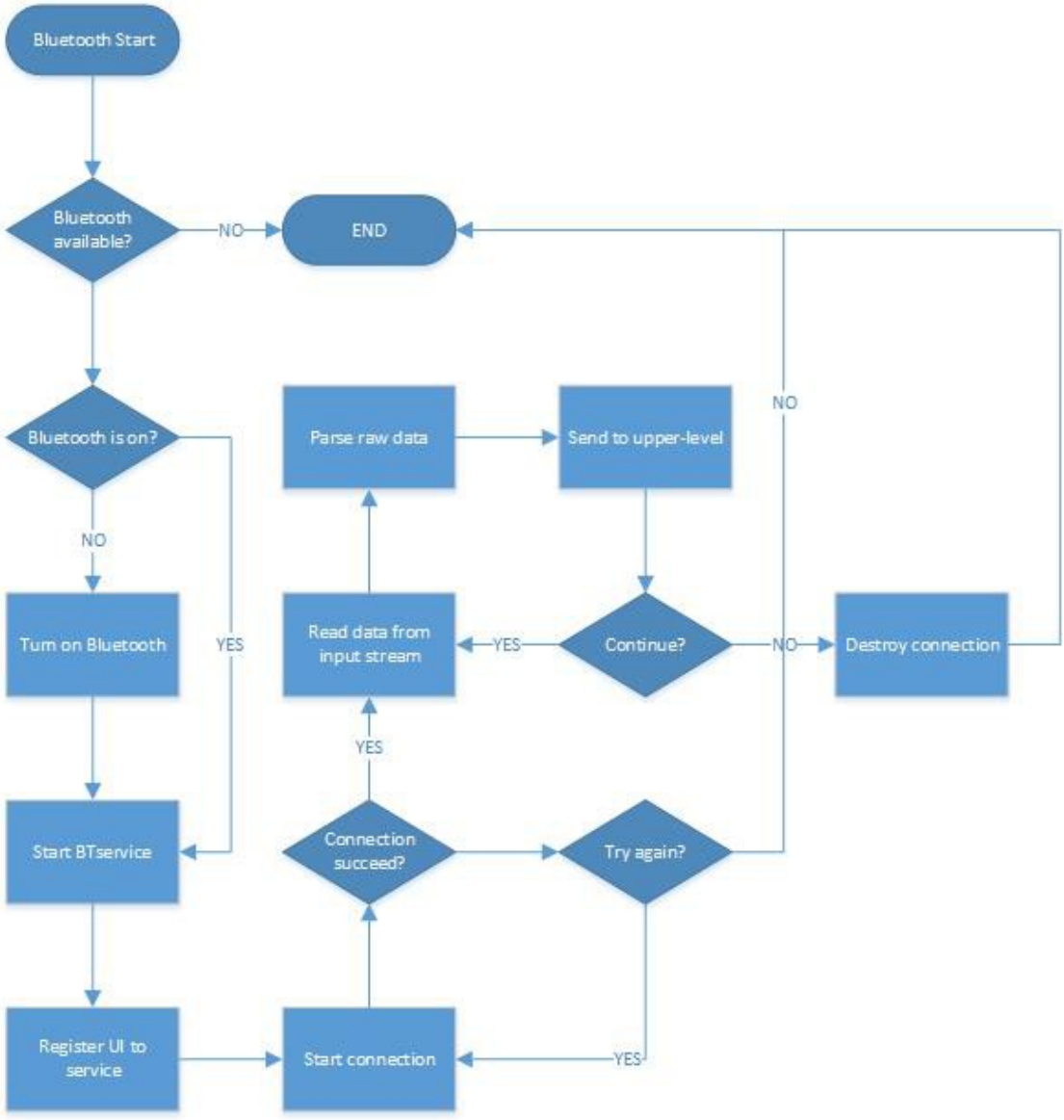
Publc Method	
DBAdapter	open() throw SQLException open a writable database Returns The object of DBAdapter
void	Close() Close the database
Long	insertStats(numericBP bp) insert a row of values in table Parameter bp BP values Returns the id of the row inserted, if failed it would be -1;
Boolean	Deletestats(String timestamp) Delete a record corresponded to certain time

	Parameters Timestamp time of the record Returns Status of the operation
Cursor	getAllstats() get all records stored in the database Returns A Cursor object, which is positioned before the first entry.
Cursor	getStats(String timestamp) get a certain record corresponding to certain time Parameters Timestamp time of the record Returns A Cursor object, which is positioned before the first entry.
Cursor	getPeriodStats(String timestart, String timestop) retrieve a set of records belonging to a given period Parameters timestart start time of the period timestop end time of the period Returns A Cursor object, which is positioned before the first entry.
Boolean	updateStats(numericBP bp) update a certain record Parameters Bp bp values Returns Status of this operation

4.2.4.4 BluetoothHDP module

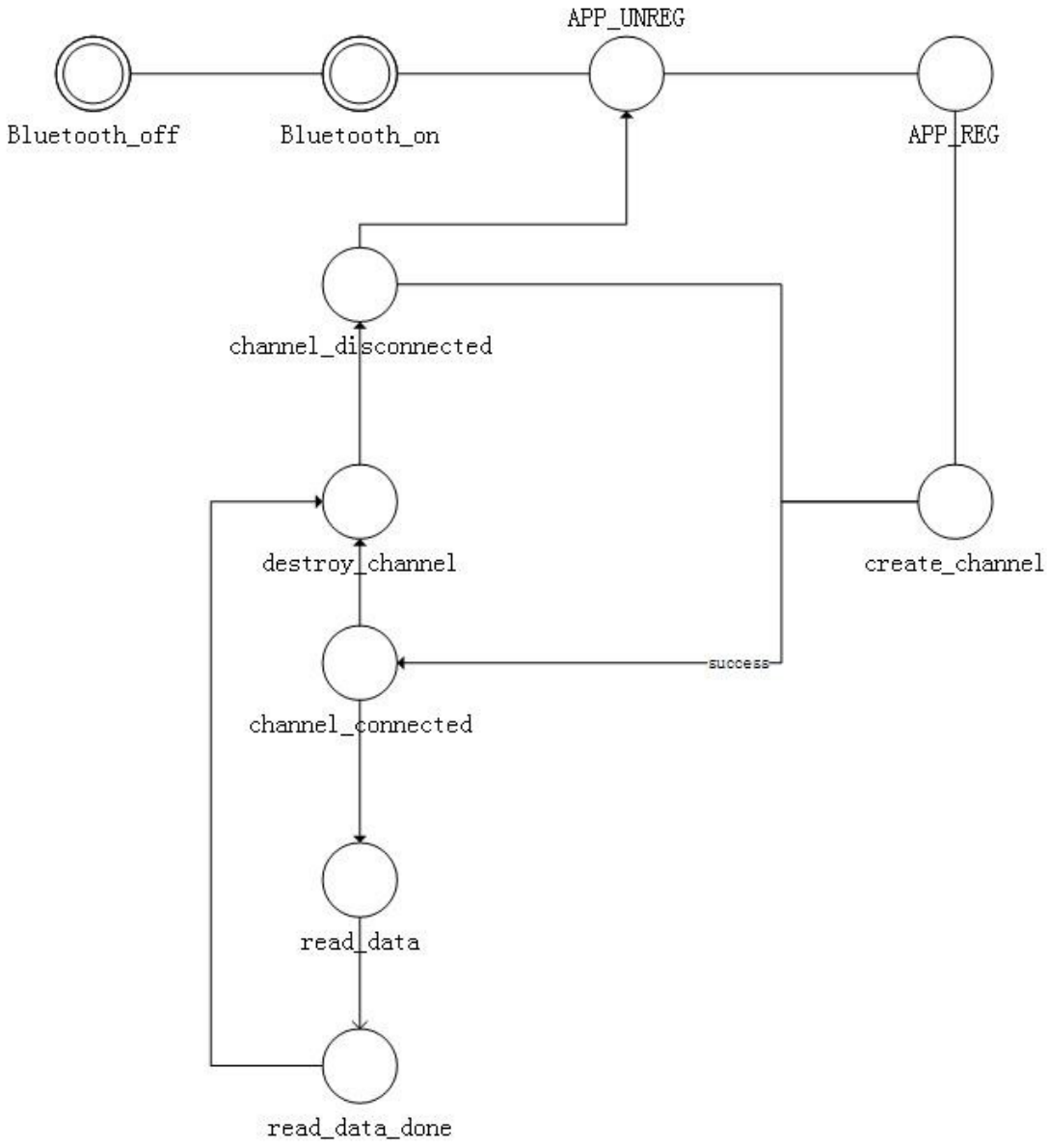
Bluetooth module is for communicating with the Bluetooth health device, in this case, the Bluetooth blood pressure monitor. It's a module independent from the app. This module is created based on the example of BluetoothHDP in the Android SDK.

- Module work flow



- State chart diagram

There are several working states on this module, to handle the events



- Class description
  - Public class HDPdataParser

This class is used only for parsing the Bluetooth packet to get BP data

Publc Method	
Static numericBP	parseBPpacket(byte[] data, int bytecount) parse a packet sent by Bluetooth BPM, according to IEEE11073-10407 Parameter data buffer which store the raw data bytecount valid data number Returns Parsed result store in the data structure numericBP

- public class BluetoothHDPService extends Service

This is the Bluetooth service running in the background to establish, manage and disconnect communication between the android device and a Bluetooth HDP-enabled device. Possible HDP device types include blood pressure monitor, glucose meter, thermometer, etc. Currently, in this BPM app, it supports communication between an android device and a Bluetooth-compatible blood pressure monitor.

Constants	
String	TAG
int	STATUS_HEALTH_APP_REG
int	STATUS_HEALTH_APP_UNREG
int	STATUS_CREATE_CHANNEL
int	STATUS_DESTROY_CHANNEL
int	STATUS_READ_DATA
int	STATUS_READ_DATA_DONE
int	MSG_REG_CLIENT
int	MSG_UNREG_CLIENT
int	MSG_REG_HEALTH_APP
int	MSG_UNREG_HEALTH_APP
int	MSG_CONNECT_CHANNEL
int	MSG_DISCONNECT_CHANNEL

- Public class BluetoothController

This is the Bluetooth controller combined with an activity. It controls the behavior of this Bluetooth module, such as setting up Bluetooth service, informing the user about the status of the connection, managing the procedures of this module.

- Public class BluetoothHDPActivity extends Activity

This is the working thread running on the android system. It creates the user interface for interacting with the user, controlled by BluetoothController.

5. Client Interview & Feedback

5.1 Client interview Q&A

MINUTES CLIENT MEETING Q&A Friday 25th October

Present:

1. Dr. Afsana Bhuiya (**AB**)
2. App team 35 (**t35**)

1. Nick Brookes-Hocking (**NBH**)
2. Kyle Liu (**KL**)
3. Leslie MacMillan (**LM**)

AB and t35 introduce each other. Talk about backgrounds. **NBH and LM** have backgrounds in biology, **KL** has software developer background. **AB** is GP and also does some writing for medical journals and public education.

AB briefs **t35** on prepared powerpoint briefing presentation (BP monitoring app presentation.pptx).
Purpose of the app is to allow patients to take their own BP readings. Currently patients visit GP for initial BP measurement. If further investigation is required then patient must be referred to hospital. Here patient is issued with ambulatory BP measuring device which automatically measures their BP. Patient returns home and for ~24 hours BP is measured every 20 - 30 mins. After recording of measurements is complete patient must then return to hospital to return device and for records to be retrieved. Records are then sent from hospital to GP.
Aim of app is to make this process much simpler. Patient simply would need a sensor (issued by GP) to measure BP and app on own phone to record BP measurements from sensor. Patient could record own BP measurements and take directly to own GP, thereby significantly reducing amount of time and travel currently required.

AB explains the necessary functions of the app, such as options to enter manually, options to connect to a sensor, get measurements and do analysis.

AB: Is it possible to find existing code for the app?
t35: No, any existing code for app will be closed source

t35: What are the requirements for the report, what interval of measurements, statistics, output format etc?
AB gives example of journal article (ABPM-APF-Nov-2011) and sample report (LBekuretsionbp171013.pdf) that together we should consider 'gold standard' with regard to format and content of what app should report.

t35: What should be format of report that app sends to GP? E.g. PDF or excel? Should GP be able to interact with data or read only?
AB: PDF/ read only is preferred. Not currently necessary for report data to be accessible interactively (i.e. read/write).

t35: How tech savvy should we expect users to be? E.g. features like cloud storage and access to data, is that something that could be desirable?
AB: Expect majority of users to not be tech savvy. App should be as user friendly as possible. Features like cloud storage could be nice but will not be priority for most users.

t35: What medical considerations should the app have? E.g. if user enters a very

high BP value what should happen?
AB: App should notify user to contact their GP immediately.

t35: Our project assignment requires us to create an interface for a wireless BP sensor, but we've not been given any further info on the sensor.
AB: Ok, in that case manual input is the priority.

t35: The briefing presentation specifies the app should run on both Android and iOS. We have only recently learnt java for Android, building for iOS also could be too difficult, how much of a priority is an iOS build?
AB: It's extremely important that app runs on both Android and iOS. This is to avoid a situation where GP must recommend different apps to users. This would risk causing confusion and that could outweigh the benefits of the app. Also to avoid a situation where only half the GP's patients can use the device. Better for app to be really simple but work on both platforms.

t35: We have our first lecture next week on gathering requirements, so shall we pencil in a meeting for after that lecture in case we have further requirements to gather?
AB: Yes sure, let's tentatively schedule a week today, and cancel if decide not necessary.

t35: What's the best way to keep in contact?
AB: Any way is fine, obviously email is easy, if skype conference call is necessary then can do that, or if in person is necessary can also be arranged.

5.2 Client feedback

5.2.1 Client feedback regarding user interface paper prototype

Hello Team - no it looks great so far!
If I think of any additional stuff when I take a more detailed look will email you before sunday..
Thanks!

On 15 November 2013 20:41, Macmillan, Leslie <leslie.macmillan.13@ucl.ac.uk> wrote:
By the way, no pressure to reply by this Sunday! We only really need to know if it's approved by next Sunday the 24th, which is our first coursework deadline.

From: Macmillan, Leslie
Sent: Friday, November 15, 2013 5:51 PM
To: Afsana Gmail
Cc: Liu, Kyle; Brookes-Hocking, Nick
Subject: Model of App

Hi Afsana,
In the past few weeks, we have been working on the technical design of the app, planning the user interface, and doing some initial coding. Below is a link to a plan for the user interface screens of the app. Please let us know if you have any suggestions for changes, or if this is acceptable as is. The three of us are having a meeting on Sunday morning, so if you could let us know any changes by then, that would be great.
Thanks,
Leslie

https://drive.google.com/file/d/0B4WyV86fEN5wd1ppN24xempKNVU/edit?usp=sharing

--
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GP

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Twitter: @afibhu

Yesterday I was clever, so I wanted to change the world.

Today I am wise, so I am changing myself.

5.2.2 Client feedback regarding User requirements

From: Afsana Gmail <afsanab2011@gmail.com>
Subject: **Re: App Team 35 - an app for wireless digital sensors in GP clinics**
Date: 5 November 2013 00:42:51 GMT
To: "Brookes-Hocking, Nick" <nick.brookes-hocking.13@ucl.ac.uk>
Cc: "Macmillan, Leslie" <leslie.macmillan.13@ucl.ac.uk>, "Liu, Kyle" <yifei.liu.13@ucl.ac.uk>, "Brookes-Hocking, Nick" <nick.brookes-hocking.13@ucl.ac.uk>

Thank you very much for the email.
Sounds super.
Look forward to see it in progression.

Afsana.

Sent from my iPad

Dr Afsana Bhuiya
GP
Mob: 07877136123

On 4 Nov 2013, at 05:24, "Brookes-Hocking, Nick" <nick.brookes-hocking.13@ucl.ac.uk> wrote:

Hi Afsana,

Thanks a lot for your edits on our user requirements document. It's really helpful to us to have those comments, together with the extra details and references that you've added to the

google drive folder.

Our team is meeting this afternoon to discuss our plans for for the app, which we've been working on in more detail, at the same time we'll also go over your comments on the user requirements and work out if we have any further questions we want to ask you.

To keep you informed of our progress, our next steps are:
to complete our research and planning for the appearance of the app (i.e. look at what the other apps provide and what we think is good and bad about that).
Complete out detailed design for the app (taking your user requirements and detailing exactly how our design will satisfy those, from the level of the user view down to our plan for the actual code).
Create a storyboard walkthrough of the app, detailing every screen that the user would see.

I think it would be a good for all of us to keep you updated with our progress, as that will mean that you are able to see what we're doing with the app and can make any comments you think are necessary and we'll have time to respond to that.
So I suggest we send you copies of our work at each of the above steps (apart from the really technical stuff in step 2 that I think won't mean very much to you). Does that sound ok?

Best,

Nick

On 31 Oct 2013, at 23:55, Afsana Bhuiya <afsanab2011@gmail.com> wrote:
Made a few changes.
To concepts - Ambulatory BP and Home BP - one is for the sensor when it is ready and the second for manual entries.
Additional guidance of hypertension - by NICE - see the PDF in the folder. - page 6 has a good overview of BP and and high BP.
Please let me know if it isn't clear.

Thank guys.

On 31 October 2013 23:07, Afsana Bhuiya <afsanab2011@gmail.com> wrote:
Great ! Looks good.
making some changes right now.....
Moved the file to a folder so the PDFs are together.
Hope thats ok.

On 31 October 2013 16:33, Macmillan, Leslie <leslie.macmillan.13@ucl.ac.uk> wrote:
Hi Afsana,Here is a link to our preliminary requirements document on google docs: https://docs.google.com/spreadsheet/ccc?key=0Aq4CB_K-EX1QdGNlWXJ1d2RfdFBJU2JtRUhFWEFTMVE&usp=sharing. Please let us know if this is acceptable, and feel free to comment or edit. In particular, we have several questions for you in column E.

FYI, we just spoke to Dean Mohamedally, and he clarified that he expects our group to develop a way for the app to communicate with the cuff sensor. So whereas previously we considered manual input to be the minimum requirement, we now consider the input source to include both the manual option and the integrated sensor option.

Best,

Team 35

From: Afsana Gmail <afsanab2011@gmail.com>
Sent: Wednesday, October 30, 2013 4:38 PM
To: Brookes-Hocking, Nick
Cc: Macmillan, Leslie; Brookes-Hocking, Nick; Liu, Kyle

Subject: Re: App Team 35 - an app for wireless digital sensors in GP clinics

Perfect !

Sent from my iPad

Dr Afsana Bhuiya
GP
Mob: 07877136123

On 30 Oct 2013, at 16:19, "Brookes-Hocking, Nick" <nick.brookes-hocking.13@ucl.ac.uk> wrote:

Hi Afsana,

Re. potential meeting for blood pressure app client requirements this Friday 1st November

We'd like to cancel this meeting Friday. We had our lecture this afternoon on gathering client requirements and we think it didn't introduce anything significant that we didn't do in our first meeting with you.

We've now written a list of what we understand to be your client requirements and we'd like to get your confirmation on that. We just need to check the client requirements between ourselves then we'll send it to you by this Friday or before.

Best,

Nick

(More client communication can be found in the appendix.)

6 Demo Video

The demonstration video for this app can be found at http://www.youtube.com/watch?v=jdBKIAz7Zpc

The channel is App Team 35 and the title of the video is “BP-Ease Demo”.

7 Future of the App

This app is meant to be operable from the time of hand-off to the client. It should be able to run with no additional modification. The app does work best with a Bluetooth-enabled Blood Pressure Monitoring device fitting the IEEE standard for Bluetooth-enabled health devices.

In the about page, this app has a warning that it is to be used only in consultation with a medical professional.

We feel that the main achievement of this app is to lay the groundwork for a total health monitoring system. While the current app may have a somewhat lightweight user-interface, the app is backed by extensive, solid, data management.

There are many features that could be added to this app in the future:

- an Alarm function could be added to remind the user when to make a measurement
- app could be translated into other natural languages
- could be made to use haptic feedback and audio to guide people with low vision through blood pressure measurements
- could be ported to Apple iOS
- could connect to a website, which would store user data for access without a mobile device, following the principles of ubiquitous computing
- could be used to monitor pulse, weight and other health metrics.

8 Known Issues, Errors and Conditions

This app works if some conditions are met.

The user's phone first needs to be paired with the Bluetooth device. This depends on the Bluetooth devices capabilities. The user may need to consult the Bluetooth device's user manual to trouble-shoot this operation.

Some phones may be incompatible with the app. For example, in testing, the Alcatel OneTouch has a memory error while attempting to generate the report. This presents as an “mtprof” errror in the LogCat.

In the automatic pathway, the user can only enter one reading at a time. If they want to take more than one measurement using the Bluetooth, they must store these entries to their database by making a report after each entry, and then login again to take the next reading.

We were able to achieve the client's needs of a simple easy-to-use app with manual and automatic entry of blood pressure values, with a report matching the desired format. Though the report is an image file, attaining the goal of data preservation, it is not the desired PDF file format. One area in which the project fell short of the client's wishes is that it does not have the capability to alert the user to take readings on a schedule chosen by the user, or fitting a predefined format. This would be a great area to expand the app in the future.

9 Appendix

Please see the appendix for additional documents and resources, including additional diagrams, meeting notes, and client communication.

10 References

1. Lee, Wei-Meng. *Beginning Android Application Development*. Indianapolis: Wiley Publishing Inc., 2011. PDF e-book.
2. "Android Developers," *developer.android.com*. Accessed October 1 2013-January 25, 2014, http://developer.android.com/index.html.

Libraries used:

1. "Apache Commons Lang 3.2.1". Accessed January 3, 2014, http://commons.apache.org/proper/commons-lang/
2. "Apache Commons Math 3.2" Accessed January 5, 2014, http://commons.apache.org/proper/commons-math/
3. "AChartEngine" Accessed January 7, 2014, http://www.achartengine.org/content/download.html

Appendix

Table of Contents

Team 35 Documentation
Repository Locations....2
Meeting Minutes....3
Descriptive Poster....13
Gantt Chart of Work Packages GC01....14
Gantt Chart of Work Packages GC02....16
Paper Prototype....17
Screenshots of Workflow of Final App....20
Software Requirements Doc ….....22
Excel for App requirements with Client Comments....28
Client Communication....30

Reference Materials
Client Doc for App Requirements (provided by client, Dr. Afsana Bhuiya)....47

Repository Locations

Google Drive:
https://drive.google.com/folderview?id=0B64CB_K-EX1QMVZLTmxJXzMtVGM&usp=sharing

GitHub:
https://.com/nick-b-h/team35app/tree/development

Blog:
http://appteam35.wordpress.com/

All of these are viewable with the links, you are welcome to take a look.

November 4th:

Meeting notes

1. Need to expand basic MVC diagram to include smaller more detailed blocks. Expand basic MVC model into detailed block/ state diagram. E.g. UI block expanded to include storyboard of UI views. Includes work flow relationships, relationship between activities such as condition
2. Workflow for interaction between blocks with all input states
3. Description of MVC and storyboard. How inputs change the state of the program. Limited to our individual assignments within the team.
4. (Eclipse ADT bundle)
5. Analysis part of MVC must also include database manager

November 10th:

November 10 Group Meeting - Minutes recorded by Leslie
10 am-meeting started.
Nick talks about what he has been researching- we are reading an intro to Android book.
Kyle mentions Nick should look at the Java angle because he's working on the database.
We decide that Nick can start writing the classes with methods - to be discussed Monday or Tuesday
We review the UI activities list written by Leslie.
We decide to add notification system for alerts. Need a service that monitors system time and provides notifications ie
toasts
Kyle says Leslie should draw state diagram for controller
Controller has a lot of if logic to control the states
What are the states? What are the relationships between states?
Keep the logic in the controller, activity is just the display.
10:20 we start to discuss the message concept
It's the communication between service and activities
Kyle mentions we need to research message concept, just be aware of it for future design.
Leslie can start writing full classes, draw controller state diagram.
Meeting 2pm Tuesday - engineering cafe.
Start thinking about how to manage threads.
Be aware of memory issues- how sometimes two activities try to access the same data. Eg generate graphics and
draw report at same time. Nick should look into this. Synchronization is one way of controlling this, according to Kyle.
1035
Question time. Leslie brings up the issue of the email doctor method.
Call building application using intent. Kyle says we should call the system method for email.
We'll start designing classes and data structure, input and output of methods, the architecture of the app.
Finalize input and output flow on Tuesday, so we can all discuss what each block needs from each other, with the specific
methods and what they each need.
Nick mentions numeric data - set up a class to store the BP. Might need to check with Afsana about what is needed.
Kyle will look into packet information, and then we can decide how to handle this data.
By Tuesday:
Kyle will write classes for data interface. Maybe state diagram for data interface or workflow.
Nick will write classes for analyser block. And state diagram for analyser, and research synchronization.

Leslie will refine classes for controller and UI, write a sample activity with corresponding controller code, and make
a state diagram for controller.

November 7th:

MINUTES Team 35 meeting Thursday 7th November

1. MVC workflow. Kyle corrected workflow between UI and Analyser blocks. Workflow relationship between UI and analyser is 1 way only. No data from UI to analyser. Instead UI sends data to controller. Controller sends to data controller. Data controller calls analyser to check data. Analyser only sends data to UI for graph and list views of data and summary report of data.
2. UI activities and classes. Kyle explained metaphor of java activities for UI views. And also how each activity is a class.
3. Kyle proposed another meeting Saturday 9th to discuss android classes. The meeting time is 3pm. Before meeting Nick and Leslie need to
    1. explore Android SDK and ADT bundle.
    2. Read up java book that Kyle already sent us.
    3. If can also produce basic classes for Saturday that's a benefit
4. Java messages. Kyle explained how these work to send messages between classes.
5. Role of controller. Controller includes button listener. This is instead of each button in UI having its own listener. So each button listens for its input but the code for listening is in the controller.
6. Template for a button listener is a switch statement where each case is a button ID and matching the case calls the activity for that button ID.
7. Discussed Nick analyser block diagram. Kyle gave example of work flow for analyser. Analyser has a state machine. State machine controls and records state of the analyser. Records command from controller. Work flow for analyser needs to consider classes for creating graphics and data values and types. Also need to figure out how to create .pdf. Picture will be bitmap painted by Android canvas in .png file. Need to find out how to add that to .pdf. Analyser must be all one big object. Contains smaller classes.
8. Discussed Kyle's work package of data interface. Kyle explained how data controller will receive data from bluetooth receiver as an array of classes where each class is one set of records for a BP measurement (i.e. systolic BP/ diastolic BP/ time). When a database is needed controller will instruct database controller to create a new database.
9. Kyle discussed data types in app.
    1. User account stored in config file. Associates user account with user database. Configs are be stored in 2 ways: 1 shared preference (secure). Shared preference can only be accessed from its own app (access is shared between all activities within app but no activities outside app). 2. BP data (systolic, diastolic, mean BP, time recorded)
    2. Database. The actual storage of the user records (personal information and BP measurements)
    3. Graphics. The graphical representation of the data that is output to the user and to the summary report.

November 12th:

Kyle has written initial classes for data interface block. Kyle explained classes and their package

structures. For example class to retrieve a measurement time from the database.

1. Kyle has written code for bluetooth receiver code. Bluetooth protocol is roughly:
    1. Start
    2. Configure
    3. Connect to device
    4. Transmit data
    5. Disconnect
2. Kyle discussed possible primary keys for database entry
    1. time
    2. systolic
    3. diastolic
    4. mn BP
3. Leslie explained her research into creating a state diagram for the controller. Leslie was unsure about the components for the controller. Kyle explained that an example of a component would be a controller for all the buttons. Kyle explained that controllers use handler classes.
4. Kyle explained services that BP app will need.
    1. Will need a bluetooth service to receive bluetooth data.
    2. A time and date service to give time stamps to BP measurements.
    3. (Receiving data from UI does not need to be a service)
5. Nick explained his diagrams for analyser block. Kyle advised that can use each state in analyser can be represented as a public method. (All sub methods can be private).
6. Kyle suggested we should think about data flow within the app.
    1. bitmap. Bitmap is handled by
        1. analyser (draws on bitmap) and
        2. data interface (stored).
        3. API handles translation between graphical representation and memory storage format (hexadecimal).
        4. Kyle will create a file operator object with two methods. Load bitmap() and write bitmap(write data).
    2. Database. Kyle has created a structure class (for passing around our BP data).
        1. Kyle provides a database adapter class with methods we can use to write to the database
            1. Give database a name (on initialisation)
            2. Delete entry (e.g. is user wants to delete an incorrect record).
    3. Input data
        1. From UI (HBPM)
        2. From sensor (ABPM)
7. Kyle explained how we should use a thread for tasks that are demanding on CPU. Kyle has created a thread for read file. Using threads prevent undesirable interrupts to whatever task you are doing and so protect the integrity of your task.
8. Looked at using version control. Will begin to get out code on github
9. Next meeting this Thursday 14th in GC02 lab time
10. Reviewed minutes from last meeting
    1. Nick still needs to look at threading and synchronisation and also finish analyser workflow and inital class design for analyser.
    2. Leslie has done initial state diagram for controller
    3. (Kyle has written a lot of code for data interface so that’s under control)

November 17th:

MINUTES Team 35 meeting Thursday 17th November

1. Kyle showed his work on bluetooth activity.
2. Leslie explained that she has created her first button. Woo! Leslie was not sure about how and where the signal of the button onClick is passed. Kyle explained the idea of how a controller can receive a signal from a button. Kyle also suggested that it might be more effective for us to have a base abstract controller class that our actual controllers are extended from.
3. Nick showed his work on the analyser. Working on analyser validateBPvalue method. Kyle explained instead of returning error message to controller instead analyser can just use Android TextView class to display error directly to screen.
4. Leslie asked Kyle about location in code of things that display notifications to user. Kyle showed location of these in his own code.
5. Leslie asked about location of database - should it go in assets folder? Kyle said that can look at in future, not currently priority.
6. Nick suggested we should send basic workflow for the UI to Afsana. Leslie volunteered to do this, as she created those files in the first place. Leslie also suggested we should ensure our interview Q and A with Afsana is written up into a proper document.
7. Next meeting Sunday 17th November 10.30. In meantime we all have coding to do

Minutes from last meeting:

8. Checked minutes of last meeting Tuesday 12th November. Only point of action from then not done is a github account. Nick will do that today.

November 19th:

Meeting time: 2pm
Minutes taken by Nick

1. Discussed progress on Leslie's code which she emailed us. Kyle has looked at Leslie's code. Kyle explained the benefits of Android fragment. Benefits of fragment are that it
    1. reduces memory usage
    2. reduces code
    3. can easily be dynamic

   Kyle feels is probably too late to now rewrite her code to include fragment, but can do for milestone 1.
2. Leslie explained her code.
    1. Code doesn't currently have a controller, at the moment all button calls are within their own activity. But we should redesign so that each activity calls controller button handler on click.
    2. Leslie is also working on an activity which will display to user a list of all measurements. When they click on any individual measurement in the list it will take them to a new activity with the full details of that measurement. Leslie is

finding this activity to be a bit tricky. She thinks Android requires an array list of buttons to give this functionality. She is investigating further.

3. Kyle is giving feedback on the code.
    1. Activity (from ‘do you have a heart arythmia?’) ‘this app may not be suitable for you, consult your doctor’, Kyle advises that instead be a dialog as this will reduce memory use.
    2. Kyle explains how can reduce number of activities. Can create 1 activity for multiple screens. Activity can be designed as a fragment by overriding .onPause and .recycle methods. This means only one activity is created in memory but it is reused for multiple purposes by simply resetting the activity.
4. To do:
    1. create controller that holds onClick() method that activities can call, rather than each having their own onClick() methods.
    2. Identify which activities can be reduced to one activity and reused as fragments
    3. Add state machine to controller to facilitate state dependence of fragments.
    4. We need to add to paper prototype for UI to include:
        1. bluetooth pairing and
        2. activity for user to tell app duration of recording
        3. activity to alert user when recording duration finished

Talked about these things UI could have and decided that since not must haves from client requirements should instead add to list of future features

        4. whether user should be able to generate report as they go (currently report is only at end)
        5. whether user should be able to generate only a single measurement (i.e. ‘what’s my blood pressure right now?’)
    5. Kyle designed rough sketch for controller state machine
3. Nick explained his work on analyser module:
    1. Graphics class takes height and width for bitmap, creates a bitmap, gets data from database, draws graph on the bitmap and returns it.
        1. Kyle explained data controller methods just return address of data. So analyser needs its own method to then go get the data. Kyle explained can do this using the cursor..moveToNext() method, when it returns 0 then end of database records.

November 22nd:

Group 35 Meeting Minutes 22/11/2013 - recorded by Leslie MacMillan
4:30pm
The plan for today's meeting is to merge our code (which has been split into 3 blocks) and also to go over documentation
requirements, and divide the work for those. Then on Sunday we will merge the documentation.
First, we are looking at Milestone 1 documentation requirement list pdf, going through the requirements point by point:
1. Table role assignment to Sunday
2-3. Copy/paste from requirements documentation

**How to put documents together? Make a word/open office file with an Index.
4. Nick will do. Kyle and Leslie will let him know if they find any notes regarding it.
5. Each person draft their own list of their work packages.
6. Merged list of 5, (adding time frame). Which we will compile on Sunday. NIck will do template for documents.
7. Data Dictionary- Kyle will do. Leslie and Kyle finalize controller-activity block and then we will send to Nick tonight.
who will put it on github, will merge it. Kyle will use this recent version to write data dictionary.
Contains two parts-a. data flow and b. public variable documentation. Kyle will draw data flow diagrams.
** Unrelated:
Modules and class definitions also go in documentation. Each person shall write general description of our own module
and basic class descriptions. (i.e. Leslie would write a class description for controller)
8. Done
9. Use cases- Leslie will do
10. We have and will polish that on Sunday
11. Come up with individual comments, merge on Sunday
12. a. UML how do objects interact diagrammatically
  b. state chart diagrams
  c. inheritance
  d. conditions
we discuss this for a while. Kyle and Nick go over how the analyser and controller communicate.
  how to split up?
each do a-d. and then we merge. Use Visio (via Dreamspark) and/or Agilian (free version) to illustrate.

Where to put block diagram? We have additional documentation, which is good. Will add to the file, and list it in the index item by item.
Structure of module- goes to extra investigation stuff. Kyle will send example.
Sat evening status report by email- set time for Sunday meeting.
Leslie reads a summary of minutes to make sure everyone knows their tasks.
Nick's part is done so he leaves, then Kyle and Leslie discuss controller-activity interaction in detail.

December 2nd:

Talked about poster that Leslie has worked on

1. Poster displayed for dept open day on Monday 9th December needs to satisfy all requirements for HCI component of GC02
2. Nick to reformat paragraphs to bullet points
3. Kyle felt should make medical terms less specific so Nick will do that also

2. Talked about testing of app.
    1. Kyle talked through the tests that he has done on the code so far.
        1. Gave examples of the type of input using to test (code generated by for loops)
        2. Showed how using basic activity screen to generate input to the code.

2. Discussed when to next meet. Decided Friday 6th December, 2pm, Engineering Cafe

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December 6th:

MINUTES Team 35 meeting Milestone 2 Friday 6th December

Minutes taken by Nick

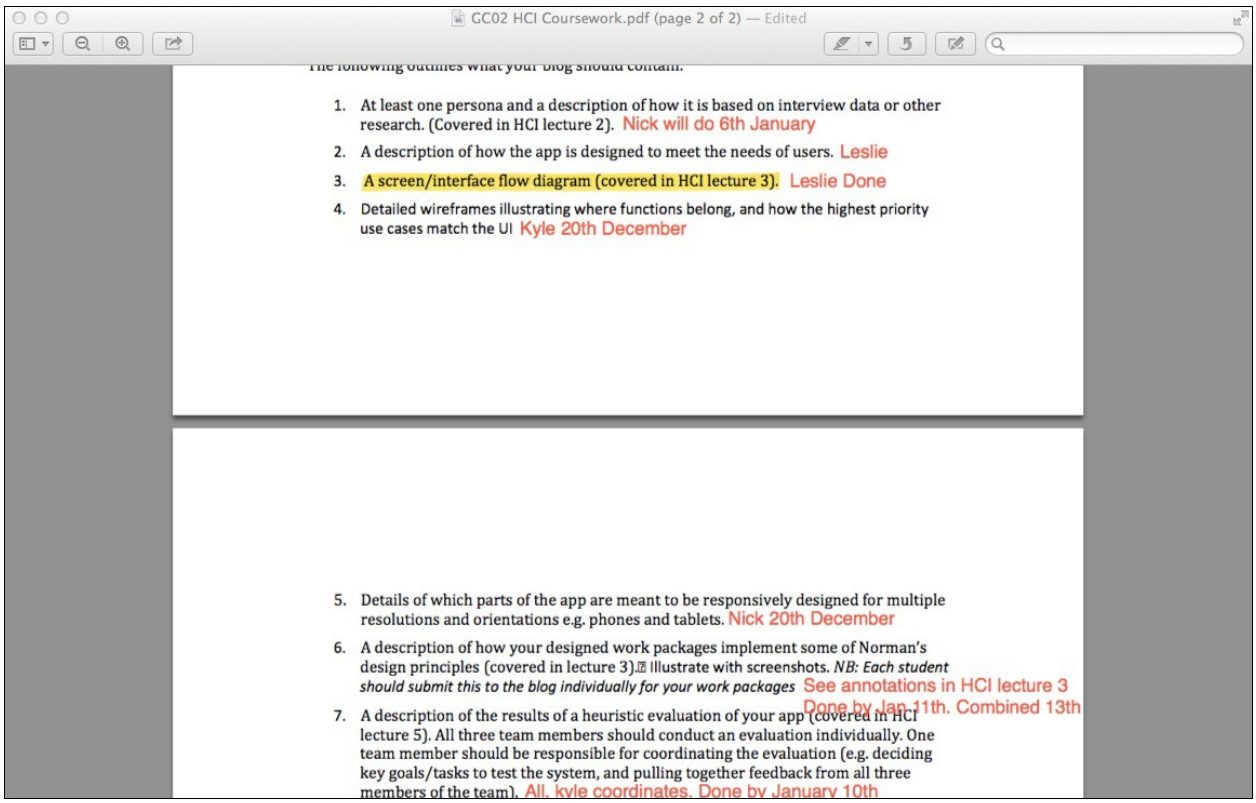
Items to discuss

1. Kyle will show how to test apps on physical android device
2. Nick wants to discuss what to do about user requirement that app differentiate recordings in day vs night

(Leslie asks that:)

3. we divide blog tasks
4. decide what dates to meet afsana to test app

1. Kyle has written a simple activity. It has buttons to call his database classes. He attaches the android nexus 5 that we have on loan from CS dept.
    1. Kyle explains his use of Android.util.Log class. He explains the different Log objects and why he has used different ones at different positions in the code.
2. Talk about how would possibly differentiate recordings day vs recordings night
    1. No way to automatically detect when user asleep. Would need user to tell us.
    2. Could ask user after recording when they were asleep
    3. Could have default values for asleep (e.g. 11pm - 7am).
    4. Either way would need extra activities and code to handle this. We should contact Afsana and ask.
3. Divide blog tasks as per image below:



4. We reckon that we will not have a working app before Christmas. Leslie is keen to meet with the client before then. Nick thinks the most important thing to discuss with client in person will be a working copy of the app. Nick thinks that before then will not be good use of time. Decide as compromise to explain to Afsana and ask what her preference is. We decide that we will need 2 meetings in person to show client working app. 1. to show client first draft of working app. We expect that there will be a lot of feedback from that 1st meeting and that after that it will be a good idea to have meeting number 2. scheduled.

Additional items discussed:

1. Leslie asks about how UI should display list of users measurements.
    1. Discuss Cursor object in com.BPM.databaseAdapter where Kyle has written class that can return Cursor. Kyle and Nick explain Cursor object to Leslie. Kyle also explains that Cursor is part of Android API.
2. Leslie queries how UI behaves with input of data: validation and storing of database:
    1. Should UI colour code values as to healthy v unhealthy?
        1. We discuss and decide that it's not in the original user requirements. If we want to pursue further we should check with Afsana to see she wants it done.
    2. We discuss how analyser methods work and how UI will call them
    3. How does UI store BP values
        1. An insance of numericBP object
    4. How does data get from that instance of numericBP to database?
        1. Kyle explain methods in the database adapter that UI can call to store the numericBP in the database.
    5. How should app display a counter for manual input number?
        1. We'll try putting a counter in the UI controller and see how that works.

December 10th:

MINUTES Team 35 meeting Milestone2 Tuesday 10th December

Minutes by Nick

Items to discuss:

1. Progress since last meeting for each of us

Items discussed

1. Progress since last meeting
    1. Kyle explained the progress he's made on writing his bluetooth communication class (400 lines!), and also the progress he's made on testing it.
    2. Leslie showed off the progress she's made with the user interface. She has it installed on her own Android phone, and it works!
    3. Nick explains the progress he's made on installing robolectric to bypass the Android emulator and to use for running JUnit tests

Additional items discussed

1. Kye explained to Leslie the new public method he's added to the DBadapter class that returns numericBP objects rather than a Cursor object.

Items from last meeting Friday 6th December:

1. Leslie contacted Afsana re. dates for testing. Afsana's times are good for us so we'll reply and confirm those times.

Winter Break: Communication occured over email. Available upon request.

January 9th:

Minutes for meeting, January 9th, 2014
10:30am
Discussed how to finish analyzer and integrate it.
Step one: make sure can communicate with other modules using information request method.
Step two: test input/output to other modules
Step three: make report: Part A: make sure can display a dummy image. Part B: make sure can display correct image
Kyle will test input/output of analyser.
Leslie will make sure UI can access a dummy image and display it. Can reference similar method in Test1.java. May need to scroll for final formal report, which will be A4 sized.
Report: Kyle will do basic framework. Leslie will help with content.
Kyle will work on bluetooth workflow with analyzer.
Other work to do:
Leslie will connect UI to shared preferences using configAdaptor class. It has static methods that write to shared pref.
Leslie will test that new user makes a userinfo class instantiation which stores info correctly.
Kyle will investigate the report configs for bluetooth.
Leslie will optimize and validate time input so that it is useful for the report, and store timestamps in the

AppState class instance.
Finish HCI blog and update documentation: hopefully Nick can do.
From now on, all should send daily, short update.
Kyle helps Leslie with an error (array couldn't be initialized until class was instantiated).
11:45 meeting adjourned.
-LM

Blood Pressure Monitoring App

Client: A. Bhuiya, MBBS BSc DRCOG MRCP MRCGP DFSRH

Nick Brookes-Hocking, Kyle (Yifei) Liu, Leslie MacMillan
nick.b.h@mac.com, liu_yifei701@163.com, lesliemacmillan@gmail.com

Problem:

Blood pressure (BP) is often first determined in a single, in-office measurement

- This is not always accurate (white-coat syndrome)
- If at home, patients may take inaccurate records
- Further studies can be time consuming

Figure 1. An example of a device currently used to measure blood pressure

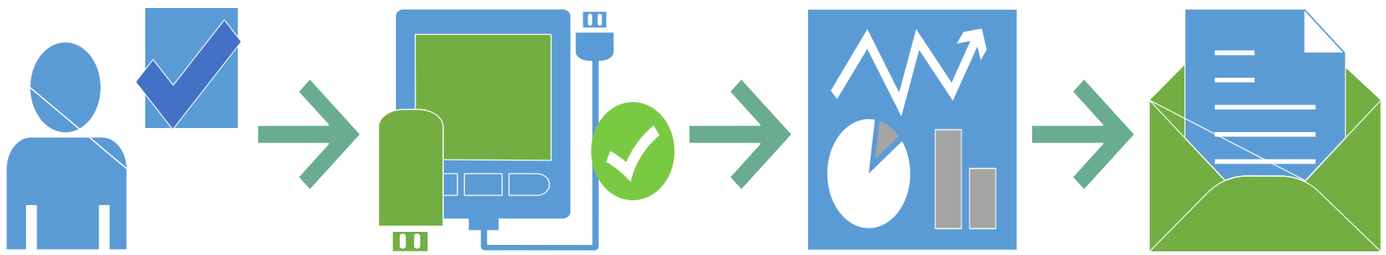


Figure 2. Simplified diagram of app workflow

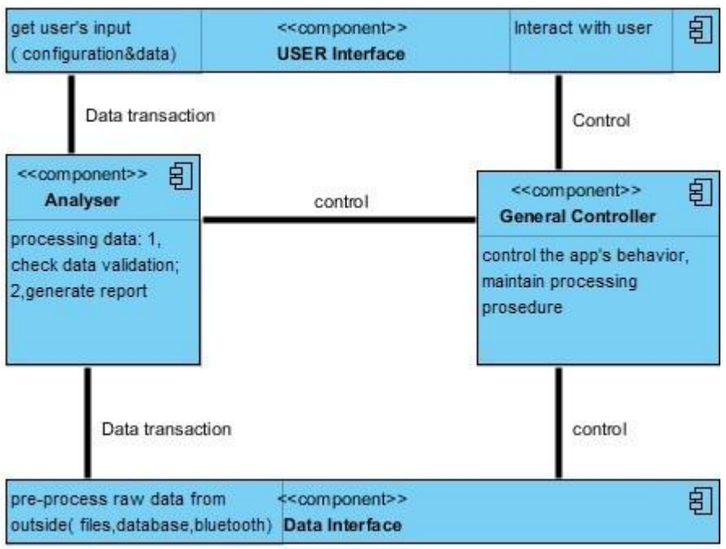


Figure 3. System block diagram (software design component)

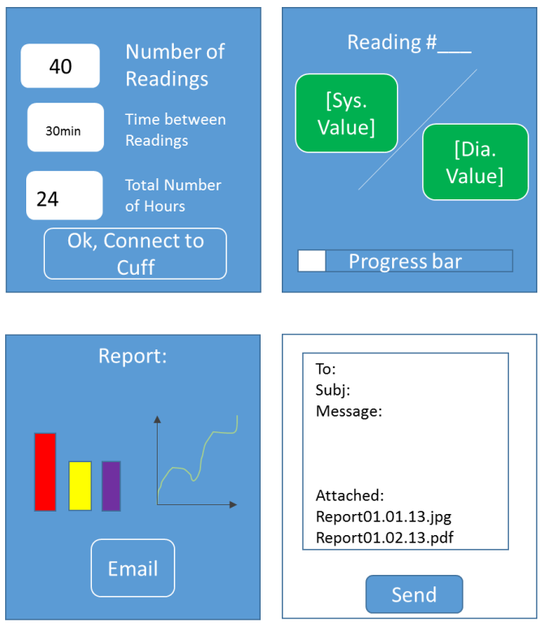


Figure 4. Examples of key user interface screen mock-ups

Highlights:

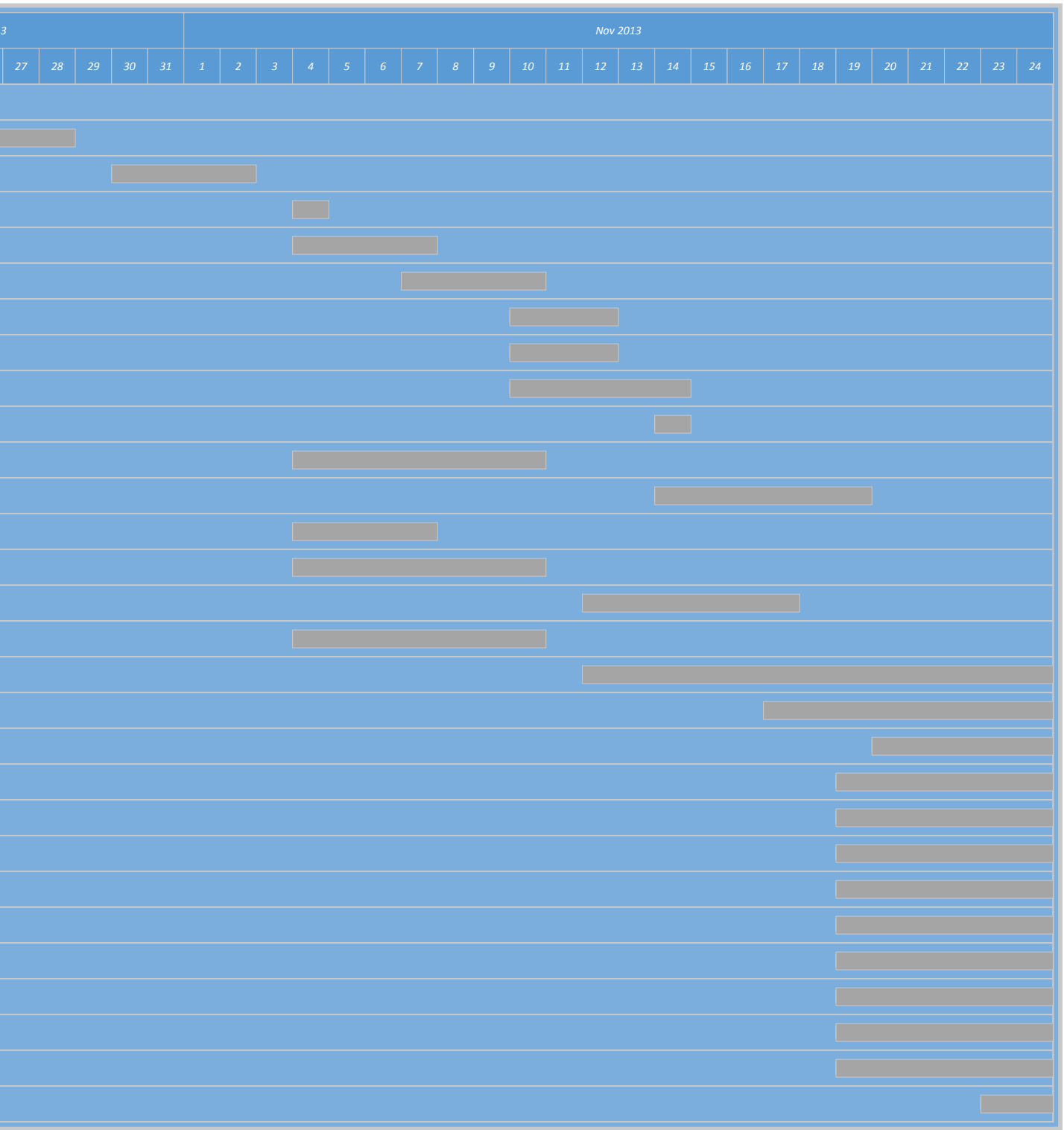
- A powerful tool for doctors to connect directly to their patients
- Report conforms to medical gold standard of BP analysis
- Large, simplified screens for patients with limited sight and dexterity
- Reusable connectivity framework to Bluetooth-compatible health devices
- Potential for future expansion to a total health monitoring app

Solution:

This app is designed to make at-home BP measurement easy, organized and accurate:

- Prompts the patient
- Wirelessly communicates with any Bluetooth-compatible blood pressure sensor (IEEE 11073)
- Provides informative charts and statistics
- Allows remote dispatch of data to Doctor via email

ID	Task Name	Person Responsible	Type	Start	Finish	Oct 2013
						21 22 23 24 25 26 27 28
1	Plan for client interview	All	Admin/ Communications	10/21/2013	10/25/2013	
2	Research competitors	Nick	Research	10/25/2013	10/28/2013	
3	Software Requirements Document	Nick and Leslie	Documentation	10/30/2013	11/2/2013	
4	Design System Architecture	Kyle	Design	11/4/2013	11/4/2013	
5	Make a Google Drive Folder	Nick	Documentation	11/4/2013	11/7/2013	
6	Design MVC Block Diagram- System and Data Interface	Kyle	Documentation/ Design	11/7/2013	11/10/2013	
7	MVC for UI/Controller	Leslie	Documentation/ Design	11/10/2013	11/12/2013	
8	MVC for Analyser	Nick	Documentation/ Design	11/10/2013	11/12/2013	
9	Design Data Interface Module	Kyle	Design	11/10/2013	11/14/2013	
10	Make a GitHub account	Nick	Documentation	11/14/2013	11/14/2013	
11	Research Bluetooth Health Device and Sensor-Bluetooth-Device Communication	Kyle	Research	11/4/2013	11/10/2013	
12	Make packages and write code for Data Interface Module	Kyle	Development	11/14/2013	11/19/2013	
13	Design and Wireframe UI	Leslie	Design/ Documentation	11/4/2013	11/7/2013	
14	Design UI Activities List with Methods	Leslie	Design/ Development	11/4/2013	11/10/2013	
15	Make packages and write code/ pseudocode for UI	Leslie	Development	11/12/2013	11/17/2013	
16	Design analyser	Nick	Design	11/4/2013	11/10/2013	
17	Make packages and write code/ pseudocode for analyser	Nick	Development	11/12/2013	11/24/2013	
18	Rewrite UI to accommodate inheritance and external controller	Leslie	Development	11/17/2013	11/24/2013	
19	Draft client interview write-up	Leslie	Documentation	11/20/2013	11/24/2013	
20	Controller state diagram	Leslie	Documentation	11/19/2013	11/24/2013	
21	Use Cases	Leslie	Documentation	11/19/2013	11/24/2013	
22	Analyser state diagram	Nick	Documentation	11/19/2013	11/24/2013	
23	UML for controller	Leslie	Documentation	11/19/2013	11/24/2013	
24	Controller class description and module description	Leslie	Documentation	11/19/2013	11/24/2013	
25	Data Interface state diagram	Kyle	Documentation	11/19/2013	11/24/2013	
26	Data Dictionary and Data Flow	Kyle	Documentation	11/19/2013	11/24/2013	
27	UML for analyser	Nick	Documentation	11/19/2013	11/24/2013	
28	UML for data interface	Kyle	Documentation	11/19/2013	11/24/2013	
29	Draft Gantt Chart of work packages	Leslie	Documentation	11/23/2013	11/24/2013	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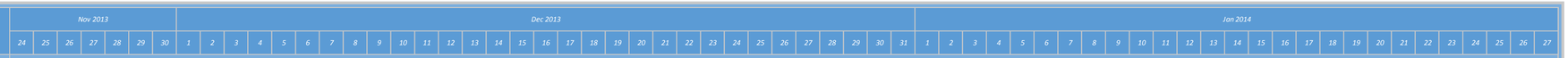
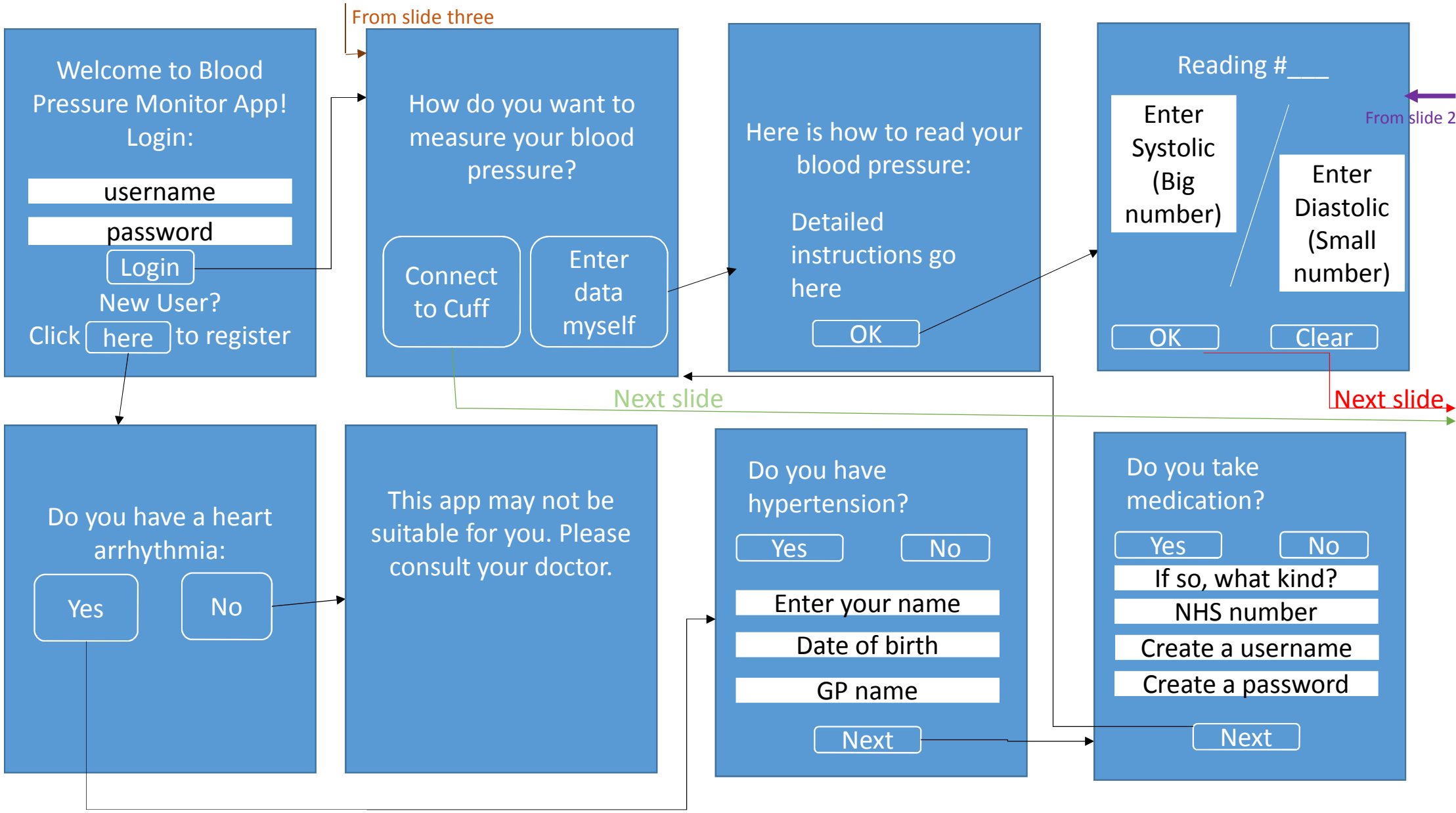
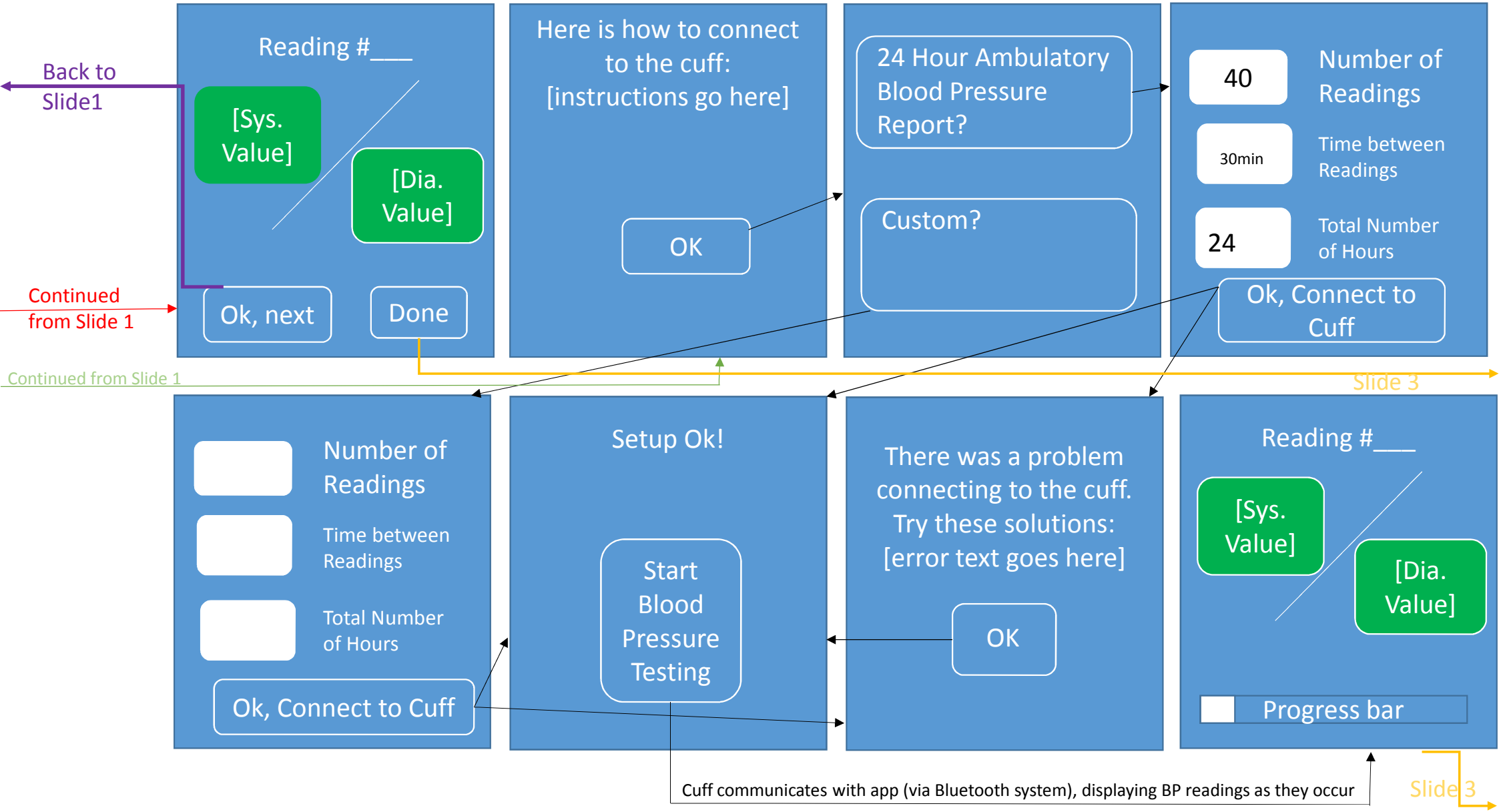
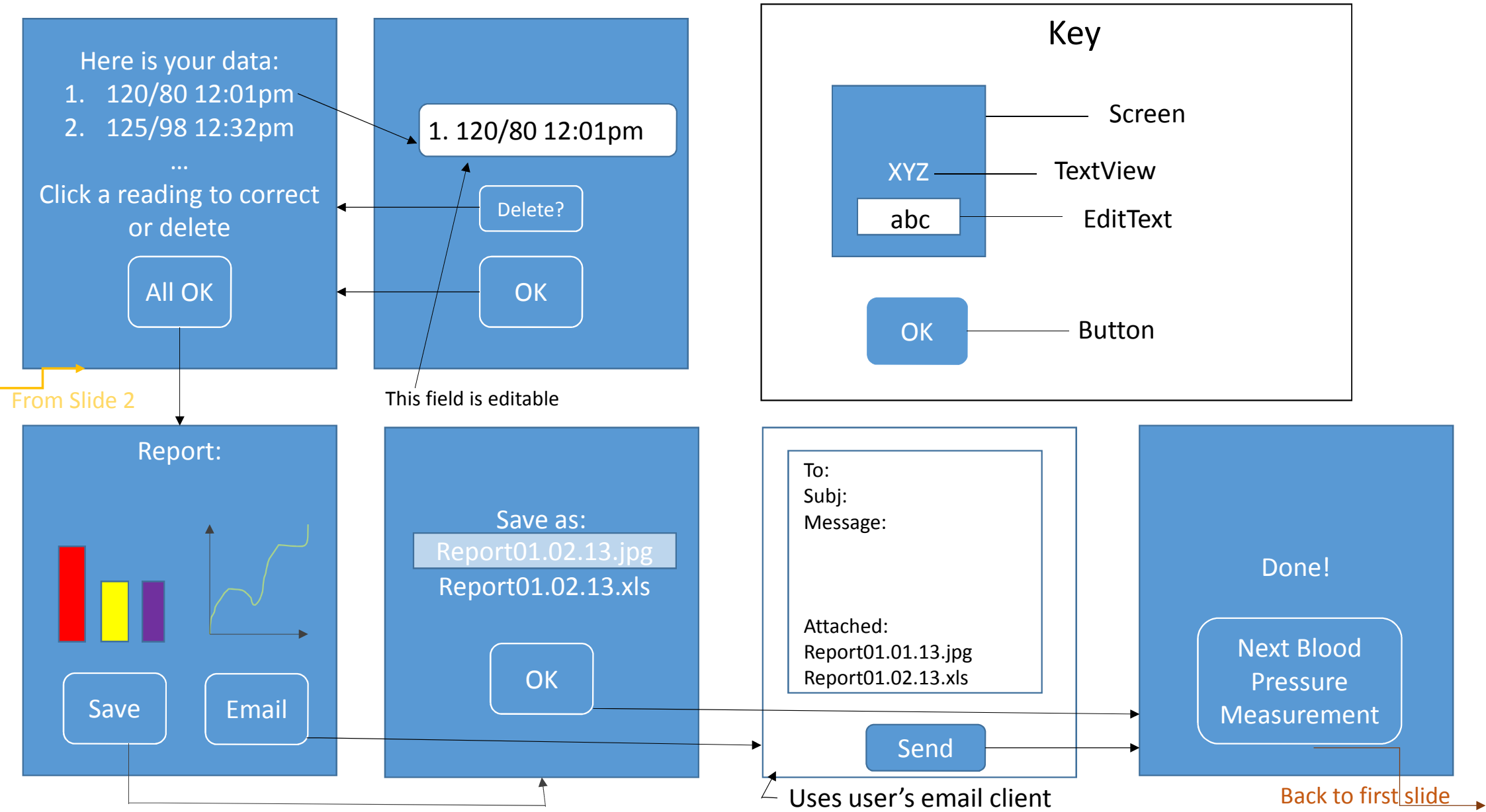
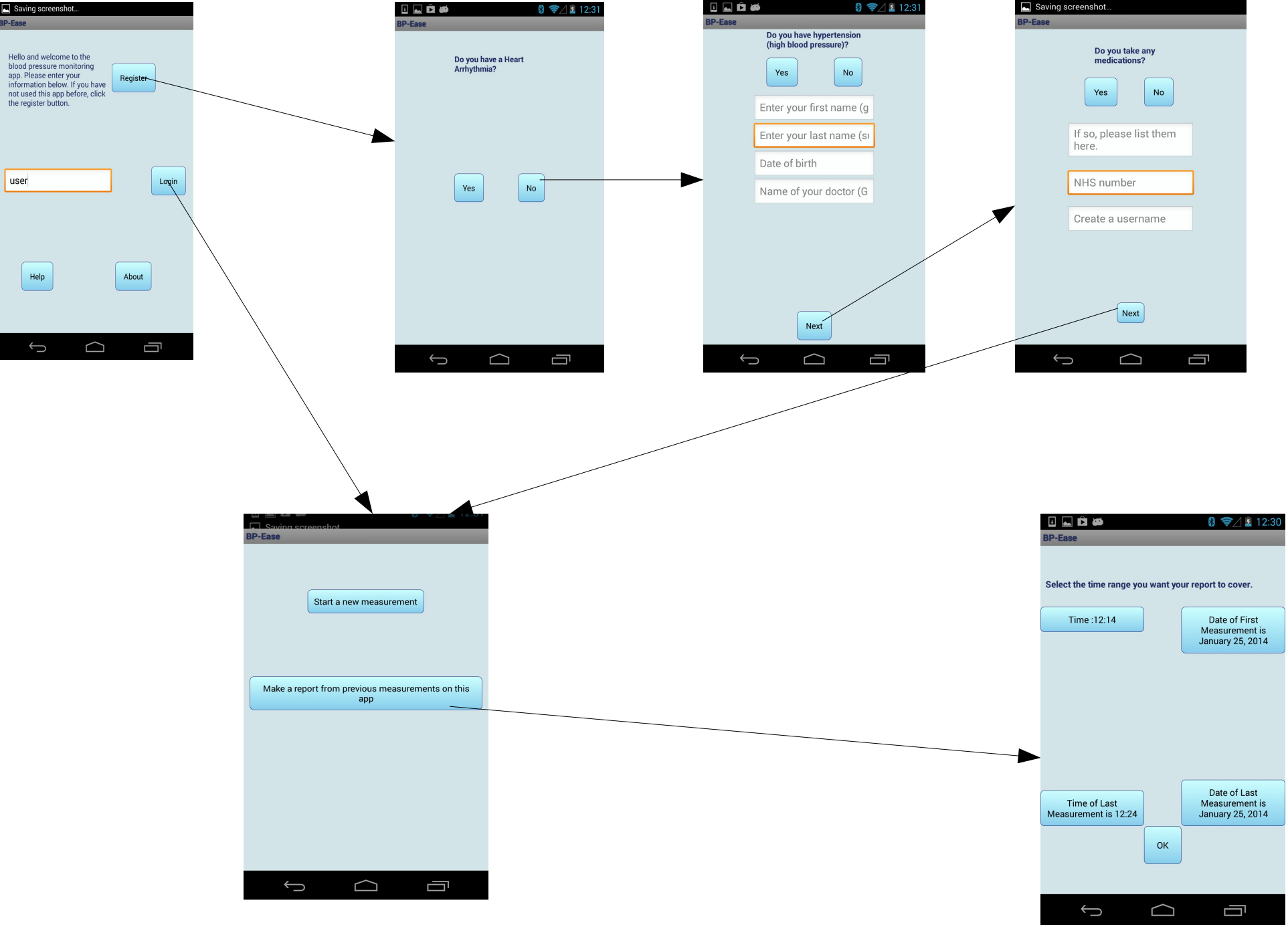
ID	Task Name	Person Responsible	Type	Assigned	Finish
1	Update all documentation	Leslie	Documentation	1/17/2014	1/19/2014
2	Code layout files	Leslie	Development	11/15/2013	12/1/2013
3	Rough draft of User Interface code	Leslie	Development	11/15/2013	12/13/2013
4	Communicate with Client	Leslie	Administration	11/25/2013	1/21/2014
5	Implement numericBP and userInfo UI info management	Leslie	Development	12/20/2013	1/17/2014
6	Test UI module	Leslie	Testing	12/20/2013	12/31/2014
7	Rough draft of analyser module	Nick	Development	11/15/2013	1/10/2014
8	Poster	Leslie & Nick	Documentation/ Administration	12/1/2013	12/5/2013
9	Code bluetooth module	Kyle	Development	11/25/2013	12/10/2013
10	Finish/rewrite, test and integrate analyzer module	Kyle	Development	1/9/2014	1/17/2014
11	Integrate UI	Kyle	Development	1/17/2014	1/19/2014
12	Final testing and debugging	Kyle and Leslie	Testing	1/19/2014	1/25/2014
13	Integrated testing	Kyle	Development	1/17/2014	1/19/2014
14	Bluetooth module testing	Kyle	Development	12/5/2013	12/15/2013
15	Write 6 blog entries	Leslie	Documentation	11/15/2013	1/19/2014
16	Write 4 blog entries	Nick	Documentation	1/16/2014	1/19/2014
17	Update XML to make more visually compelling	Leslie	Design	1/19/2014	1/23/2014
18	Make app demo video	Leslie and Kyle	Documentation	1/25/2014	1/25/2014
19	Record meeting notes	Nick	Documentation	11/24/2013	12/11/2013



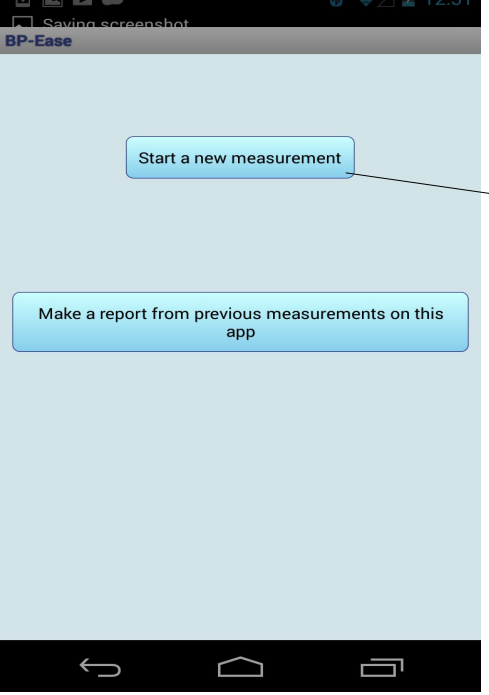

From slide three
Welcome to Blood Pressure Monitor App!
Login:
username
password
Login
New User?
Click here to register
How do you want to measure your blood pressure?
Connect to Cuff
Enter data myself
Here is how to read your blood pressure:
Detailed instructions go here
OK
Reading #___
Enter Systolic (Big number)
Enter Diastolic (Small number)
From slide 2
OK
Clear
Next slide
Next slide
Do you have a heart arrhythmia:
Yes
No
This app may not be suitable for you. Please consult your doctor.
Do you have hypertension?
Yes
No
Enter your name
Date of birth
GP name
Next
Do you take medication?
Yes
No
If so, what kind?
NHS number
Create a username
Create a password
Next

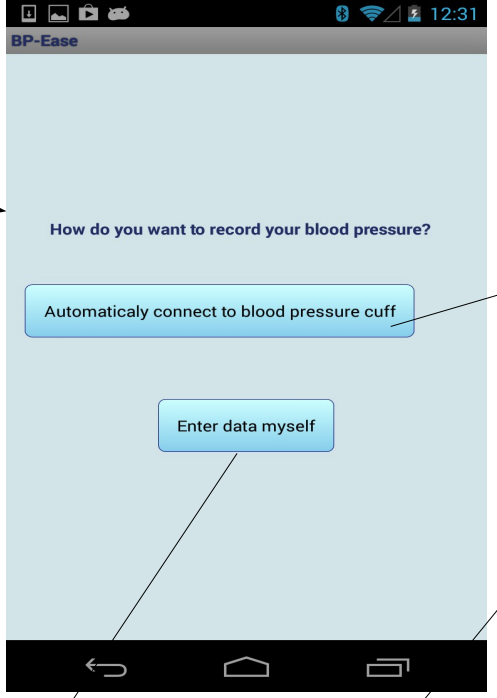

Back to Slide1
Reading #___
[Sys. Value]
[Dia. Value]
Ok, next
Done
Here is how to connect to the cuff: [instructions go here]
OK
24 Hour Ambulatory Blood Pressure Report?
Custom?
40
Number of Readings
30min
Time between Readings
24
Total Number of Hours
Ok, Connect to Cuff
Continued from Slide 1
Continued from Slide 1
Slide 3
Number of Readings
Time between Readings
Total Number of Hours
Ok, Connect to Cuff
Setup Ok!
Start Blood Pressure Testing
There was a problem connecting to the cuff. Try these solutions: [error text goes here]
OK
Reading #___
[Sys. Value]
[Dia. Value]
Progress bar
Cuff communicates with app (via Bluetooth system), displaying BP readings as they occur
Slide 3

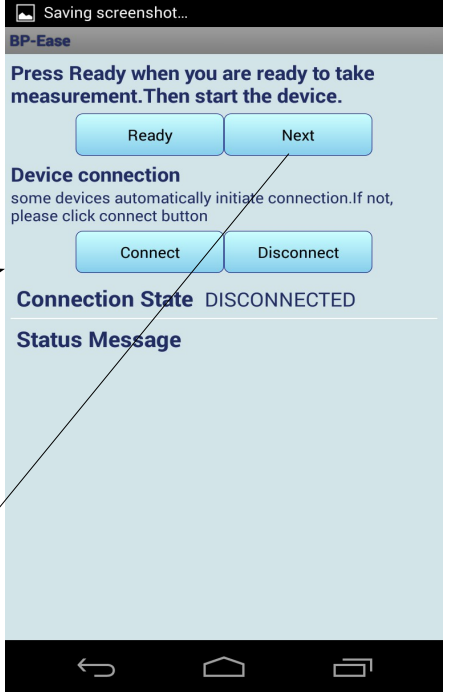

Here is your data:
1. 120/80 12:01pm
2. 125/98 12:32pm
…
Click a reading to correct or delete
All OK
From Slide 2
1. 120/80 12:01pm
Delete?
OK
This field is editable
Key
Screen
XYZ
TextView
abc
EditText
OK
Button
Report:
Save
Email
Save as:
Report01.02.13.jpg
Report01.02.13.xls
OK
To:
Subj:
Message:
Attached:
Report01.01.13.jpg
Report01.02.13.xls
Send
Uses user's email client
Done!
Next Blood Pressure Measurement
Back to first slide

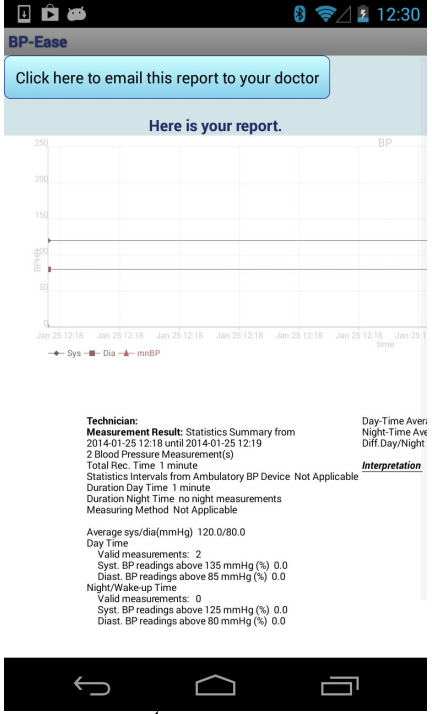


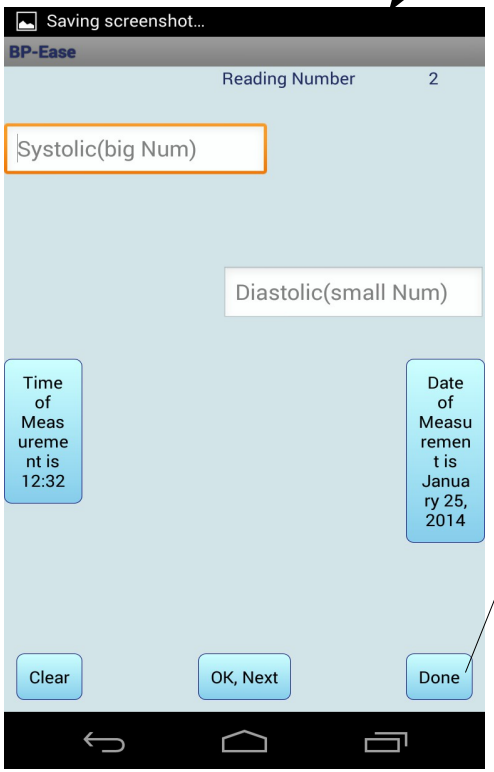
Screenshots of Final App Workflow

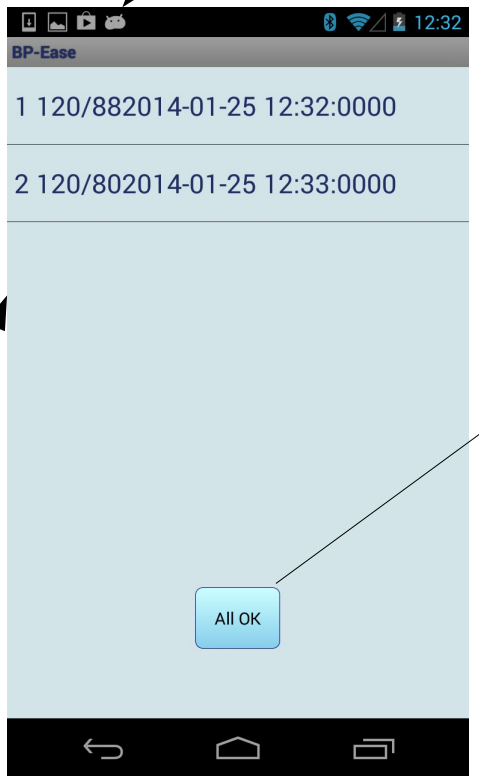

BP-Ease
Start a new measurement
Make a report from previous measurements on this app

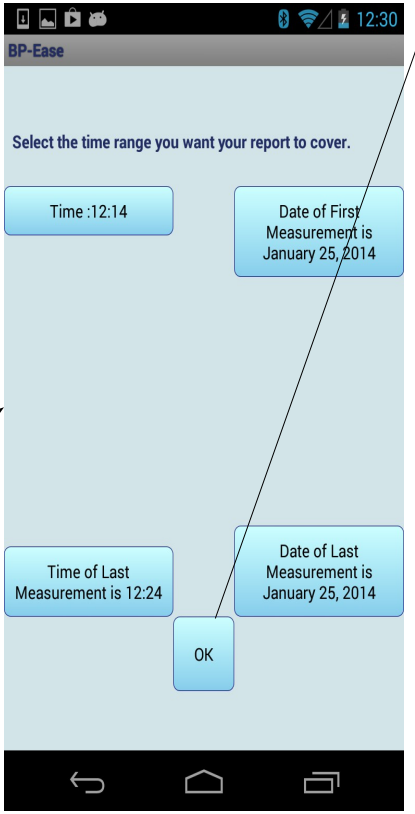

12:31
BP-Ease
How do you want to record your blood pressure?
Automaticaly connect to blood pressure cuff
Enter data myself


Saving screenshot...
BP-Ease
Press Ready when you are ready to take measurement.Then start the device.
Ready
Next
Device connection
some devices automatically initiate connection.If not, please click connect button
Connect
Disconnect
Connection State DISCONNECTED
Status Message


12:30
BP-Ease
Click here to email this report to your doctor
Here is your report.
Technician:
Measurement Result: Statistics Summary from 2014-01-25 12:18 until 2014-01-25 12:19
2 Blood Pressure Measurement(s)
Total Rec. Time 1 minute
Statistics Intervals from Ambulatory BP Device Not Applicable
Duration Day Time 1 minute
Duration Night Time no night measurements
Measuring Method Not Applicable
Average sys/dia(mmHg) 120.0/80.0
Day Time
Valid measurements: 2
Syst. BP readings above 135 mmHg (%) 0.0
Diast. BP readings above 85 mmHg (%) 0.0
Night/Wake-up Time
Valid measurements: 0
Syst. BP readings above 125 mmHg (%) 0.0
Diast. BP readings above 80 mmHg (%) 0.0
Interpretation


Saving screenshot...
BP-Ease
Reading Number 2
Systolic(big Num)
Diastolic(small Num)
Time of Measurement is 12:32
Date of Measurement is January 25, 2014
Clear
OK, Next
Done


12:32
BP-Ease
1 120/882014-01-25 12:32:0000
2 120/802014-01-25 12:33:0000
All OK


12:30
BP-Ease
Select the time range you want your report to cover.
Time :12:14
Date of First Measurement is January 25, 2014
Time of Last Measurement is 12:24
Date of Last Measurement is January 25, 2014
OK

Software Requirements

for Blood Pressure Monitoring App

- Introduction
  - Purpose of this document
  - Definitions
    - Systolic blood pressure
    - Diastolic blood pressure
    - Mean arterial blood pressure (mn BP)
    - Ambulatory blood pressure measurement (ABPM)
    - Home blood pressure measurement (HBPM)
  - Scope
    - The name of the software
    - Aim of the app
  - Objectives of the app
      - Ambulatory BP monitoring (ABPM)
      - Home BP monitoring (HBPM), and notification of BP measurement
      - Remote dispatch of BP record to GP
      - Independent and easy and intuitive use of the BP app
  - Overview
  - References
    - User requirements document.
    - Client briefing presentation
    - Example ABPM report
    - Australian Family Physician ABPM guide
    - IEEE 11073 Health informatics - personal health device communication. Part 20601 optimized exchange protocol
    - Android APIs for bluetooth health
- Overall description
  - Product perspective
  - Product functions
  - User characteristics
  - Constraints, assumptions and dependencies
- Specific requirements
  - External interface requirements
  - Functional requirements
  - Design constraints
    - Standards Compliance
  - Logical database requirement
  - Software System attributes

Introduction

Purpose of this document

This document is a Software Requirements Specification for a blood pressure (BP) monitoring app to be developed by UCL MSc CS GC02 app team 35 for Dr Afsana Bhuiya.
The intended audience of this document is the supplier, Team 35, and the client, Dr Bhuiya. The document should also help future maintainability of the BP app by providing documentation of the design process.

The purpose of this document is to specify the following requirements of the app:

i. Functionality - what the app will do.
ii. External interfaces - how the app will interact with people, the hardware of the systems on which it will run, any other hardware and software.
iii. Performance - the speed, response time and recovery time of the functions of the app.
iv. Attributes - such as portability of the app, its maintainability, and security.
v. Design constraints upon the implementation of the design - such as standards, policies for database integrity, resource limits, operating environments.

Definitions

Systolic blood pressure

The pressure of the blood when the heart muscle contracts and pumps blood from the chambers of the heart into the arteries. [1]

Diastolic blood pressure

The pressure of the blood when the heart muscle relaxes. [2]

Mean arterial blood pressure (mn BP)

Determined by occlusion of the brachial artery (the forearm). A cuff is inflated until the brachial artery is blocked. As the cuff is deflated the blood begins to flow. While blood flow is return to normal, the flow of blood fluctuates or oscillates against the wall of the brachial artery. These oscillations are detected by a sensor. The maximal oscillations are defined as mn BP[3].

Ambulatory blood pressure measurement (ABPM)

Measurements of blood pressure taken for a period of time at regular intervals while the patient performs their normal daily activity. The minimum number of measurements are 2 each hour and a total of 14 measurements[4]. The user

[1] "systole". Oxford Dictionaries. Oxford University Press, n.d. Web. 04 November 2013. <http://www.oxforddictionaries.com/definition/english/systole>
[2] "diastole". Oxford Dictionaries. Oxford University Press, n.d. Web. 04 November 2013. <http://www.oxforddictionaries.com/definition/english/diastole>.
[3] "RACGP - Ambulatory blood pressure monitoring." 2012. 6 Nov. 2013 <http://www.racgp.org.au/afp/2011/november/ambulatory-blood-pressure-monitoring/>
[4] "CG127 Hypertension: quick reference guide." 2011. 6 Nov. 2013 <http://www.nice.org.uk/guidance/CG127/QuickRefGuide>

requirements for the BP app specify a measurement period of 24 hours. As a result of these requirements ABPM devices must include a number of features. They must include a sensor and recording device that can be worn without interrupting the patient's normal activities, for example working and sleeping, and they must be easily and comfortably worn and used by the patient. To satisfy these requirements modern ABPMs are designed to be small in size and automatically measure the patient's blood pressure.

Home blood pressure measurement (HBPM)

HBPM is similar to ABPM in that the patient performs their own measurements. However there are significant differences. Firstly, the time period of measurement is 2 measurements every 24 hours, ideally in the morning and evening. The minimum time period for measurements is 4 days, with 7 days being the ideal. Secondly, because the patient can perform the measurements in the same location, rather than throughout their normal activities, the necessary features for the HBPM device are fewer; the size of the device is not so important, and the device does not need to automatically measure BP. However use of the device must still be easy and comfortable for the patient.

Scope

The name of the software

The working name of the app is 'BP app'. A branded name can be given at a later time if necessary.

Aim of the app

The aim of the BP app is to allow users to easily record their blood pressure outside of a hospital appointment or a visit to their Doctor (GP).

The current system for monitoring BP has two disadvantages. Currently blood pressure is initially measured during a GP appointment. A disadvantage of this system is that a number of factors can cause the GP measured BP to differ from the patient's true BP and thus result in an inaccurate measurement[5].
If clinic BP measurements are not conclusive then further investigation can be provided in a hospital appointment. Here the patient can be issued with a blood pressure monitoring device and given instructions on how to use the device to record their blood pressure. After enough records have been gathered over the necessary time period the patient then returns to the hospital and the records of their BP measurements are then retrieved from the device. This is the second disadvantage of the system. It requires the patient to attend 2 hospital appointments. This is a costly process. It costs the patient the time and expense of travelling to and attending the appointments and costs the hospital the expense of providing staff to issue the device and give instructions for its use.

[5] (2012). RACGP - Ambulatory blood pressure monitoring. Retrieved November 5, 2013, from http://www.racgp.org.au/afp/2011/november/ambulatory-blood-pressure-monitoring/.

Objectives of the app

A principal aim of the BP app is to allow users to take measurements of their own BP. In order to achieve this aim the BP app must allow patients to monitor their BP in two modes:

Automated Blood Pressure Monitoring

This mode will require a separate sensor with a bluetooth transmitter. BP measurements could then be taken automatically by the sensor. The design of the app will make use of the Android API for bluetooth communication with health devices. This API requires that the receiving device conforms to the IEEE 11073-xxxxx standard. We have chosen to use this API and IEEE standard as the most likely method to ensure greatest and easiest communication between the BP app and any possible bluetooth equipped sensor.

Manual Blood Pressure Monitoring

This mode will not require a separate sensor with bluetooth transmitter. Instead the user will manually perform the BP measurement. Any device that measures and displays systolic and diastolic BP will be suitable. The BP app will allow the user to store and view BP measurements.

Remote dispatch of BP record to GP

Another of the aims of the BP app is to minimise the appointments that the user must attend in order to receive measurements of their BP. Consequently an objective of the app is that the user is able to send their BP measurements remotely to their GP. The user requirements for the BP app specify that the method of remote dispatch should be via email to the GP and the format should be .pdf.

Independent and easy and intuitive use of the BP app

Another aim of the BP app is that the user should be able to take BP measurements independently. As a result another objective is that it should be possible to use the app without needing to contact a GP or hospital. An additional objective is that it should be easy and intuitive to use the app.

Overview

The rest of this document covers the overall description of the BP app:

References

User requirements document.

A google docs spreadsheet produced by Team 35 after the first meeting with Dr Bhuiya. The document is intended to ensure that Team 35 have captured Dr Bhuiya's user requirements. It contains reproduction of the requirements in Dr Bhuiya's briefing presentation for the BP app, together with further requirements added after the meeting by Team 35 members. Each requirement is ranked in priority by must/ could/ should have.[6]

[6] BP app user requirements google docs spreadsheet https://docs.google.com/spreadsheet/ccc?key=0Aq4CB_K-EX1QdGNIWXJ1d2RfdFBJU2JtRUhFWEFTMVE&usp=sharing

Client briefing presentation

A powerpoint presentation produced by the client, Dr Bhuiya, that contains the initial briefing for the BP app. [7]

Example ABPM report

An example of the report that Doctors currently receive when a patient undergoes ABPM. This document shows the data summary and presentation that the GP currently receives, which the BP app must also produce[8].

Australian Family Physician ABPM guide

A guide published by Australian Family Physician that explains the methods, proper usage, and benefits of ABPM.

IEEE 11073 Health informatics - personal health device communication. Part 20601 optimized exchange protocol

IEEE/ ISO standard that defines protocols for communication between personal health devices and compute engines, such as Android and iOS devices[9].

Android APIs for bluetooth health

Android API for communication with health devices. The received data must be interpreted by a health manager that conforms to the IEEE 11073 standard[10].

Overall description

Product perspective

The BP app must run on the android platform. The BP app will have the following interfaces:

1. Bluetooth receiver
2. Hardware display
3. Platform storage (database)

Product functions

The product will interface with a blood pressure monitoring cuff to accept blood pressure readings. The app will store, analyze and report graphically these readings, enhanced with medical interpretation.

User characteristics

Users consist of patients at a hospital. For maximum effectiveness, app should be usable by those with a low level of technical knowledge, low level of medical knowledge, low level of English language, poor vision, and limited manual dexterity.

---

[7] Initial client BP app presentation
https://drive.google.com/file/d/0ByMRGe2xlYbwMDZnaW1lX1AxRVE/edit?usp=sharing
[8] Example ABPM report
https://drive.google.com/file/d/0ByMRGe2xlYbwX2NHRmg1d0xyS00/edit?usp=sharing
[9] "ISO/IEEE 11073-20601:2010 - Health informatics -- Personal health ..." 2009. 6 Nov. 2013
<http://www.iso.org/iso/catalogue_detail.htm?csnumber=54331>
[10] "BluetoothHealth | Android Developers." 2011. 6 Nov. 2013
<http://developer.android.com/reference/android/bluetooth/BluetoothHealth.html>

Constraints, assumptions and dependencies

Constraints:

Should be able to interface with bluetooth-Blood pressure cuff system.

Compatible with Bluetooth API for health devices (which follows IEEE standards).

Should be written in Java for Android 4.0. Report should be issued in PDF to reduce editability (maintain data integrity).

Should include disclaimer about how this product is not intended to replace medical treatment and should only be used in consultation with a medical professional.

Assumptions & Dependencies:

Assume blood pressure cuff is compatible with arduino-bluetooth system.

Assume arduino-bluetooth system is compatible with Android interface.

Specific requirements

External interface requirements

Data should ultimately be output in a report with graphical, on-screen components, as well as data output in pdf.

App should be navigable by large, simple buttons.

Functional requirements

The system shall perform a validity check on blood pressure input.

Easy-to-interpret error messages.

Informational screens to explain input method will appear first, followed by input capture functions, followed by validation and finally, reporting.

For 24-hour BPM function, must have at least 40 inputs, 85 percentage correct.

Output should include: 24-hour BPM report as listed in Appendix A.

Design constraints

Standards Compliance

Should meet IEEE standards for health devices.

Logical database requirement

Personal health data should be stored locally on the device. User should approve all transfer of data to an external source (emailing report to doctor).

Requirement	Requirements in detail	Priority (must/ should/ could)	Source	Comments to client	Comments to team 35
Start/interface	Patient identifiable details - name, DOB, GP name,NHS number. Medical data - medication taken (free text) ? do you have Hypertension (Y/N), DO you have a heart arrythmia? (may not be suitable for you - check with your doctor)	must			Please can you ensure there are secuirty features...PW or encyption etc. As confidentiality pivotal.
Both iOS and android platforms		must have	Original briefing presentation (BP monitoring app presentation.pptx)		
INPUT - Take Systolic and Diastolic Blood Pressure	Manually from user	must have	Original briefing presentation (BP monitoring app presentation.pptx), Requirement from Dean Mohamedally		If your clinic BP is greater than 140/90 you are likley to be sent for further BP tests - Home BP monitoring or Ambulatory BP monitoring
	Provide an interface to receive data from wireless sensor (no current details on sensor)	must have			
MODE - A and B	AMBULATORY mode (ABP) or Home BP monitoring (HBPM)	should - if too complex we can stick to general mode	ABPM APF NOv 2011 and NICE guidance page 6		see second tab for specifics on ABP and HBPM
A - Ambulatory BP mode	The Specifications - measuring blood pressure (BP) at regular intervals (usually every 20–30 minutes) over a 24 hour period while patients undergo normal daily activities, including sleep.	must	ABPM APF NOv 2011		
B - HBPM - suitable whilst we dont have a sensor attached	When using home blood pressure monitoring (HBPM) to confirm a diagnosis of hypertension, ensure that: – for each blood pressure recording, two consecutive measurements are taken, at least 1 minute apart and with the person seated and – blood pressure is recorded twice daily, ideally in the morning and evening and – blood pressure recording continues for at least 4 days, ideally for 7 days. Discard the measurements taken on the first day and use the average value of all the remaining measurements to confirm a diagnosis of hypertension.	must	NICE HTN doc		ABPM/HBPM ≥ 135/85 mmHg Stage 1 hypertension –– ABPM/HBPM ≥ 150/95 mmHg Stage 2 hypertension
Monitor Errors	If cuff falls off, not inflating, too much arm movement....	must have	Original briefing presentation (BP monitoring app presentation.pptx)		Errors - for faults or hugely disparate readings.
	Daytime Systolic greater than 220		Example blood pressure report (LBekuretsionbp171013.pdf)		see gp
	Daytime diastolic greater than 120				see gp
	Systolic less than 80	could have			see gp
	Diastolic less than 60	could have			see gp
	Systolic/ diastolic is 0 (i.e. indicates error with measurement)	could have			
BP calculations - the report shows the calculations and he break down should be like this	Calculation is Mean Arterial Pressure = BPdiastolic + 1/3 (BPsystolic - BPdiastolic)	must have		Please confirm formula is correct	see additional document saved on sahred folder
		must have	Original briefing presentation (BP monitoring app presentation.pptx)		
Completed BP recording and analysis emailed to GP		must have	Original briefing presentation (BP monitoring app presentation.pptx)		
	Emailed data format is .pdf	must have	Client meeting Friday 25/10/2013	Please confirm .pdf format is best. If others are required, please list	yes please !

Requirement	Requirements in detail	Priority (must/ should/ could)	Source	Comments to client	Comments to team 35
	Emailed data format is very similar to that in example BP report (LBekuretsionbp171013.pdf)	must have	Client meeting Friday 25/10/2013		yes!
	App automatically composes email with content, user only needs to press send	could have	Comparison with iHealth app NBH 27/10/2013		
App sumarises completed recording		must have	Example blood pressure report (LBekuretsionbp171013.pdf)		
	Total number of recordings	must have			
	Total recording duration				
	Average systolic and diastolic				
	Valid measurements: number and percent				
	Systolic readings above threshold hypetension (135mmHg)				
	Diastolic readings above threshold hypetension (85 mmHg)				
	Minimum 3 recordings (Diastolic, systolic and BP)				
	Maximum 3 recordings (Diastolic, systolic and BP)				
	Automatic interpretatation of results	could have			
App displays and analyses BP records		must have	Original briefing presentation (BP monitoring app presentation.pptx)		
	List view	must have	Example blood pressure report (LBekuretsionbp171013.pdf)		
	Graph view				
	Summary view	could have			
Alert user if less than 85% of completed recordings are accurate (i.e. new recording needed)		should have	LM 30/10/2013		
Recorded data from app is sent to GP in editable formats (i.e. not simple pdf)		could have	Team 35 discussion		
SAVES to CLOUD		could have			as discussed before

Client Communication

Meeting to go over App

Afsana Bhuiya <afsanab2011@gmail.com>

Fri 1/17/2014 2:41 PM

No problem. See you later. Dr Afsana Bhuiya GP Sent from Samsung Mobile 07877136123 -------- Original message -------- From: "Macmillan, Leslie" Date:17/01/2014 13:59 (GMT+00:00) To: Afsana Bhuiya Cc: "Brookes-Hocking, Nick" ,"Liu, Kyle" Subject: RE: Meeting

Macmillan, Leslie

Fri 1/17/2014 1:59 PM

Ok, that should be fine. We will try for 5:30, but may be closer to 5:45.

Afsana Bhuiya <afsanab2011@gmail.com>

Fri 1/17/2014 11:42 AM

Ok - that would be better - I am working near finsbury park today. Shall we meet at the costa again? Will you be able to do 5:30pm ?

Brookes-Hocking, Nick

Fri 1/17/2014 10:28 AM

Cool, sounds good! Sent from my iPhone

Macmillan, Leslie

Fri 1/17/2014 9:52 AM

Yes, we can meet there- the Green and Fortune cafe? We could also meet you closer to where you are so you don't have to drive if you want. I (and I think Nick) just have class til 5pm on campus at UCL, but can leave any time after that.

Afsana Bhuiya <afsanab2011@gmail.com>

Fri 1/17/2014 9:33 AM

Hi Leslie - Is around kings cross ok to meet ? I can make it for 6:30-45pm as then I can drive and park the car. The Kings Place is a lovely place to sit and there is coffee there too. Would that be ok?

Afsana Bhuiya <afsanab2011@gmail.com>

Tue 1/14/2014 1:31 PM

Hello - Yes friday sounds good. Let me just check where I will be and we can work out a location.

Macmillan, Leslie

Mon 1/13/2014 11:01 PM

You

To:
Afsana Gmail <afsanab2011@gmail.com>;
forwarded this message on 1/13/2014 11:01 PM.

Hi Afsana,
Would you be available to meet early Friday evening, around 6 or 7? Or sometime this weekend? We will have a functional app by then.
-Leslie

Model of App

Subj: Model of App

Afsana Bhuiya <afsanab2011@gmail.com>

Tue 11/26/2013 9:52 PM

Inbox

Hi - thanks for the attachment.

I don't think there is much to add from my part at this stage.

Will await the skeleton version of the app and hope the cuff gets delivered soon.

To:
Brookes-Hocking, Nick;

Cc:
Macmillan, Leslie;

Liu, Kyle;

Afsana Bhuiya <afsanab2011@gmail.com>

Tue 11/26/2013 4:39 PM

Hi Guys - will take a look this evening!

Brookes-Hocking, Nick

Mon 11/25/2013 3:08 PM

Oops, I forgot to reply to the rest of the points in your email… Testing the app: I attach a PDF that shows all the dates that we're working to (The Thursday 14th November deadline got pushed back to yesterday)

Brookes-Hocking, Nick

Mon 11/25/2013 2:47 PM

Hi Afsana, We were still chasing down the order, no one had told us it had already been made! But we just got confirmation an hour-ish ago that the it has been made. We don't have an estimated delivery, though apparently the order in the end was made through

Afsana Bhuiya <afsanab2011@gmail.com>

Sun 11/24/2013 9:47 AM

Morning Team - Good to hear the bluetooth BP machine is on its way..... I also hear there a massive app exhibition on the 9th of December, so it would definitely be worth publicizing app then...! Also the first deadline is 13th December. I expect after that

Macmillan, Leslie

Wed 11/20/2013 4:23 PM

Thanks for letting us know, we'll look into it (we thought we ordered it already). From: Afsana Bhuiya <afsanab2011@gmail.com> Sent: Wednesday, November 20, 2013 2:36 PM To: Brookes-Hocking, Nick Cc: Liu, Kyle; Macmillan, Leslie Subject: Re: Model of App

Afsana Bhuiya <afsanab2011@gmail.com>

Wed 11/20/2013 2:36 PM

Hey guys. . Dean says he is waiting for the item order number so he can order! Drop him an email with the details. Thanks Dr Afsana Bhuiya GP Sent from Samsung Mobile 07877136123 -------- Original message -------- From: "Brookes-Hocking, Nick" <nick.brookes-hocking.13@ucl.ac.uk>

Brookes-Hocking, Nick

Wed 11/20/2013 8:26 AM

Hi Afsana, Was just going through my email and saw we forgot to reply to you on this. Turns out that's a very pertinent question! That omron model Kyle linked is one of the few we've been able to find for which the manufacturer gives enough detail about how

Afsana Bhuiya <afsanab2011@gmail.com>

Sun 11/17/2013 9:36 PM

Oh wow - i see - But how does one buy it?

Liu, Kyle

Sun 11/17/2013 8:51 AM

Morning Omron does have Bluetooth BP monitor. Here is the product link: http://www.healthcare.omron.co.jp/bt/english/index.html We are trying to find supplier. From: Afsana Bhuiya <afsanab2011@gmail.com> Sent: 17 November 2013 07:30 To: Liu, Kyle; Macmillan,

Afsana Bhuiya <afsanab2011@gmail.com>

Sun 11/17/2013 7:30 AM

Morning, No I do not. I couldn't find a blue tooth one.... Did u see one ? If so send me the link anday be able to purchase it ... Dr Afsana Bhuiya GP Sent from Samsung Mobile 07877136123 -------- Original message -------- From: "Liu, Kyle" <yifei.liu.13@ucl.ac.uk>

Liu, Kyle

Sat 11/16/2013 8:00 PM

Hi Afsana We plan to do some experiments on BP sensor. Do you have any BP monitor with bluetooth available now? It is a little hard to find a supplier.

Afsana Bhuiya <afsanab2011@gmail.com>

Sat 11/16/2013 4:58 PM

Hello Team - no it looks great so far! If I think of any additional stuff when I take a more detailed look will email you before sunday.. Thanks!

Macmillan, Leslie

Fri 11/15/2013 8:41 PM

By the way, no pressure to reply by this Sunday! We only really need to know if it's approved by next Sunday the 24th, which is our first coursework deadline. From: Macmillan, Leslie Sent: Friday, November 15, 2013 5:51 PM To: Afsana Gmail Cc: Liu, Kyle; Brookes-Hocking,

Hi Afsana,
In the past few weeks, we have been working on the technical design of the app, planning the user interface, and doing some initial coding. Below is a link to a plan for the user interface screens of the app. Please let us know if you have any suggestions for changes, or if this is acceptable as is. The three of us are having a meeting on Sunday morning, so if you could let us know any changes by then, that would be great.
Thanks,
Leslie

https://drive.google.com/file/d/0B4WyV86fEN5wd1ppN24xempKNVU/edit?usp=sharing

App Meetings

Subj: App meetings
mark as unread

Afsana Bhuiya <afsanab2011@gmail.com>

Fri 12/13/2013 9:34 AM

Inbox

Hi guys - sounds good. Look forward to it.
Lets put the date in and decide nearer the time
Camden is good though.

Have a lovely Christmas and new year period!
Do let me know if you have any queries in the interim.

Afsana.

mark as unread

Macmillan, Leslie

Tue 12/10/2013 3:55 PM

Hi Afsana,
We didn't end up having to do a presentation per se. Our poster was on display and people mulled around looking at all the posters. But I think it was a good poster. There were some interesting talks on technology- this one company called Chirp uses sounds to communicate between devices.
I will try to send you screenshots sometime next week.
Evening time around 7:15 on the 7th works for us. We can meet up near UCL at the Starbucks at 77 Tottenham Court Road as some of the other ones close earlier. Or if you wanted to meet in the middle, we could go somewhere in Camden, such as Caffe Nero 7 Jamestown Rd, London NW1 7BW, by Camden town tube.
See you in the New Year!
Leslie

Afsana Gmail <afsanab2011@gmail.com>

Mon 12/9/2013 11:14 PM

Inbox

You replied on

To:
Macmillan, Leslie;

Cc:
Liu, Kyle;

Brookes-Hocking, Nick;

12/10/2013 3:55 PM.

Hello Team,

How was the presentation today ?? Hope it went well.

I think we can wait to meet jan when the app is functional.
But if you like you can send me the screenshots or stuff you want to query or get second opinions on. Would be happy to review or edit....
I think 7th is better.
I will finish work around 6:30/7pm....so can meet for around 7:15 if we meet centrally ?

Let's put the 7th into the diary and work out where the time.

Oh yes not to worry, perhaps another team can work on the ios version.....

Sent from my iPad

Dr Afsana Bhuiya
GP
Mob: 07877136123
mark as unread

Macmillan, Leslie
Sun 12/8/2013 7:10 PM

Hi Afsana,
To give you an update on our progress, we turned in our app model and are now writing the actual code of the app. This week is the last week of class before winter break. We're hoping to have a rough draft of the app's UI by Friday. Would you like to meet up and look at our rough draft? You could look at the screen flow and let us know if this would be suitable. However, the whole app may not be functional at this time. Do you think it would be productive to go over what we have so far or do you want to wait until it's functional?
We should have a functional app by January 7th. If we can get feedback at that stage, we can spend the next week making tweaks based on that feedback, and then would like to schedule another meeting around the 14th, for final approval (or changes).
So would you be available for meetings around Jan 7th and Jan 14th?
One issue we should alert you to is that it's not looking like we'll have time to make an iOS version of the app, unfortunately. Making the sensor connection took a lot of our time and it seems like writing an iOS version would take another couple of months. Sorry about that.
Best,
Leslie

Screenshots

Afsana Bhuiya <afsanab2011@gmail.com>
Tue 1/7/2014 1:44 PM

Inbox

Yes - lets reschedule.
Let me know next week when you can.

cheers

To:
Brookes-Hocking, Nick;

Cc:
Macmillan, Leslie;

Liu, Kyle;
Brookes-Hocking, Nick

Tue 1/7/2014 1:37 PM

Inbox

From: Brookes-Hocking, Nick
Sent: Tuesday, January 07, 2014 10:31:03 AM
Cc: Macmillan, Leslie; Liu, Kyle
Subject: Re: Screenshots

Hi both. For myself I'd prefer to postpone our meeting this evening with Afsana. I can instead spend the time finishing my code for the analyser. And it sounds like Afsana would prefer to postpone also. Is that ok? I'm still confident I can get the analyser part of the app finished by tomorrow. We could give her an update then?

Cheers,

On 7 Jan 2014, at 08:44, Afsana Bhuiya <afsanab2011@gmail.com<mailto:afsanab2011@gmail.com>> wrote:

Hi Guys, I see. It may better to meet when you have something functioning then?
When do you think that will be?
Let me know and we can reschedule.

thanks

On 6 January 2014 22:52, Macmillan, Leslie
<leslie.macmillan.13@ucl.ac.uk<mailto:leslie.macmillan.13@ucl.ac.uk>> wrote:
Hello Afsana,

We got a little behind over the break and don't yet have a fully functional app. However, we do have a method to connect to the bluetooth-enabled monitor, which we can show you, and also have a demo for the UI flow. But the app is not able to store and retrieve data from the database or print a report.
Would you still be interested in having a meeting? It might be a good idea to make sure our plan at least matches your needs. We could meet at the Costa at 20 Chalk Farm Road, NW1 8AG at 7:15pm, it's open until 9 and has wifi.
Best,
Leslie

_____
From: Afsana Bhuiya <afsanab2011@gmail.com<mailto:afsanab2011@gmail.com>>
Sent: Monday, January 06, 2014 1:27 PM
To: Macmillan, Leslie
Cc: Liu, Kyle; Brookes-Hocking, Nick
Subject: Re: Screenshots

Hello Guys - we are meeting tomorrow evening right?

Shall we go to a costa again or somewhere with wifi as we may need it.
Did we say Camden....i think chalk farm has a costa .....

On 18 December 2013 09:24, Macmillan, Leslie
<leslie.macmillan.13@ucl.ac.uk<mailto:leslie.macmillan.13@ucl.ac.uk>> wrote:
Hi Afsana,
Enclosed please find some screenshots of the UI of the app. The flow is as depicted in the powerpoint flowchart we sent previously. We plan to do a lot of "beautification" after we get the functionality working, so the aesthetic is not the final one. But please let us know if you have any comments or questions, thanks.
Best,
Leslie

--
Dr Afsana Bhuiya
GP

MBBS BSc DRCOG MRCP MRCGP DFSRH
Mob: 07877136123
Emails: afsanab2011@gmail.com<mailto:afsanab2011@gmail.com>,
afsana_bhuiya@msn.com<mailto:afsana_bhuiya@msn.com>,
afsana.bhuiya@nhs.net<mailto:afsana.bhuiya@nhs.net>
Twitter: @afibhu

Yesterday I was clever, so I wanted to change the world.

Today I am wise, so I am changing myself.

--
Dr Afsana Bhuiya
GP

App Update

Afsana Bhuiya <afsanab2011@gmail.com>

Fri 1/24/2014 4:40 PM

1 attachment

I am attaching an icon that may be suitable.
DOnt worry if there is no time now - but perhaps after your submission date?

Thanks.

Afsana Gmail <afsanab2011@gmail.com>

Fri 1/24/2014 8:23 AM

Ok guys thanks.
Do your best with the debugging and lets see what happens.
!

Thank you.

Sent from my iPad

Dr Afsana Bhuiya
GP
Mob: 07877136123

Macmillan, Leslie

Thu 1/23/2014 11:55 PM

Sent Items

Hi Afsana,
Regarding your comments:
1. Sure.
2. We have been working hard to debug this and it seems to be a problem with Android's code. If this is the case, the best we may be able to do is document the problem and send that report to Google

and wait for them to fix the software.
3. We have another icon we can try.
4,5. We can look into it.
6. I think it may get busy if we try to put an image on the background. Maybe if it was very transparent it would be okay, but it might be better with just a solid background.

I realize if the app crashes that is a serious problem, but even in professional software projects sometimes the tools themselves have bugs in them. This crash seems to be only on certain devices. We'll do the best we can to isolate the problem but I just want you to be prepared for the possibility that this bug might not be fixable.

Afsana Bhuiya <afsanab2011@gmail.com>

Thu 1/23/2014 2:35 PM

Hello - guys - looks much better!

I had a quick RV and a few things to suggest:

1. the blue buttons occlude the writing underneath - can you make the blue background more transparent?
2. the app crashes if you try to enter any BP readings manually - in the past - I am sure you know this. It also crashes when you try to email the report - again I am sure you know. And also when you forward date a BP it allows you to enter it - but then crashes! perhaps forward dating to be made not possible - the message could say -
3. Shall we change the BP icon on the app - so it doesn't show the generic green robot? perhaps a simple BP machine with BP_EASE written at the bottom?
4. the report is great but it appears quite small on the screen - perhaps try to spread it out over a few screens?
5. the button on the screen which starts ' you should have a machine which measures.... - can we make it larger or more centered?
6. shall i send an image to incorporate onto the first page background?

Send me another update if the crashing resolves - thanks!

Macmillan, Leslie

Wed 1/22/2014 11:37 PM

Sent Items
1 attachment

Hi Afsana,
Here's an updated version of the design. Still has bugs, we're working on that!
What do you think of it from a design perspective?

Thanks,
Leslie

Afsana Bhuiya <afsanab2011@gmail.com>

Mon 1/20/2014 11:28 PM

To:
Macmillan, Leslie;

Cc:
Brookes-Hocking, Nick;

Liu, Kyle;

You replied on 1/22/2014 11:37 PM.

Lets call it BP-Ease.

Afsana Bhuiya <afsanab2011@gmail.com>

Mon 1/20/2014 10:22 PM

Hi All -

Thanks for your update.
Ok I think a go to the ABOUT and HELP pages is fine too,
I like the name - just give me another day though, I was doing the logo and name for the other app just now - so I would like to think about this a bit more.

Please email me a 'non-crashing' version of the app when you can.

cheers.

Macmillan, Leslie

Mon 1/20/2014 9:02 PM

Sent Items

We can get rid of the password and rename the button to "Go" instead of login.
The lowest version is Android 4.1 and we expect it to work on Android tablets as most android apps should by default work on android tablets.
Creating a navigation system could add hundreds of lines of code. What if we add buttons that go to the about and help pages on the home screen?
For the name, we suggest "BPMe".
It is designed to work with bluetooth-enabled devices meeting the "IEEE 11073" format (a standard

used for personal health devices).

Afsana Bhuiya <afsanab2011@gmail.com>

Mon 1/20/2014 12:26 PM

Whoops- apologies - was quite late when i wrote that.....

1. The login thing: I think the app doesn't have true encryption - so having a login is a false concept. So the registration stuff is fine to get started but instead of being called login can it be named something else ? So registration is fine so it can produce a report - then afterwards can the user just one the app?
2. Yes - the ABOUT and HELP sections should be on different pages - under a tab at the start - I can help write stuff if needed for this section.
3. The icon needs to change- its called UCL BP monitor - as before I will produce an icon to use and a better name.
4. We need to stop it crashing!
5. The other questions remain - what is the lowest android version it can work with? does it work on tablets? does it work on all bluetooth devices?

I will work on the icon/name/background colour this evening and send this to you.

Thanks!

Macmillan, Leslie

Mon 1/20/2014 9:24 AM

Sent Items

Hi Afsana,
I have a few questions, and then to answer your other questions, I will need to talk to my groupmates.
I think your keyboard shifted or something- what did you mean "login nan it say ser! V ,"?
I'm concerned that words in the background might make other things hard to read. Could we put it on some pages or does it need to go on all?
I think there will be no problem adding a logo you design.
Thanks,
Leslie

Macmillan, Leslie

Mon 1/20/2014 9:18 AM

Afsana Gmail <afsanab2011@gmail.com>

Mon 1/20/2014 12:01 AM

Hi - yes i do !

Ok i will try this tomorrow.

Some other things that i thought about.

I think the login is a false sense of security..as you guys didn't get taught about encryption..so the front page instead of login nan it say ser! V ,

We need the name and copyright on the background.....i will get back to you on this.
We need and about and help section.

What is the lowest version this is compatible with please ?
Will it work on a tablet ?

I think i will use photoshop and design a logo i would like you guys to incorporate with ?

Sent from my iPad

Dr Afsana Bhuiya
GP
Mob: 07877136123

Macmillan, Leslie

Sun 1/19/2014 8:19 PM

Sent Items
1 attachment

Hi Afsana,
Enclosed please find our update of the app after today. I find that it is still crashing after entering manual data, but it works on Kyle's so we still have some work to do.
I'm not sure if you know this already, but our deadline has been extended until next Monday, so we should have time to work out bugs and make the interface more visually appealing.
Best,
Leslie

___

Final Code

Afsana Bhuiya <afsanab2011@gmail.com>

Sat 1/25/2014 7:40 PM

Oh wow. The video is a really well made. Good stuff.
Yes check with dean re crashing. Make sure it's not due to a different version of Android?

Cheers

Dr Afsana Bhuiya
GP

Sent from Samsung Mobile
07877136123

-------- Original message --------
From: "Macmillan, Leslie"
Date:25/01/2014 18:57 (GMT+00:00)
To: Afsana Gmail
Cc: "Liu, Kyle" ,"Brookes-Hocking, Nick"
Subject: RE: Final Code

It works fine on his phone too. On my phone it crashes. We will email Dean.

From: Macmillan, Leslie
Sent: Saturday, January 25, 2014 5:48 PM
To: Afsana Bhuiya
Cc: Liu, Kyle; Brookes-Hocking, Nick
Subject: RE: Final Code

It's strange. We were able to get it to work earlier today and even made this video:

http://www.youtube.com/watch?v=jdBKIAz7Zpc

Maybe there is a problem translating it to the apk format. Kyle will test if that is the case.

From: Afsana Bhuiya <afsanab2011@gmail.com>
Sent: Saturday, January 25, 2014 5:37 PM
To: Macmillan, Leslie

Cc: Liu, Kyle; Brookes-Hocking, Nick
Subject: Re: Final Code

Hello Team;

This version doesn't work at all.
After I installed it the app crashes after the first page and doesn't let me enter any data? The registration button doesn't work.....?

I know that time is very limited for you.

If you can fix this bug then please try.

But at this stage I cannot sign that agreement. In theory of course the app should be able to fulfil the requirements but practically you are not there yet.

I think it may be worth dropping an email to Dean for further advice as he may have some suggestions re the crashing of the app.

Good luck.

Dr Afsana Bhuiya
GP

Sent from Samsung Mobile
07877136123

Macmillan, Leslie

Sat 1/25/2014 6:57 PM

Sent Items

It works fine on his phone too. On my phone it crashes. We will email Dean.

Macmillan, Leslie

Sat 1/25/2014 5:48 PM

Sent Items

It's strange. We were able to get it to work earlier today and even made this video:

http://www.youtube.com/watch?v=jdBKIAz7Zpc
Maybe there is a problem translating it to the apk format. Kyle will test if that is the case.

Afsana Bhuiya <afsanab2011@gmail.com>

Sat 1/25/2014 5:38 PM

Hello Team;

This version doesn't work at all.
After I installed it the app crashes after the first page and doesn't let me enter any data? The registration button doesn't work.....?

I know that time is very limited for you.

If you can fix this bug then please try.

But at this stage I cannot sign that agreement. In theory of course the app should be able to fulfil the requirements but practically you are not there yet.

I think it may be worth dropping an email to Dean for further advice as he may have some suggestions re the crashing of the app.

Good luck.

Dr Afsana Bhuiya
GP

Sent from Samsung Mobile
07877136123

-------- Original message --------
From: "Macmillan, Leslie"
Date:25/01/2014 16:00 (GMT+00:00)
To: Afsana Gmail
Cc: "Liu, Kyle" ,"Brookes-Hocking, Nick"
Subject: Final Code

To:
Afsana Gmail <afsanab2011@gmail.com>;

Cc:
Liu, Kyle;

Brookes-Hocking, Nick;

2 attachments

Hi Afsana,
Enclosed please find our final version of the app.
If it is suitable, please return a signed version of the approval letter.
Thank you,
Team 35

BP MONITORING APP

Dr. Afsana Bhuiya

AIM

- Create an APP that allows almost anyone to keep a record of their Blood pressures over a given time frame so they can then report back to their GP.
- Can work in conjunction with an external BP sensory input.
- Also can work manually if sensor is broken or patient prefers to input data

Functional Requirements

- Take BP from BP monitor
- Allow manual inputting
- Allow sensory input from BP machine
- Monitor if cuff fallen off or BP readings seem flawed.
- Analyse data as per outlined in next document – with graphical presentations
- Email capacity of data to health professional
- Usable on android/apple phones

Ambulatory blood pressure monitoring

- When using ABPM to confirm a diagnosis of hypertension, e**nsure that at least two measurements per hour are taken during the person's usual waking hours (for example, between 08:00 and 22:00).**
- Use the average value of at least 14 measurements taken during the person's usual waking hours to confirm a diagnosis of hypertension

Calculations and statistics requirments

Simialr Structures in the market:

- https://play.google.com/store/apps/details?id=com.boxeelab.healthlete.bpwatch&hl=en
- http://www.amazon.co.uk/Withings-Smart-Pressure-Monitor-iPhone/dp/B004K2KYM8/ref=cm_cr_pr_product_top