**Project plan**

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1. **Introduction** 
   1. **Background**

* **What is vital sign?**

Vital signs are used in medicine to determine the severity and urgency of a patient’s health condition. The four major components are respiration, body temperature, pulse, and blood pressure. Vital signs are of great significance to the predication of serious disease such as cardiovascular and hypertension. According to the statistics from WTO, cardiovascular disease (CVDs) is the most fatal of death worldwide, the rate of death is always at the top among all disease. **[1]**. One of the most dangerous complication among the pregnancies is Hypertensive disorders (HD). According to the investigation from 38 hospitals in China, it is estimated that nearly 5.2% of all pregnancies were involved in this disease.[2]

* **Why need a monitoring system?**

Therefore, it is vital important to develop a new system to monitor the signs. Numerous investigations have been devoted to vital signs. It is proved that by the combination of machine learning with monitored data, it can improve the prediction accuracy of cardiovascular. The discovery shows that the monitoring system do have some beneficial influence on preventing diseases. **[3]** Also, there are some extra requirement should be considered. For example, for the pregnancy, bad mood symptoms may lead to many complications. Prenatal depression can cause serious complications which are harmful for both pregnancies and fetus.**[4]**

* **Gaps for current developed system?**

There are some companies have developed mobile system that for monitoring vital signs. However, the function of these systems is not mature. The Xiaomi system could only monitor hear rate and the user **cannot view tracks by period.** The Huawei system. whose data reception is **not stable** and can only monitor few of data. A common flaw in existing system is the **inability in integrating data**. This property is also essential for complete detection system.

* 1. **Motivation**

There are already many different systems on the market, such as Apple, Xiaomi, and Huawei. In general, these systems all have basic functions such as measuring heart rate or temperature. However, there is **no integrated system** designed for the pregnancy women. For example, the Xiaomi system is inadequate in monitoring heart rate, users cannot view tracks by period. For Huawei system, its data reception is unstable which may lead to the imprecision of receiving data. This cluster of data monitoring is not user friendly. An­­ ideal system should not only has the basic functions, but also has extra functions designed for the pregnancy. The system could compare the user’s data with the average data, producing line charts for user to check. Moreover, **the system could integrate all the statistics received from the devices and automatically output a report for further use.**

* 1. **Aims & Objectives**

Our main purpose aims to build a system that **integrate all data and generate a data report**. Considering the open source information currently available on the device, an Android application will be developed. The system can monitor the users’ health condition (eg. heart rate, blood pressure…) and output a report for the user. In addition, the algorithm applied algorithm developed by the PhDs and research team.

1. **Literature Review**

Wearable devices make it possible to monitor health in home and enable early detection of disease in body. The wearable devices that already used in daily lives includes wristbands, smart clothing such as smart socks and wearable healthcare bracelets, legbands, and body sensors **[5]**. The data captured by these devices (weight, heart rate, blood pressure) could be integrated for health monitoring and disease prediction. Smart sock is one of the wearable devices on the market. Abnormal foot pressures can be indications for many physical diseases such as diabetes, obesity and rheumatoid arthritis. Smart sock is designed based on that which also captured the data and analyze by its system on application **[6]**. However, an application with graphical foot pressure is need. Furthermore, the result is not accurate enough because the analysis based on single foot pressure data is too small. Wearable healthcare bracelets are also a product which are popular in recent years.

Through the bracelet, users can record real-time data of exercise, sleep and diet in daily life, and synchronize these data with mobile phones and computers, so as to guide healthy life through data. Date of daily exercise routes, calories consumed and calories consumed can also been stored by the bracelet. Nevertheless, the bracelet focuses on real-time health data such as heart rate and emergency scenarios which ignores long-term health monitoring and prediction of many chronic diseases. **[7]** **[8]**A body sensor network for mobile healthcare monitoring has been used in Australia. The body sensor measures the patients’ bio signals. The bio signals are transmitted over wireless communication links to remote locations where have experts to view the bio signals and give some advice. **[9]** This device is only suitable for patients and needs cooperation of medical experts which is difficult for promotion of public.

This device uses several vital signs for health monitoring and disease predictions. Based on enough data, it makes the result more accurate. Additionally, the data are all important data for physical condition analysis. It focuses on long term health monitoring which makes the result more accurate. In addition, the device integrates several kinds of physical data to show to the user so it is convenient and can be promoted to the public.

1. **Requirements (Haonan Chen)**
2. **Goals & Objectives**

The final goal of the project is to develop a monitoring system to **receive and integrate data** from devices.

* 1. **Requirements Specification**

Initially, the discussion was done in group to speculate users’ requirements. By attending the workshop with other group of the same project, information from testee was collected and parameters of devices are received. Finally, meeting with supervisor helps to modify requirement and affirm the goals of the subsequent project.

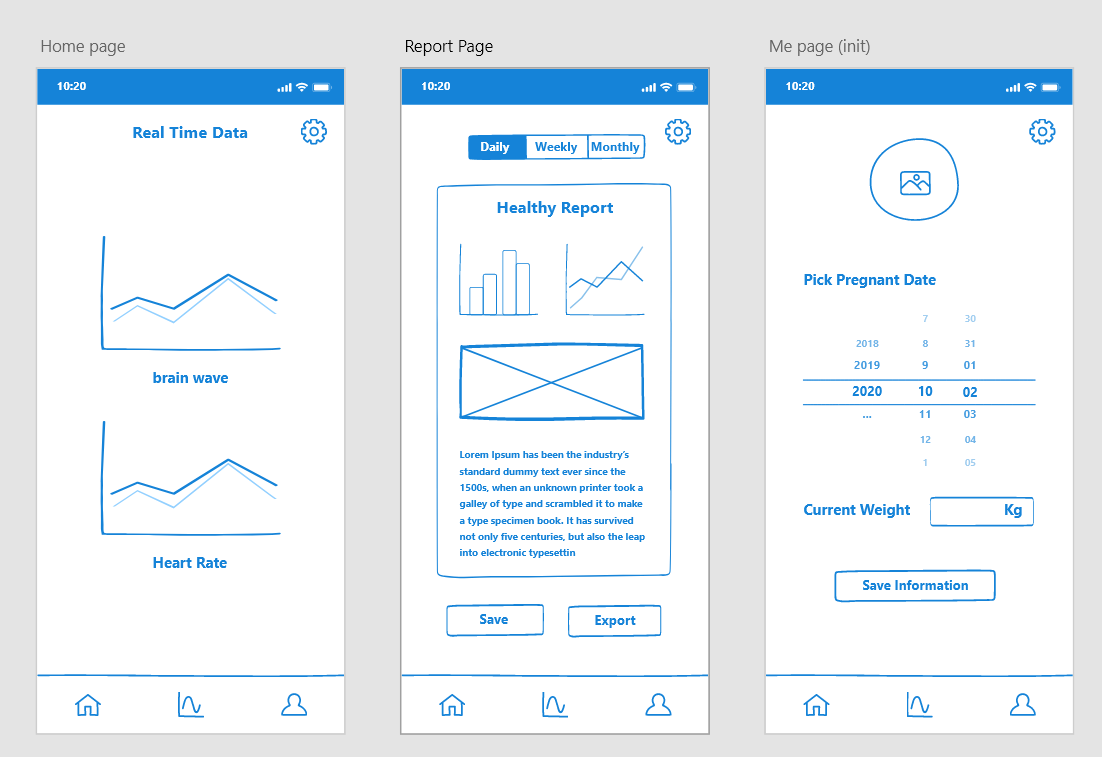
* 1. **Interim report**

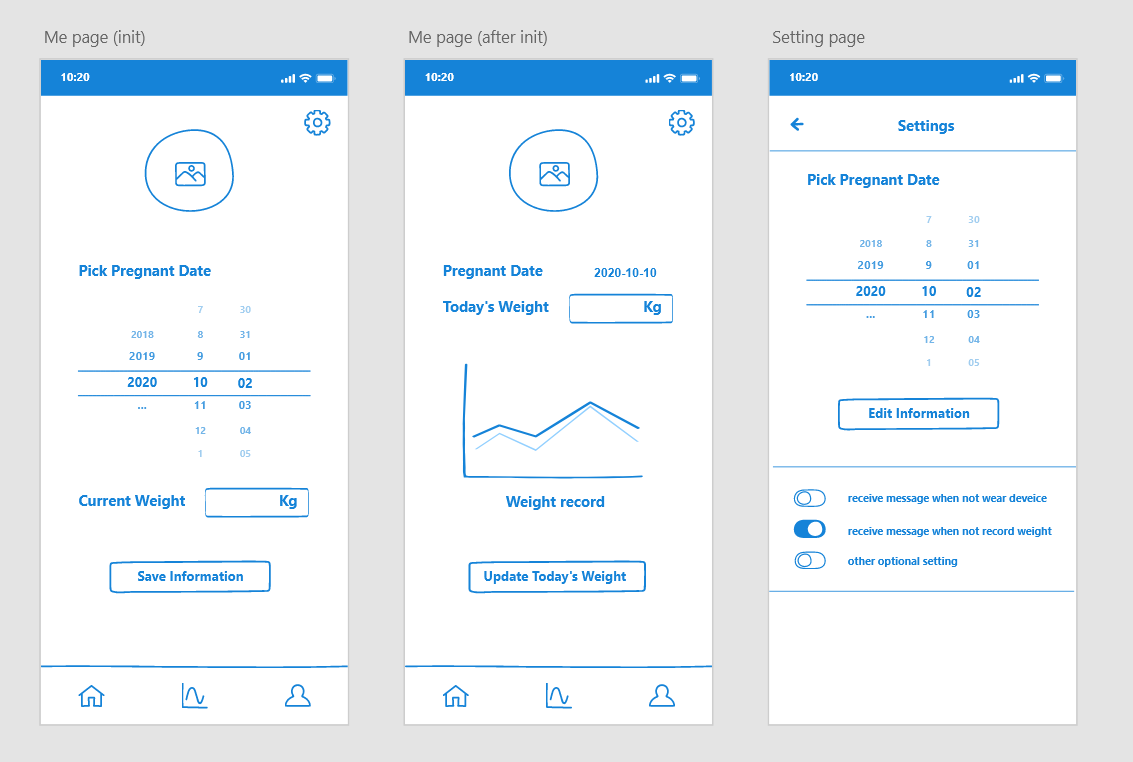
Done by the half-stage of the project. The report should include 3 main parts. Firstly, the **current stage of project** should be mentioned, including **updated and expanded description of problem**, **background information** about the research, **requirement specification** for project, **initial design** (about system, prototype, and implementation) and **key implementation decisions**. The second part is about future, which includes discussion about problem encountered and time plan for the project. The last part is details, covering project name, group members and supervisor and so on.

* 1. **System Design**

The system is designed into 5 modules, which can implement respective functions. The details about each module are shown below.

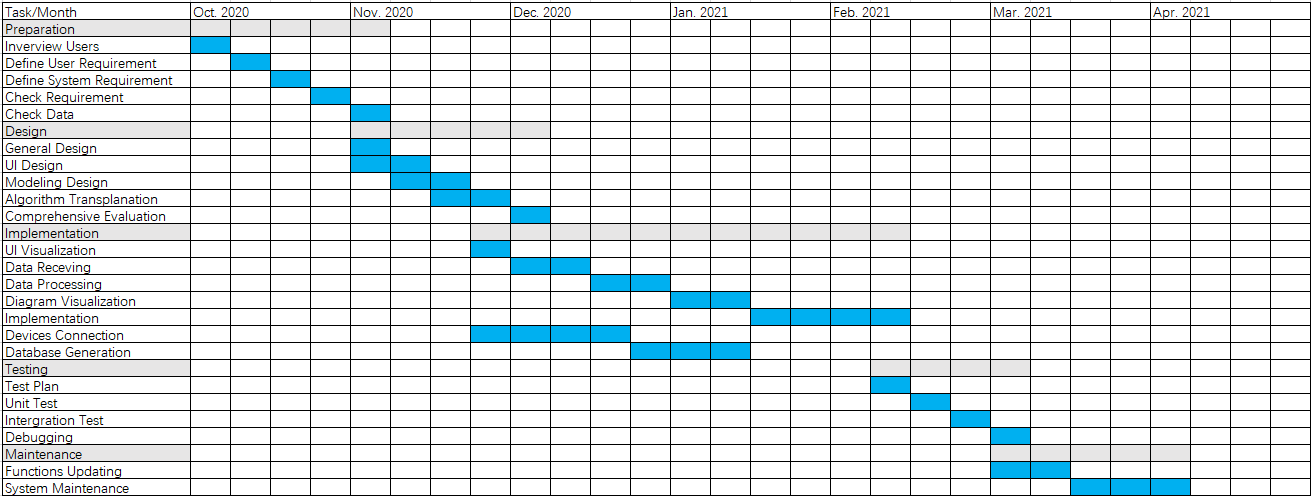
* 1. **Prototype**

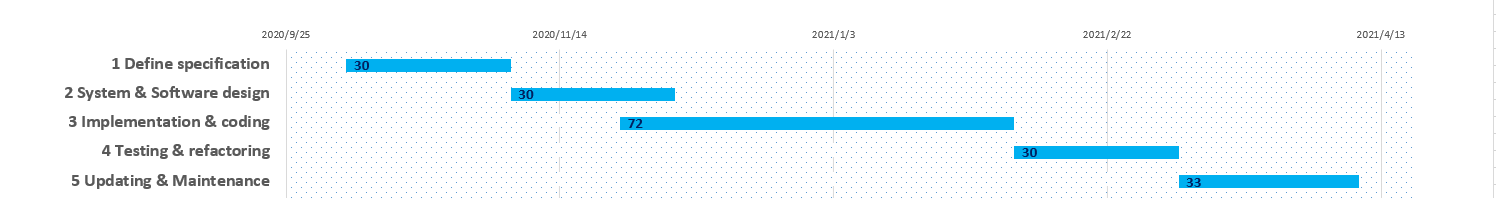
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1. **Schedule**

The graph of the whole project is shown below:



**The blue stripe is the main stages of the project.**

1. Define Specification
2. System & Software design
3. Implementation & Coding
4. Testing & Refactoring
5. Updating & Maintenance

**In the Implementation & Coding stage, we plan to divide our team into 2 groups. One group is working on the simulator and another is working on the software.**



1. The blue stipe is the total time of implementation
2. The purple stripe is the stared work.
3. The green stripe is the work of the simulator group.
4. The red stripe is the work of the software group.

**The Gannt graph is shown in the appedix.**

1. **Groups (Member Assignment)**

**Software UI: Rongjiang Yang**

**Connection: ---**

**Algorithm transplantation: Hudie Liu, Xiaotian Xia**

**Function menu: Yiyang Li, Haonan Chen**

1. **System design (Haonan Chen)**

**Data Capture module**

1. The mobile system (Android Application) can connect with the wearable devices which include heart rate belts, brain ware, smart scale, temperature sensor, breathing rate sensor, blood pressure sensor.

2. The vital signs will be measuring every minute. The vital data will be sent from wearable device to mobile application every 30 minutes.

3. The bodyweight data is captured by manual record.

4. The year and height are recorded from users.

5. The data will be sent to the integration module for the next step.

6. The connection between device and system is blue tooth.

**Data integration module**

1. The data will be updated every 30 minutes when the system collects data from wearable device.

2. The data will be processed and temporarily store in the application's memory.

3. Multiply types of data can be integration in the mobile system.

4. The received data will be stored for a month in the application memory for users' views.

5. The data will be split into different categories and shown to the users.

6. The data will be sent to the analysis module for the next step.

**Data report and analysis module**

1. Application could send a piece of message (every-day report) about the vital status analysis and advices at 8 a.m.

2. The report is about his/her body vital data. The report will include ever-day vital signs data after processing and will give some advices according to the analysis algorithm such as having more sleep or having abnormal status and need to see doctor.

3. The system could generate the report by the suggestion data and analysis algorithm daily and monthly (weekly)

4. The report could be persevered by users and exported.

**Data report and analysis module**

1. The data from users should be stored both in PC and mobile system.

2. Considering the limited memory, the details of past data will be cleaned up and the daily report will be stored in the mobile system.

3. The user could connect With the PC monthly and send the data for the long-term storage.

**Task management module (interface)**

1. The system will push the every-day reports, suggestions, and analysis at 8 a.m.

2. The system will send a message to user if user does not wear the devices.

3. The data capture function can be switch on/off.

4. The system will send a message if the user does not record the body weight until 8 p.m. every day.

5. The user can view three mode of application:

Current / last measured data

Today’s report

Long term report

settings

1. **Involving Device/Technique**

**Heart rate device**: Polar H10

**Brain ware device**: NeuroSky TGAM

**Smart scale device**: Yunmai

**Developing tools**: Genymotion simulator, Adobe XD, Android Studio.

1. **Reference**
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**Appedix.**

