Middle East University

Faculty of Information Technology

Computer Science Department

Graduation Project Final

Documentation

Smart wristband to monitor babies & toddlers health

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Acknowledgment

At the beginning, we would like to thank our project's supervisor Dr. Sharfia Murad for her support and efforts guiding us helped us to bring this project to its final form whose contribution to simulate suggestions and encouragement helped us coordinate our project and assisted us with advice that improved our skills.

Abstract

In these days, the mother's role is not limited to caring for her children only, but we see her working in addition to her primary role in caring for her children at home, where our society is distinguished by the high rate mothers working in the labour market, and mothers often resort to putting their children in nurseries, or at relatives or maids so that remains Mothers are busy thinking about the situation of their children at work time.

That is why we thought about a way that makes the mother more reassuring their children, which prompted us to think in this way that the methods that are currently in use by mothers to monitor their children such as camera or a calling them we all know that working women cannot monitor Her child is constantly while she is at work, and it was also noticed that some maids or nurseries do not treat children as good as not caring for them or beating them or not, which negatively affects children's health and psychological well-being and often this harm continues to be caused even when they grow up.

As students from the Department of Computer Science offer the role of a working woman and realize that technology and the Internet have managed to bring the distant closer, it is the first of them to bring the mother closer to her child so we have repeated a device in the form of a bracelet that is placed in the hand of the child and is linked in an application in the phone of the working mother, where the walls work on sending Notices of pulse values, pressure and temperature continuously to the mother's phone where the mother can know the condition of her child and monitor him constantly and notice any danger approaching him without needing a long time to monitor him during her work.

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Pulse oximetry: is a non-invasive method for monitoring a person's oxygen saturation. 12

SpO2: stands for peripheral capillary oxygen saturation, an estimate of the amount of oxygen in the blood 12

Body temperature: the degree of sensible heat or cold, expressed in terms of a specific scale. Body temperature is measured by a clinical thermometer and represents a balance between the heat produced by the body and the heat it loses. Though heat production and heat loss vary with circumstances, the body regulates them, keeping a remarkably constant temperature. An abnormal rise in body temperature is called fever. 12

Microcontroller: an integrated circuit that contains a microprocessor along with memory and associated circuits and that controls some or all of the functions of an electronic device (such as a home appliance) or system. 12

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List of Definitions, Acronyms, and Abbreviations

Heart rate: The number of heartbeats per unit of time, usually per minute. The heart rate is based on the number of contractions of the ventricles (the lower chambers of the heart). The heart rate may be too fast (tachycardia) or too slow (bradycardia).

The pulse: is a bulge of an artery from waves of blood that course through the blood vessels each time the heart beats. The pulse is often taken at the wrist to estimate the heart rate.

Pulse oximetry: is a non-invasive method for monitoring a person's oxygen saturation.

SpO2: stands for peripheral capillary oxygen saturation, an estimate of the amount of oxygen in the blood

Body temperature: the degree of sensible heat or cold, expressed in terms of a specific scale. Body temperature is measured by a clinical thermometer and represents a balance between the heat produced by the body and the heat it loses. Though heat production and heat loss vary with circumstances, the body regulates them, keeping a remarkably constant temperature. An abnormal rise in body temperature is called fever.

Microcontroller: an integrated circuit that contains a microprocessor along with memory and associated circuits and that controls some or all of the functions of an electronic device (such as a home appliance) or system.

Chapter I:
Software Project Management Plan

1. Introduction

New parents are anxious, here is advice: You may need to monitor the child. A healthy child who does not suffer from something can suddenly become ill, whose pressure may decrease, the rate of oxygen may decrease, or his heart rate will accelerate ... etc.

Here's the solution, a wearable device that keeps you informed of your child's health. A baby monitor, also known as a baby alarm, is a wireless system used to check a child's heart rate and oxygen. It is a device that a child can wear. Through notifications that the device sends through the application to the mother.

One of the primary uses for baby monitors is to keep the baby healthy and keep the mother up to date, although commonly used, many doctors believe it provides a false sense of safety.

Heartbeat and body temperature monitoring will detect the heartbeat using a pulse sensor and body temperature using a sensor.

Today the baby monitor is a device that parents are expected to have in practice. You can find baby monitors in the list of all parents they should have.

There is a good reason for all of this: Monitor your child's health while staying away from him. An invaluable tool in preventing unfortunate accidents

Modern baby monitors come with a lot of great features that you may not be familiar with. Technology has become an integral part of our lives and has improved a lot. You can't remember everything, especially as a parent. Fortunately, smart phones and tablets can serve as baby monitors.

You should take some time to research what modern devices have to offer and determine the functions you primarily care about before purchasing one. You can read and learn more about the modern baby monitor features here.

1.1 Project overview

We worked on our project on a smart bracelet that works on measures the heartbeat of the child and the rate of oxygen, and we have linked the bracelet to the app on the phone. We did a statistic and it turned out that more mothers will benefit from it. This is what we want.

1.2 Project deliverables

During the project life-cycle, several documents need to be produced and delivered to the supervisor and then to the registry department. All these documents should be written according to the software engineering standards. All products that will be delivered are mentioned in Table 1.1

Deliverable	Date
Problem Definition	**9/4/2020**
Project proposal	**16/4/2020**
Software Requirements Document (SRD)	**16/4/2020**
Database design	**14/5/2020**
Graphical User Interfaces (GUIs)	**18/5/2020**
Software code	**10/12/2020**
Integrated systems	**20/12/2020**
Test cases	**1/1/2021**
Deployment package	**4/1/2021**

Final documentation	**16/1/2021**

Table 1.1: Project Deliverables

1.3 Evolution of this document

This document will be updated as the project progressed, as shown in Table 1.2.

Milestone	Milestone Goal
Concept approval	Feasibility studies and basic system concepts have been approved by management and the project is authorized to proceed to detailed requirements definition.
Requirements review	Requirements specifications are complete, correct, approved and suitable for input to design.
Refinement of Diagrams	After the completion of requirements specification each requirement represent a structured specification (UML diagram)
Test plan review	Test plans are adequate for the testing of all product features, are approved and are suitable for input to the development of test cases and test procedures.
Final Project Plan	Completion and approval of a plan.
Implementation	The software product (or one of its components) has been built and it runs.

Table 1.2: Document Update

2. Project organization

This section describes the organizational structure of subsystem and cross-functional teams. The boundaries of each team and of the management are defined and responsibilities assigned. Communication roles, such as liaisons, are also described in this section. Finally, the software process model used in the project is described. By reading this section developers are able to identify the participants in other teams they need to communication with.

2.1 Process model (methodology)

In this project we used the Waterfall model, for each phase must be fully completed before the next phase can begin as shown in Figure 1.1.

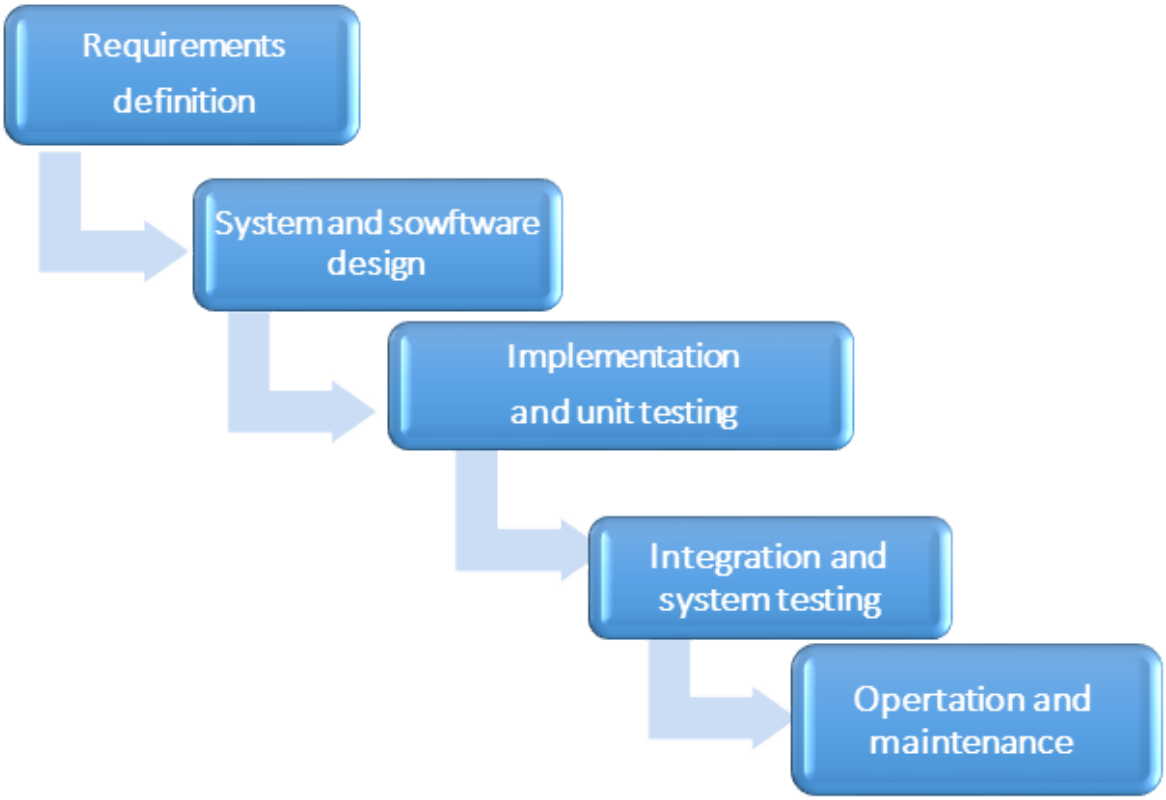


Figure 1.1: Waterfall Model

2.2 Organizational structure

Our team is to assume the responsibilities related to the idea of the project mentioned above and the structure presents the responsibilities of each member of the team as shown in Table 1.3.

NAME	ROLE	DESCRIPTION
Dr.Sharefa Murad	Project Supervisor	Manage the whole system life-cycle, and ensure the completion of the project in the available time, within budget.
Mohammad Abu-hummos	Team Leader	1. Problem definition 2. Project Proposal 3. Data Gathering 4. Requirements 5. Design 6. Requirement analysis 7. Developer
Ansam Al-Olidat	Team Member	1. Problem definition. 2. Project Proposal 3. Requirements 4. Data Gathering 5. Design 6. Developer
Sarah Abdelkader	Team Member	1. Problem definition 2. Project Proposal 3. Data gathering 4. Developer
Amjad Nasseralden	Team Member	1. Problem definition 2. Data gathering

		3. Developer

Table 2:Organizational structure

Table 1.3: Organizational structure

The team leader will be responsible for the communication between each team member for a particular phase and meetings will be conducted by the leader for proper interaction. The documentation will be done by individual who has been assigned with their respective task.

2.3 Organizational boundaries and interfaces

We will use a waterfall model to fulfil the project shown on the Figure, on this model we can't go to any process before completing all the preceded process, and the user can see the first version of the system only when it is completed, also we can't make any change on the process until we finish all processes. To use this model successfully, we must collect system requirements correctly, accurately and completely.

General design have two part which is:
Part 1: Baby Bracelet

Step1: The child wears the Bracelet.
Step2: Turn Bracelet On.
Step3: Read The Data.

Part 2: Parents

Step1: Create An Account.
Step2: Log in into Account.
Step3: Create A Baby Account.
Step4: Read vital sign.

2.4 Project responsibilities

All members of the team will be involved in all phases of the project as shown in Table 1.4

Activity	Contributors
Scheduling and keeping track of meetings	Dr. Sharefa Murad
Introduction	Ansam Al-Olidat and Sarah Abdelkader
Process	Dr. Sharefa Murad
Preliminary Requirements	Mohammad Abu-hummus
Functional Requirements	Ansam Al-Olidat
Non Functional	Sarah Abdelkader
Network diagram	Mohammad Abu-hummos
Context diagram	Amjad Nasseralden
State diagram	Sarah Abdelkader
Final Document	All Students

Table 1.4: Project responsibilities

3. Managerial process

In this project, the administrative process is dealt with through a set of points:

3.1 Management objectives and priorities

The objectives of the administration for the completion of this project are: Planning, Organizing, Directing, Coordinating, and Reporting. The management priority is to deliver the product in time and of high quality. Team Members work together to achieve this by respectively checking that progress is made as planned and monitoring the quality of the product at various stages.

3.2 Assumptions, dependencies, and constraints

We have designed this project through a set of requirements and a set of assumptions, dependencies and constraints to suit the objectives and characteristics of the project, and are illustrated through these points:

3.2.1 Assumptions

There are a number of important assumptions to complete this project as follows:

- Baby: We assume that Baby has bracelet, and internet connection
- Parent: The User is supposed to be familiar with mobile applications

3.2.2 Dependencies

- The main dependence is on the bracelet. (Store vital signs in database)
- It depends on the mobile application that determines if there is a danger to the.

3.2.3 Constraints

This project consists of several constraints that limit the process of completion on time and can be identified in the following points:

- The battery and power consumption.
- The time it takes for the bracelet to send data to the application
- Internet connection via Wi-Fi

3.3 Risk management

	Risk	Solution
1	bracelet size the pieces can be larger than our expectations	This problem can be solved by Full shape change
2	The material quality may not be waterproof	Look for waterproof material to be of high quality.
3	An event of the server failure	There is a backup feature for all the data in this system.

Table 1.5: Risk management

Monitoring and controlling mechanisms

3.3.1 Gantt Chart

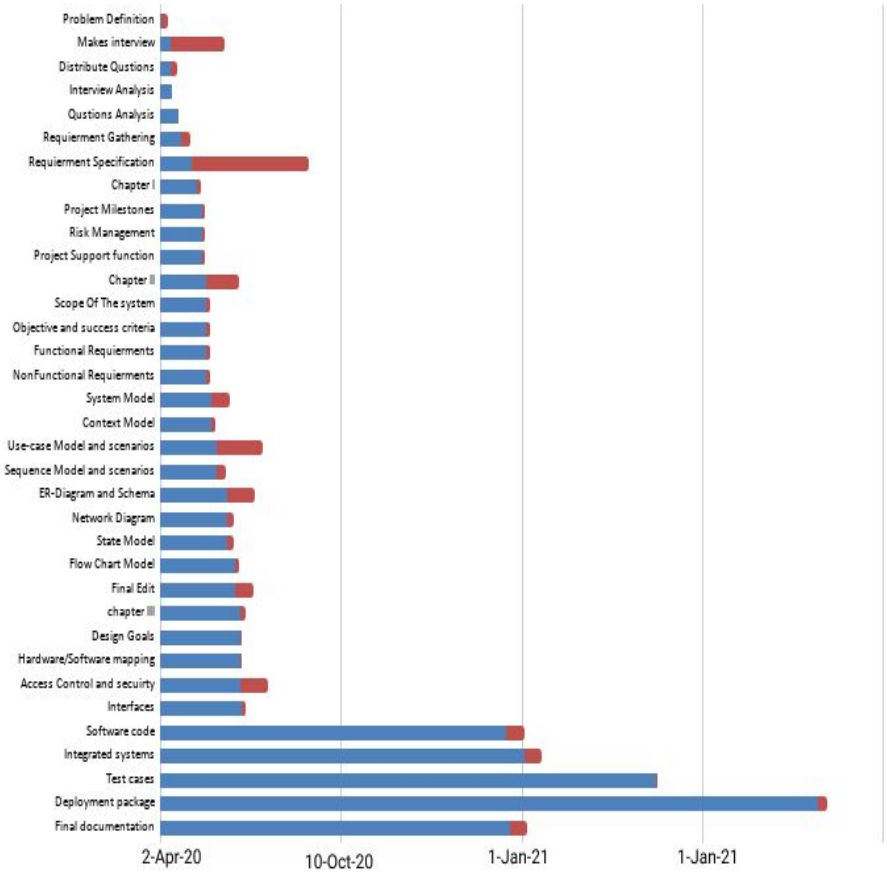


Figure 1.1: Gantt chart

3.3.2 Project metrics

Every week, the work done by the members needs to be administrated. Each team member has to fill in their hours on a web-based log. This log needs to be filled every Sunday. A week starts at Saturday and ends at Wednesday.

The team leader sends an email to the project supervisor every week, containing the hours spend on the different work packages and the hours spend on following categories: general project related, documentation, specification, design, consolidation and rework. Further, for every work

Package, an estimation of remaining hours is added

4. Technical process

4.1 Methods, tools, and techniques

This system will be built through a variety of methods and techniques:

- Mobile app programming language: we use JavaScript framework (React Native).
- Node MCU programming language: we use c.
- Database in the system we use Firebase.
- The illustrations in this project of great importance for tracking the progress of work, and the flexibility to deal with problems where we used Microsoft Office Visio.

This project hardware described below in Table 1.6.

Hardware	Specifications
Smartphone	● Operating system: android or IOS ● Smartphone must have internet connection
Microcontroller	Must be small in size and contain Wi-Fi
Router	Each bracelet must be next to Router
body temperature sensor	● Within a range of 0 to 50 Celsius and Accuracy - + 0.25 ● Low power consumption
Pulse oximeter heart-rate sensor	● Must be small in size ● Low power consumption

Table 1.6: Hardware

4.2 Software documentation

4.2.1 Expertise/software:

Office Professional
Adobe Photoshop
React Native
JavaScript
C
Firebase
Figma
Microsoft Visio

Table 1.7 Software

4.2.2 Software and Hardware costs:

Software and Hardware	Software and Hardware cost
Office Professional	**Free**
Adobe Photoshop	**Free**
React Native	**Free**
Firebase	**Free**
Figma	**Free**
Microsoft Visio	**Free**
BREADBOARD 170 TIE-POINT	**1JD**

NODEMCU	**13 JD**
LM35	**2 JD**
40 Wires Female To Male	**1.5 JD**
MAX30100	**12 JD**
7.4-2000MAH-Lithium Battery	**11 JD**
Total	**40.5JD**

Table 1.8: Software and Hardware costs

4.3 Project support functions

In addition to project management, there are three other administrative functions, which can be developed as follow by Team Leader:

- Manage System Configuration: The purpose of this point is to re-plan, organize and arrange to suit the requirements of the project.

- Verification: This point indicates the effectiveness of the system and the effectiveness of the software used.

- Quality and performance assurance: All documents must be tested to meet the requirements of this project and to ensure its quality

Chapter II:
Requirements Analysis Document

1. Introduction

The first section of the RAD is an Introduction. Its purpose is to provide a brief overview of the function of the system and the reasons for its development, its scope, and references to the development context (e.g., reference to the problem statement written by the client, references to existing systems, feasibility studies). The introduction also includes the objectives and success criteria of the project.

1.1 Purpose of the system

The main purpose of the child care system is to monitor children in homes or nurseries Especially children with diseases. And help parents monitor their children from anywhere without worrying, and if there is any risk to the child's health the application will send a notification immediately to the parents.

1.2 Scope of the system

This system is a monitoring system that helps parents to monitor their infants body temperature, oxygen saturation and heart rate through a smart phone application that is connected to an electronic bracelet placed on the infants wrest which is constantly providing readings to the application giving the parents the ability to monitor their infants vital signs from anywhere.

1.3 Objectives and success criteria of the project

The objectives of this project are to focus on child health and facilitate the process of remote monitoring of children and the criteria for its success are complemented in these points:

1 - High accuracy of readings.
2 - Small practical size.
3 - Correct handling of the situation in emergency case.

2. Current system

Wannenburg and Malekian, designed a Body Sensor Network for Mobile Health Monitoring, a Diagnosis and Anticipating System project that can monitor heart rate, saturation of oxygen and body temperature and by using a Bluetooth communication technologies to synchronize and display these information into a smartphone or a standard computer.

Such device gathers data from users and displays some related graphs in order to encourage users to remain aware of their health condition by providing a week to week feedback, they receive these results for their heart rate to verify the heart rate accuracy and measurable range.

The device is compared with an off-the-shelf pulse oximeter, both the device and off-the-shelf pulse oximeter were connected to 4 test subjects and were both measured and logged data for one minute and the results showed that the device can successfully measure heart rate with an accuracy of 7BPM For the 203 samples taken. A 90% confidence interval was used to exclude any outliers and false measurements and they got these Results for body temperature to measure the accuracy of the DS18B20 digital temperature sensor it was compared to a Totonac T802C temperature sensor.

The Totonac T802C sensor plugs into a multi-meter and gives an output of 1 mV/ºC. A stopwatch was used to perform readings at set times.

The T802C uses a type K thermocouple which has been calibrated and has an accuracy of ±0.1 ºC and a resolution of 0.1ºC, while the DS18B20 is a digital temperature with an accuracy of 0.01 ºC. Based on what is observed in the graph both temperature sensors follow the exact same trend, this trend is a decreasing since water is cools down over time.

Even though both sensors follow the same trend the DS18B20 is always approximately 0.25 ±ºC higher than the T802C concluding that it is accurate to 0.25 ±ºC.

3. Proposed system

We will design a bracelet that measures the body temperature, oxygen saturation and heart rate by a set of sensors and a Microcontroller, We will present as follows:

3.1 Microcontroller

What is a Microcontroller?

The microcontroller development board also known as Single board microcontroller. Nowadays it is very simple and cheap to develop a single board microcontroller development kit. So many open source software (IDEs) available to develop a microcontroller boards in order to develop a real time application.

- **A Comparison between Microcontrollers**

Here we are comparing between microcontrollers that are available in the market:

3.1.1 Arduino UNO

Arduino is the most popular open-source electronics prototyping platform to create interactive electronic applications. The Arduino UNO board contains everything needed to support the microcontroller. The Arduino UNO microcontroller board is very familiar to absolute beginners and experts. It should consider to be one of the first microcontroller based development boards. The Arduino UNO R3 is simplest and the most powerful prototyping environment based on the ATmega328P microcontroller (elprocus, 2020).

Figure 2.1: Arduino UNO

Features

- 32 KB of Flash memory
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limits): 6-20V
- Digital I/O Pins: 14
- Analog Input Pins: 6

The reason for its popularity is, it has an open source IDE to develop sketches, with a simple syntax based on 'C' language, and the code is easy to learn.

3.1.2 Raspberry Pi Development Board

The raspberry pi Development Board is small (like a size of a credit card computer. The raspberry pi can be easily plugged in to monitor, computer or your TV. Also, it uses standard keyboard and mouse. Even non-technical users depend on it for configuring their digital media systems and surveillance cameras. Raspberry Pi 3 is certainly the most affordable and powerful computing platform.

Figure 2.2: Raspberry Pi

The recently launched Raspberry Pi 3 included

- Processor: 1.2GHz, 64-bit quad-core ARMv8 CPU
- 802.11n Wireless LAN
- Bluetooth 4.1
- Bluetooth Low Energy
- 1GB RAM
- 40 pins

3.1.3 Arduino Nano

Arduino Nano is a microcontroller board designed by Arduino.cc. The microcontroller used in the Arduino Nano is Atmega328, the same one as used in Arduino UNO. It has a wide range of applications and is a major microcontroller board because of its small size and flexibility (theenggprojects, 2018).

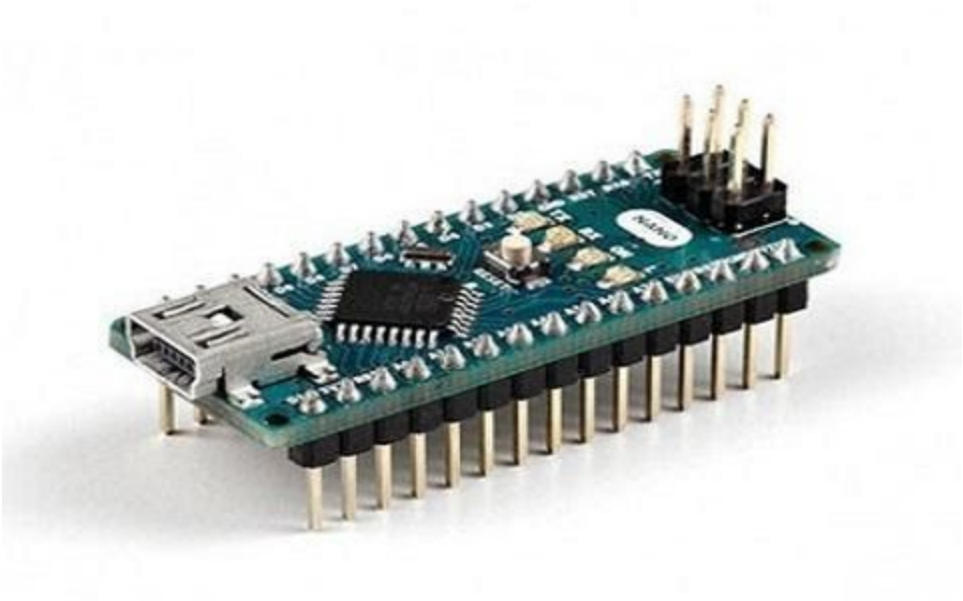


Figure 2.3: Arduino Nano

So, now let's have a look at its basic features:

- It has 22 input/output pins in total.
- 14 of these pins are digital pins.
- Arduino Nano has 8 analogue pins.
- It also has a mini USB Pin which is used to upload code.
- It also has a Reset button on it.

3.1.4 NodeMCU

Open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit).
The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits.

Both the firmware and prototyping board designs are open source (NodMcu, 2013-2020).

The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS.
Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially was based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications (Wikipedia, 2020).

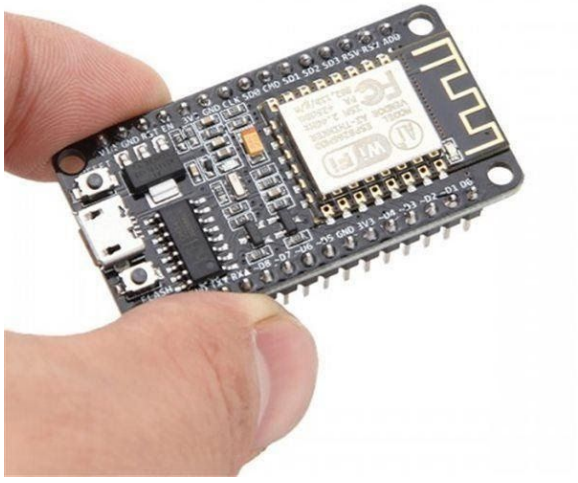


Figure 0.4:ESP8266 NODEMCU V3

Features:

- Wireless 802.11 b / g / n standard
- Built-in TCP / IP protocol stack to support multiple TCP Client connections (5 MAX)
- AD0: 1 channel ADC
- Power input: 4.5V ~ 9V (10VMAX), USB-powered
- Transfer rate: 110-460800bps
- Working temperature: -40 ℃ ~ + 125 ℃
- Drive Type: Dual high-power H-bridge driver

Which one we choose and why?

We chose ESP8266 NODEMCU V3 for the following reasons:

- Low price.
- Easy to use and develop with.
- Almost 3 times smaller compared to other boards
- Built in on-board Wi-Fi module.

3.2 Sensors

3.2.1 MAX30102

The MAX30102 is an integrated pulse oximetry and heart-rate monitor module. It includes internal LEDs, photodetectors, optical elements, and low-noise electronics with ambient light rejection. The MAX30102 provides a complete system solution to ease the design-in process for mobile and wearable devices.

Figure 2.5:MAX30102

Features:

- Heart-Rate Monitor and Pulse Oximeter Sensor in LED Reflective Solution.
- Tiny 5.6mm x 3.3mm x 1.55mm 14-Pin Optical Module, Integrated Cover Glass for Optimal, Robust Performance.
- Ultra-Low Power Operation for Mobile Devices, Programmable Sample Rate and LED Current for Power Savings.

3.2.2 Body Temperature Sensor

What is a Temperature Sensor?

- A temperature sensor is a device, typically, a thermocouple that provides for temperature measurement through an electrical signal. A thermocouple (T/C) is made from two dissimilar metals that generate electrical voltage in direct proportion to changes in temperature.
- **A Comparison between Temperature Sensors**

1. LM34 Temperature Sensor

The LM34 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Fahrenheit temperature.

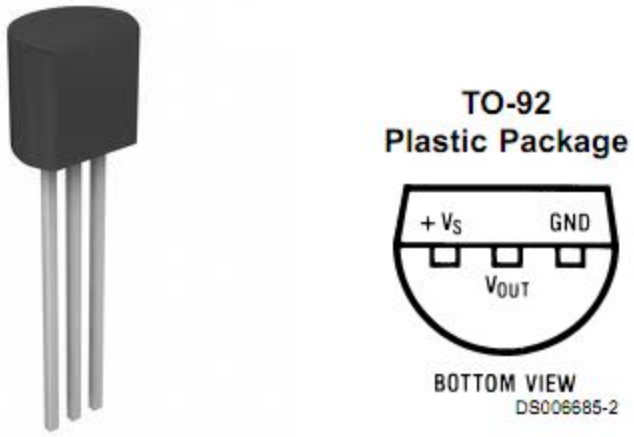


Figure 2.6:LM34 Temperature Sensor

The LM34 thus has an advantage over linear temperature sensors calibrated in degrees Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Fahrenheit scaling (Instruments, 2017) .

2. LM35 Temperature Sensor

LM35 is an analog linear temperature sensor. Its output is proportional to the temperature (in degree Celsius). The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every oC rise or fall in temperature. It can be operated from a 5V as well as 3.3 V supply and the stand by current is less than 60uA.

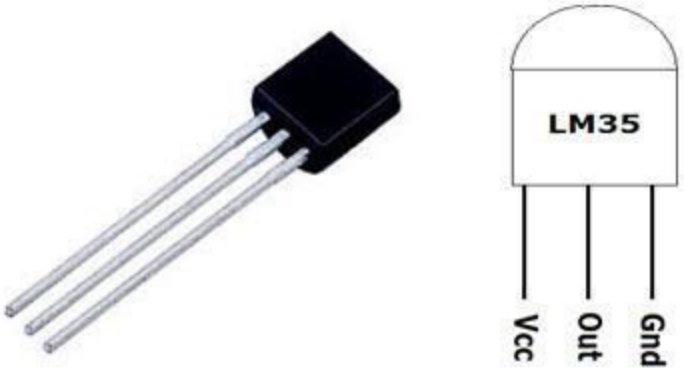


Figure 2.7:LM35 Temperature Sensor

LM35 is available in 3 series variations namely LM35A, LM35C and LM35D series. The main difference is in their range of temperature measurements. The LM35D series is designed to measure 0 to 100 degree Celsius, whereas the LM35A series is designed to measure a wider range of -55 to 155 degree Celsius. The LM35C series is designed to measure from -40 to 110 degree Celsius (Instruments, 2017).

Which one we choose and why?

We chose LM35 for the following reasons:

- Designed to measure 0 to 100 degree Celsius
- The range is less than other sensors and

3.3 Requirements Gathering

3.3.1 Mothers questionnaire

We have distributed a questionnaire using different social networking sites in order to know the views of mothers about our new product that we will design to serve both mother and child, after analysing the application of mothers' opinions, we reached these results.

As approximately 755 women answered different questionnaire questions:

It was noticed through their response to the question that the percentage of working women is as high as it was (85,7% which equal 655 worker women) as the figure explained that:

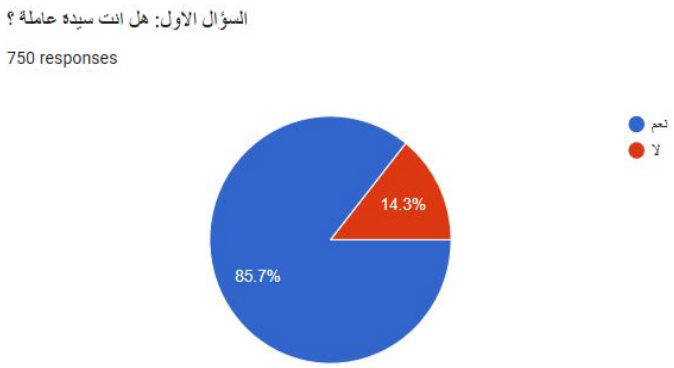


Figure 2.8: mother's questionnaire - question one

Which reflects to us the importance of this product and its ability to serve a large group of mothers.

It has been observed through a questionnaire that the proportion of children under the age of one constituted approximately (81, 2% which equal 609 worker women) which encourages us to design the product as the figure explained that:

Figure 2.9: mothers questionnaire - question two

And because we wanted to know where the majority of working mothers are giving birth to their children during their work, we were asked about it, and the majority of the answers were with relatives with percentage(83,3% which equal 617 worker women) as the figure explained that :

Figure 2.10: mothers questionnaire - question three

And to find out how the mother needed to check on her children while she was away from them, so we asked the mothers about the use of the phone and camera for this purpose and the results of the following rate of use of the phone by mothers for more than twice was as follow (74.8% which equal 617 worker women) and the percentage for the mother who was using camera about (97,2% which equal 558 worker women) as the figure explained that:

Figure 2.11: mother's questionnaire - question four

Figure 2.12 mother's questionnaire - question five

To find out how often the mother used the phone and opened the camera during her work, we asked the mothers how many times they did it and the results was about (64.2% which equal 476 worker women) as explained in the figure:

Figure 2.13: mother's questionnaire - question six

Because we wanted to know about the satisfaction about the using of camera by the mother the majority of mother don't agree about (70, 0% which equal 532 worker women) with this method which lead to positive impact to design our product as the figure explained that:

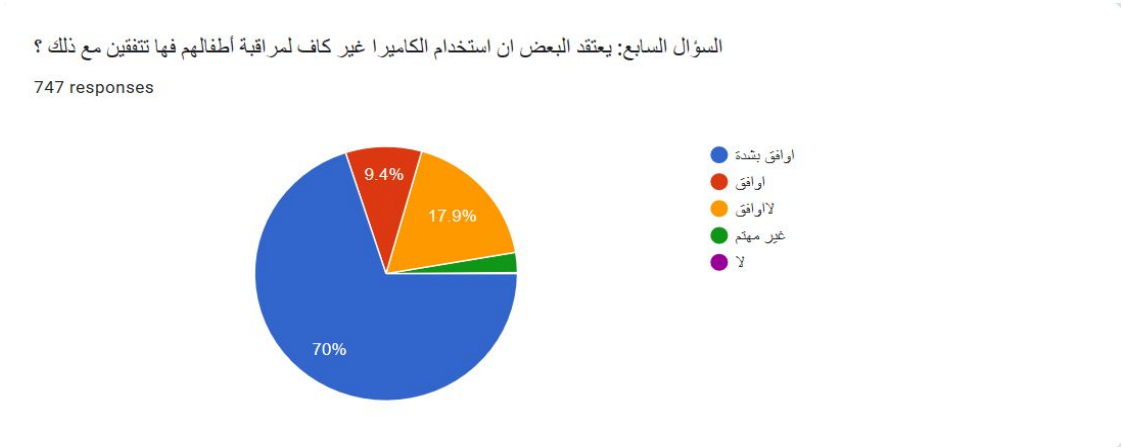


Figure 2.14: mother's questionnaire - question seven

And because we wanted to know how effective the camera is in using it to check on children we asked mothers when there was a problem for their children and they didn't know about it because they didn't open the camera and the results was about (80.0% which equal 596 worker women) as explained in the figure:

Figure 2.15: mother's questionnaire - question Eighth

And because we wanted to know the opinions of mothers and the extent to which they accept a new product to check on their children we asked them about introducing new product , so the results were almost (79.5% which equal 595 worker women) and the result confirms the importance of introducing a new product as figure showed that :

Figure 2.16: mother's questionnaire - question ninth

By asking working mothers a set of questions that gave them a description of our product, we found the following:

It's almost about (82.2% which equal 614 worker women)mothers who want to get alerts about their children's condition over the phone as the figure showed that :

Figure 2.17: mother's questionnaire - question tenth

And that percentage (85.9% which equal 644 worker women) of mothers agreed to use fences to measure temperature and pressure as the figure showed that:

Figure 2.18: mother's questionnaire - question eleventh

But at a price ratio, a majority of women (59.3% which equal 443 worker women)would prefer the estimated price to be between 10-20 dinars as the figure showed that :

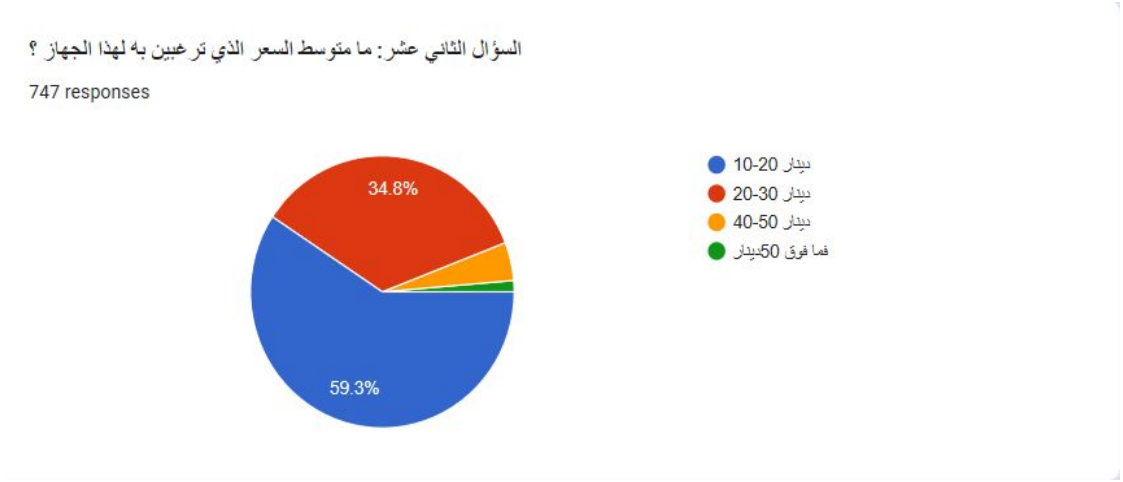


Figure 2.19: mother's questionnaire - question twelfth

Based on that, we conclude that the project will serve a large percentage of mothers and achieve the required benefit from it.

To view the questionnaire click on the link :

https://docs.google.com/forms/d/e/1FAIpQLScMHZvVfSIuQ_1LgEVJkCWoR4yQ-QmI-3rsaQjWkoLMhf2NKA/viewform?vc=0&c=0&w=1&usp=mail_form_link

(mother's questionnaire , 2020)

3.3.2 The Second questionnaire

We distributed a questionnaire using the various social media sites in order to know the views of the owners of child care homes about our new product that we will design to serve both mothers and supervisors, after the analysis we reached these results about 14 people answered the various survey questions:

The following ratios were observed through their response to the first question, as shown in the figure:

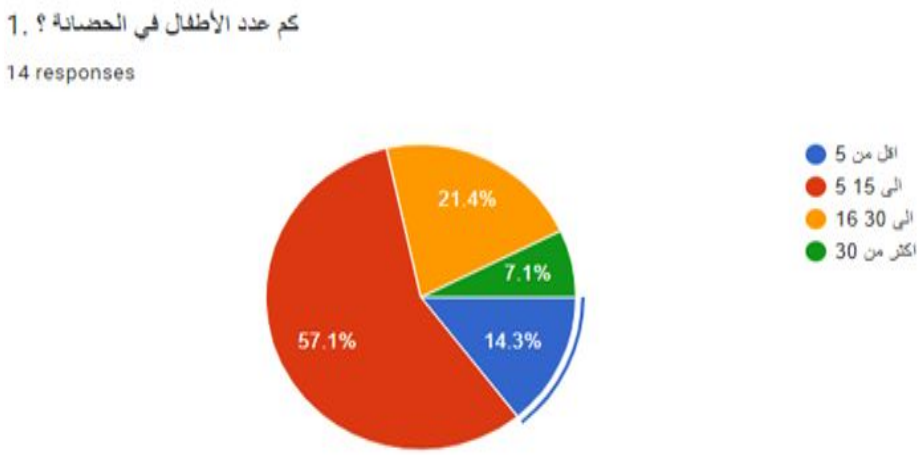


Figure 2.20: children nursery's questionnaire - question one

It was noted through the questionnaire the number of children under one year of age in each nursery the following ratios as shown in the figure:

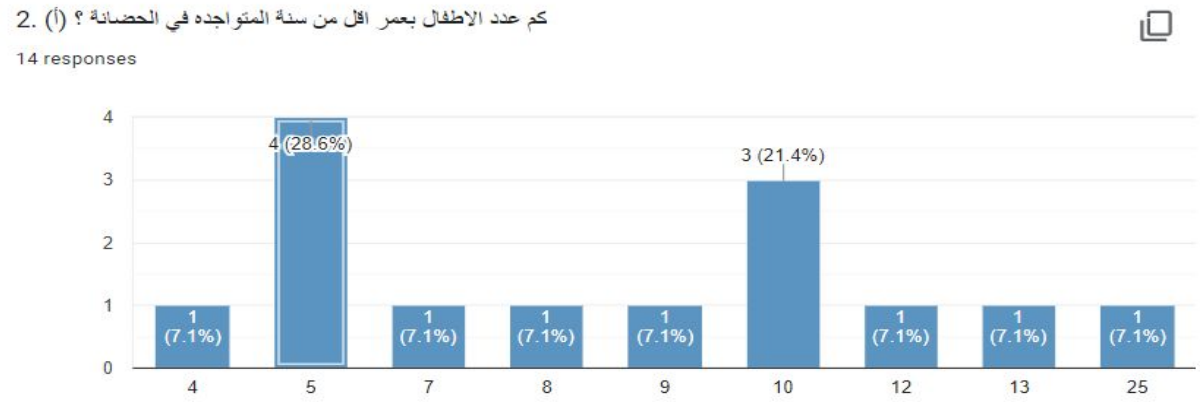


Figure 2.21: children nursery's questionnaire - question two

It was noted through the questionnaire the number of children from the age of one to three years in each nursery the following ratios as shown in the figure:

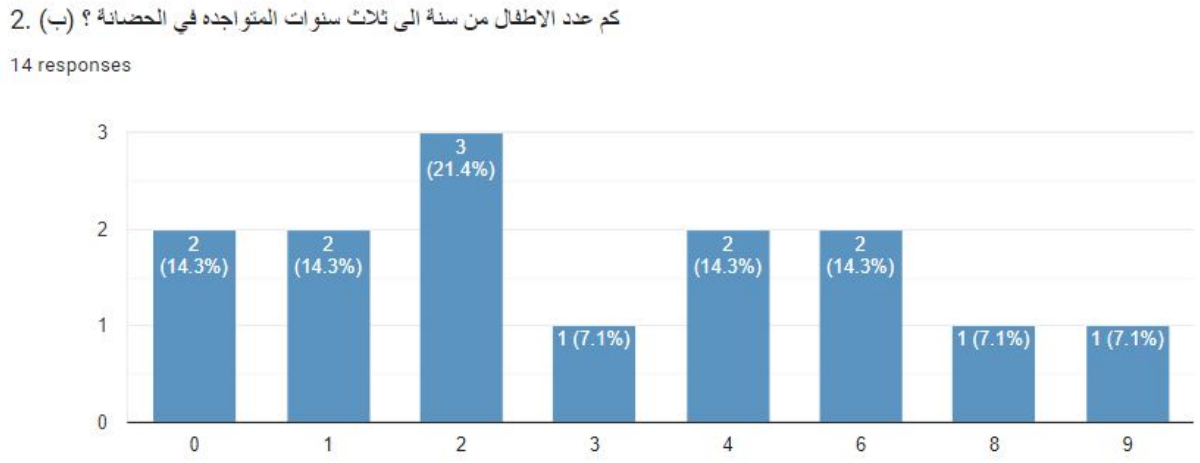


Figure 2.22: children nursery's questionnaire - question three

It was noted through the questionnaire the number of children from the age of four years or more in each nursery the following ratios as the figure shows:

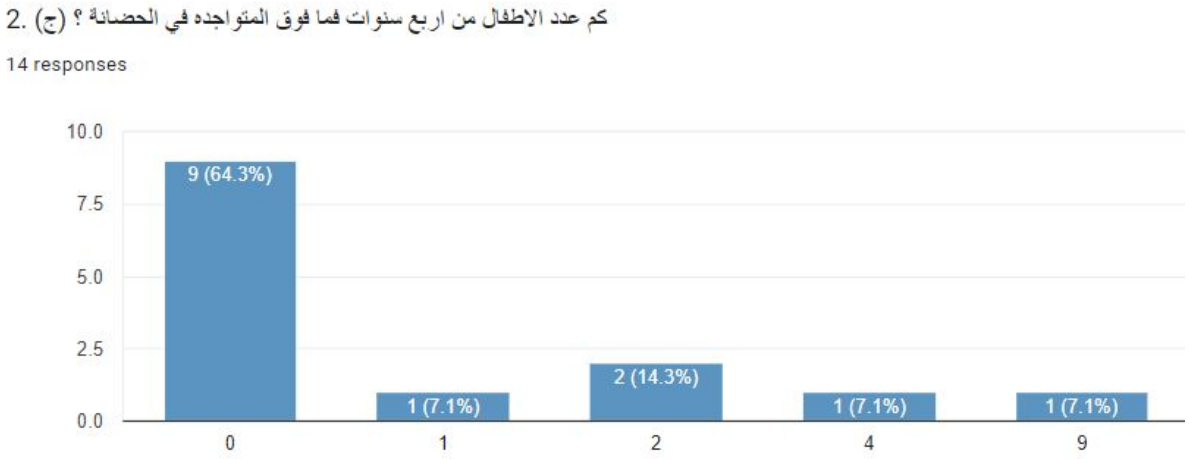


Figure 2.23: children nursery's questionnaire - question four

We also learned the ratio of the number of female supervisors responsible for children, and obtained the following ratios:

Figure 2.24: children nursery's questionnaire - question five

We also got to know each supervisor responsible for how many children and we also got the following percentages:

Figure 2.25: children nursery's questionnaire - question five

It was found out that there is a nurse in charge of health and safety in the care home, we obtained the following ratios:

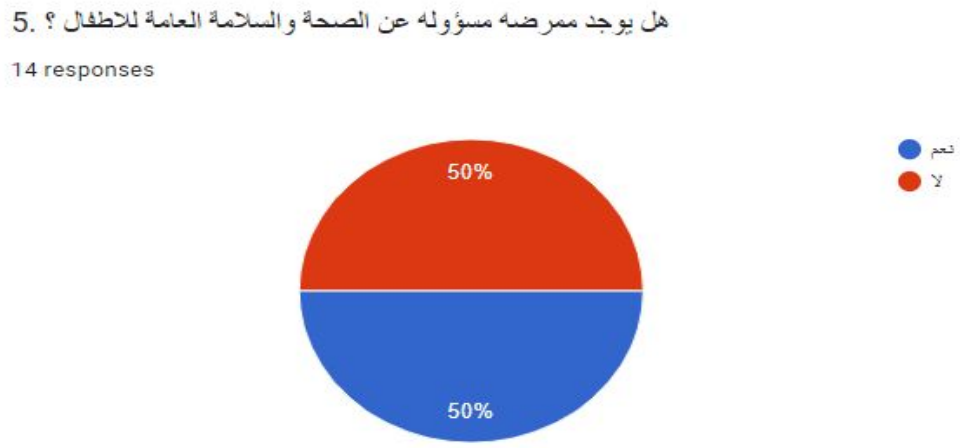


Figure 2.26: children nursery's questionnaire - question six

And in the absence of a nurse, what is the procedure that is taken, and the largest percentage was contacting me, the guardian, as explained:

Figure 2.27: children nursery's questionnaire - question seven

We also learned in the event of a change in the state of health of a child, would they inform the parents, and the percentage was 100% as shown:

Figure 2.28: children nursery's questionnaire - question eighth

We also asked when the parents would call to check on their children, the ratios were as follows:

Figure 2.29: children nursery's questionnaire - question ninth

Also, we asked the question if there is a bracelet in the form of a bracelet placed in the child's hand to measure pressure and temperature and send it to the phone responsible for the child and the mother constantly and the answer was as follows:

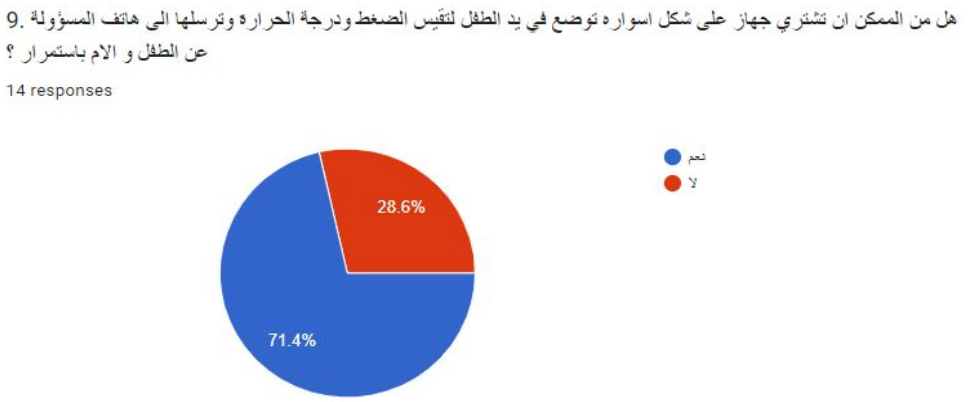


Figure 2.30: children nursery's questionnaire - question tenth

We also asked: Are there any health conditions in the nursery that require this device more than other children? The answer was with the following proportions:

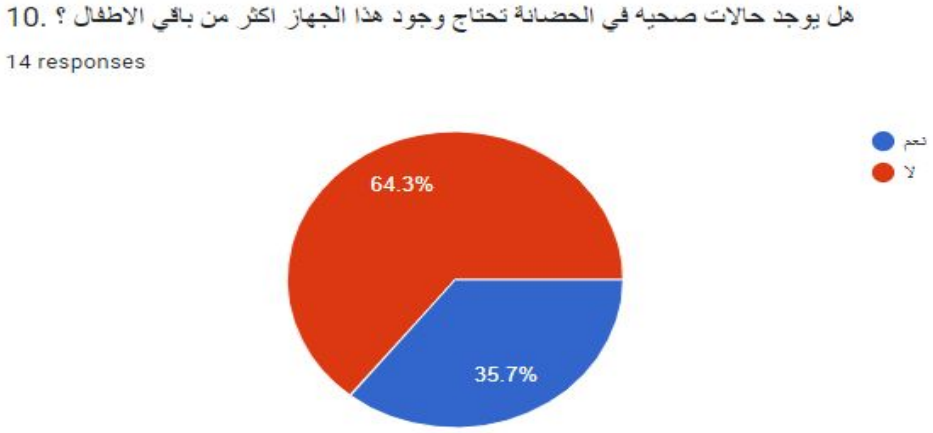


Figure 2.31: children nursery's questionnaire - question eleventh

And the question was asked in the event that the device is available to reduce the burden on the supervisor. Do you wish to be there? The answer to the question was in the following proportions:

Figure 0.32: children nursery's questionnaire - question twelfth

We also asked if this device is available at a reasonable price. Do you want it to be available? The answer is as follows:

Figure 2.33: children nursery's questionnaire - Thirteenth question

We also asked about the average price they would like for the device, and the ratios were as follows:

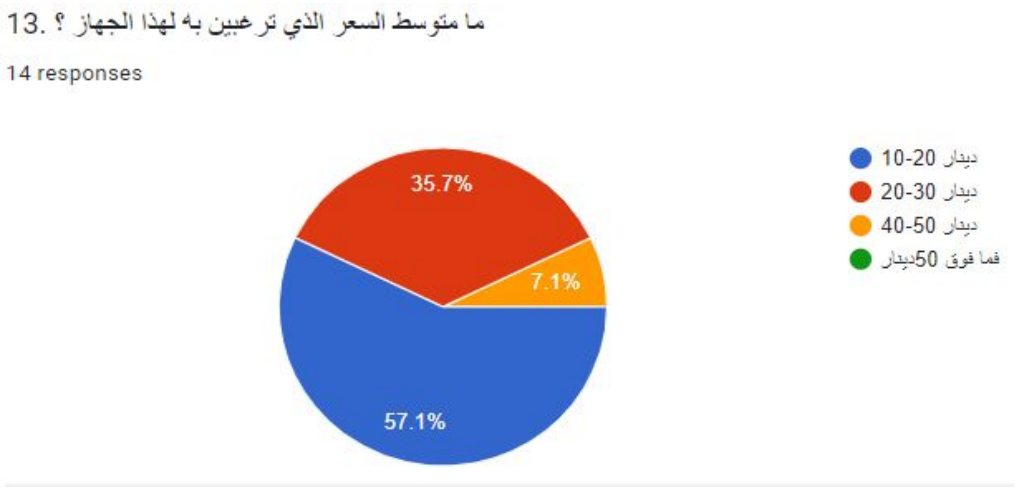


Figure 2.34: children nursery's questionnaire - fourteenth question

Accordingly, we conclude that the project will serve a large percentage of female supervisors in child care homes and achieve the required benefit from it.

To view the questionnaire click on the link:

https://docs.google.com/forms/d/e/1FAIpQLSey3Ch64nf0outIBM_qoqP_DgWqKKhBLmlkqCbX8wy2kIYs-Q/viewform?usp=sf_link

(children nursery's questionnaire , 2020)

3.3.3 The paediatrician questionnaire

We have made a questionnaire for a paediatrician to find out what diseases can be known from the wrist and some general questions about children, their diseases and symptoms.

Conclusion

After interviewing the doctor, the doctor graduated as a Medical doctor from the university of Jordan paediatric resident in 2017. As for the current activities do on the daily basis is attending paediatric projects and examining a lot of kids.

When diagnosing a child, the common symptoms a doctor should look for are cough, fever, diarrhoea, and the decrease in aphtha fatigue.

For better and accurate diagnosing, most need to be clear that most children with heart problems are successfully treated. You should not be so protective, yet not careless. Keep in touch with your child's assigned doctor to see what level of physical activity is safe for your child.

Child blood pressure is normally low and rises as they age.

If for example a nursery or school administrators calling regarding a child is having a cough or a fever, I would advise her to bring the child to the clink to do an appropriate testing to making sure nothing is major.

It's not possible to get any kind of oxygen percentage from a child wrist hand but we can from hand fingers.

As for the temperature, the wrist is not recommended at all for an accurate measure, it must be measured from the axilla or orally.

If the heart rate of child increases, it could be dangerous as the child might face conditions like blood loss.

In addition to that the normal heart rate and body temperature for different age's children:

3.3.3.1 Babies and children:

In babies and children, the average body temperature ranges from (36.6°C) to (37.2°C).

3.3 Functional requirements

1. The device provides continuous readings of pressure and temperature values to an application on the mother's phone.
2. In the event of a risk, a notice will be sent on the mother’s phone.
3. The application can be downloaded for free and easily from the Internet on cross platform.
4. The mother logs in to an application by creating a special email and password.
5. The mother can (Edite) information about her child such as:

   A) child’s name.

   B) Age.

   C) Gender.

6. The mother can review the average of weekly History readings for her child.
7. Its walls have the advantage that they are made of suitable metal to the child's skin so that they do not cause sensitive skin
8. Its walls provide full coverage for the child and instead have a 8-hour battery
9. The walls are available in multiple colours to suit all tastes
10. The bracelet is lightweight, easy to wear and take off.
11. The advantage of the product is that it is available at a cheap price.

3.4 Nonfunctional requirements

1. Usability

- The system should be easy to use and learn.
- A small device wearable.

2.Maintainability

- The system should be easy to change.
- The system should be easy to drop or add hardware devices.
- The system should be easy to change the database that we use.

3. Availability

- The bracelet shall be available in all pharmacies for easy purchase.
- If damaged, spare parts are available.

4. Adaptability

- The application must be flexible.

5. Aesthetics

- All text in the app must have a unified font and color.
- The bracelet should look child-friendly and comfortable.

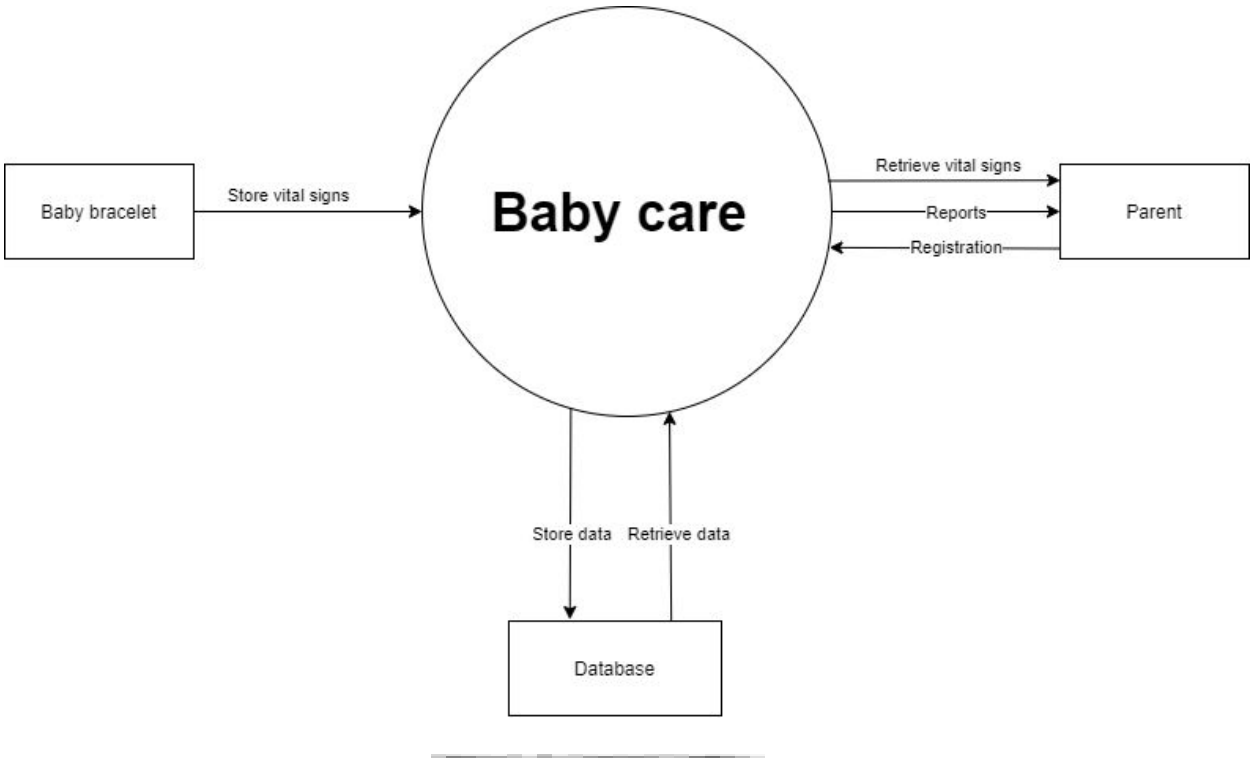
6. Reliability

- A bracelet should be solid, so it doesn't break if dropped.

3.3 System Models

3.3.1 Context Diagram

A context diagram, sometimes called a level 0 data-flow diagram, is drawn in order to define and clarify the boundaries of the software system. It identifies the flows of information between the system and external entities as shown in Figure 2.35



3.3.2 State Diagram

A state diagram shows the behaviour of classes in response to external stimuli. Specifically a state diagram describes the behaviour of a single object in response to a series of events in a system as shown in Figure 2.36

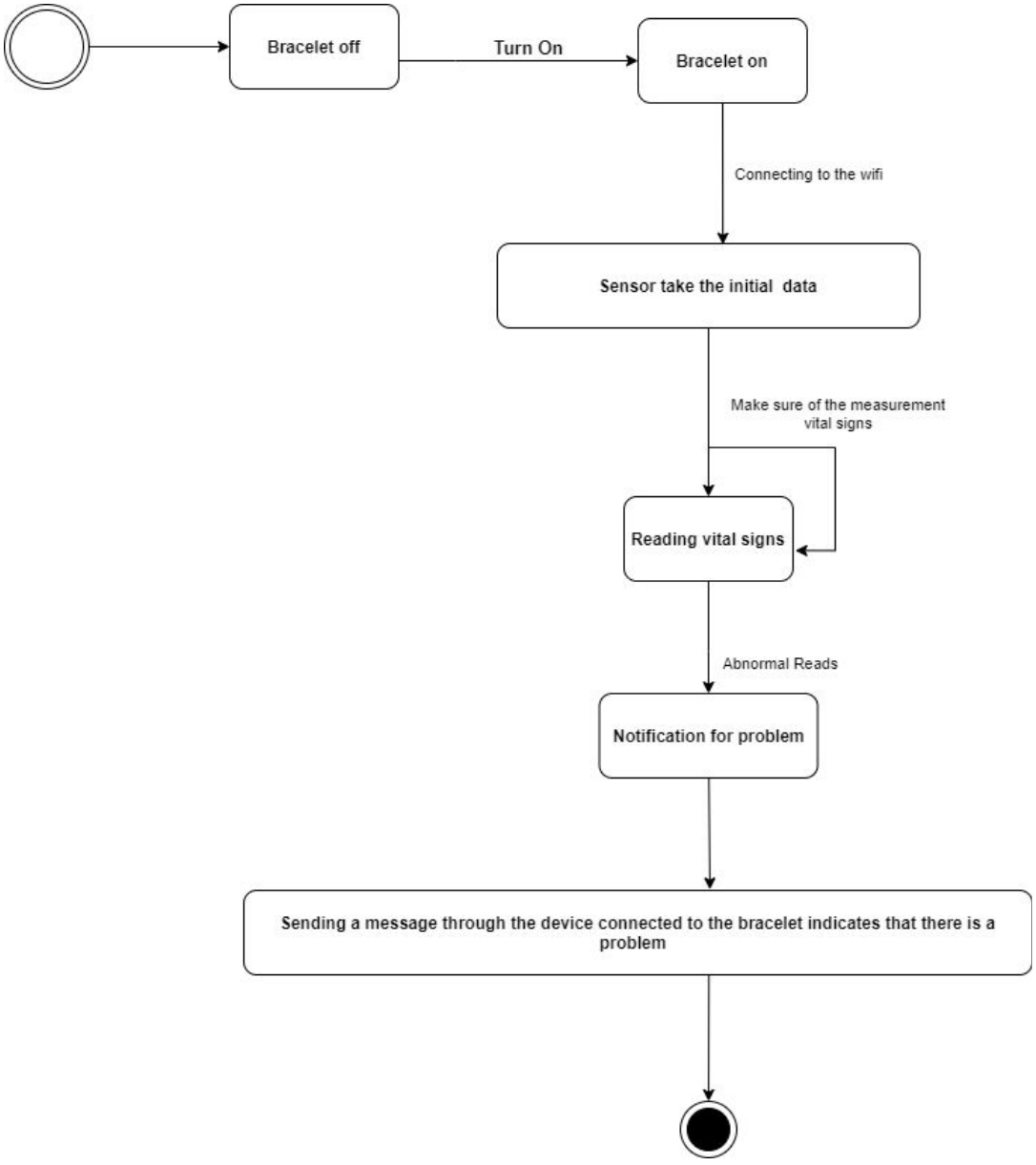


Figure 2.36: State Diagram

3.3.3 Network diagram

A network diagram is a visual representation of network architecture. It maps out the structure of a network with a variety of different symbols and line connections. It is the ideal way to share the layout of a network because the visual presentation makes it easier for users to understand how items are connected as shown in Figure 2.37.

Figure 2.37: Network diagram

3.3.4 Scenarios

Purpose: Scenario that describes the use of an (Bracelet Baby with Application) by Mothers

Individual: Working moms (who spend long time outside the home) and teachers in nursery school

Equipment: Bracelet in the hand of the child, Application on the mother's phone, the mother's phone has a permanent connection to the internet

Scenario:

Step1: Place a bracelet on the child's hand.

Step2: mothers download the application on their phone

Step4: The user created his own account on the application by filling in the registration form consisting of the (Email, password, phone number,first name,last)

Step 5: User Enter Bracelet Id.

Step 5: User saves (Email and Password) with the possibility of changing the password and recovering it in case of forgetting by email

Step6: the mother entries the child's data through answering a set of questions that include (the child's name, age) with the user's ability to apply (modify, Edit and add) to them

Step 7: After completing the settings, the application starts by displaying the values monitored from the bracelet on the form of a curve.

Step 8: The mother can view the value (temperature, pressure, and heart rates) for her child on his mobile phone when the start of using the device until the device is removed from the child's hand

Step9: Ensure that the user has achieved an internet connection to be able to see warning notifications in case of danger (values change from normal rates)

Step 10: A mother logs off of system by taking off the child's bracelet, the values in the curve will be stopped.

Step 11: The possibility of mothers to look at the values of curves again by weekly History (option in the application) so that constitutes a reference for the child's health condition from daily use for a week and after a week it is removed from the application

3.3.5 Use case model

The Use Case Model describes the proposed functionality of the new system. A Use Case represents a discrete unit of interaction between a user (human or machine) and the system as shown in Figure 2.38.

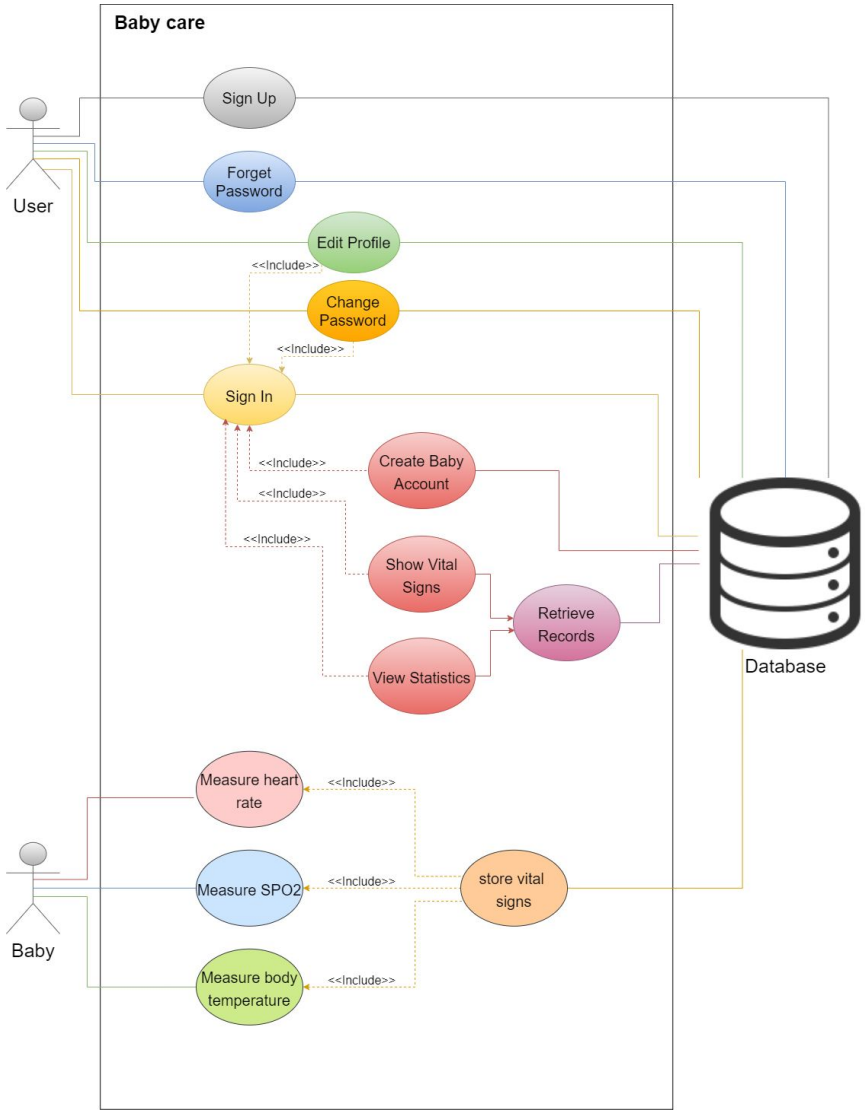


Figure 2.38': Use case model

1.Uses Case Description:

Use Case Name:	Sign Up
Scenario:	A new user wants to make an account to use the system.
Actors:	User , Database
Pre-Conditions:	NON
Post-Conditions:	Massage shows the user signed up correctly.

Table 2.1 Sign up Uses Case

Use Case Name:	Forget Password
Scenario:	The user forgot one of his username or password, or both
Actors:	User , Database
Pre-Conditions:	Sign Up
Post-Conditions:	Massage shows the user signed up not correctly.

Table 2.2 Forget Password Uses Case

Use Case Name:	Sign In
Scenario:	User want to sign in to the system to edit profile/ change password /create baby account commands .In addition to show vital signs / view statistics in Application
Actors:	User , Database

Pre-Conditions:	Sign Up
Post-Conditions:	Massage shows the user logged in to the system.

Table 2.3 Sign in Uses Case

Use Case Name:	Edit Profile
Scenario:	User want to edit or update his own information in system
Actors:	User , Database
Pre-Conditions:	Sign in
Post-Conditions:	Massage shows the user edit profile correctly.

Table 2.4 Edit Profile Uses Case

Use Case Name:	Change Password
Scenario:	User want to update his own password.
Actors:	User , Database
Pre-Conditions:	Sign in

Post-Conditions:	Massage shows the user change password correctly.

Table 2.5 Change Password Uses Case

Use Case Name:	Create Baby Account.
Scenario:	The user wants to create an account for his child that includes the following information (name, gender, and date of birth)
Actors:	User , Database
Pre-Conditions:	Sign in
Post-Conditions:	Massage shows the user create baby account correctly.

Table 3 Create Baby Account Uses Case

Use Case Name:	Show Vital Signs.
Scenario:	The user wants to see the values (temperature, pressure, and heart rate) of his child at the present time
Actors:	User , Database
Pre-Conditions:	Sign in

Post-Conditions:	The values monitored are shown as a graph on the user page.

Table 4.7 Show Vital Signs Uses Case

Use Case Name:	View Statistics.
Scenario:	The user wants to see the old values recorded from one to seven days
Actors:	User , Database
Pre-Conditions:	Sign in
Post-Conditions:	A page appears that includes all weekly records.

Table 2.8 View Statistics Uses Case

Use Case Name:	Measure heart rate.
Scenario:	The user wants to activate all elements of the system.
Actors:	Baby , Database
Pre-Conditions:	Child wearing a bracelet.
Post-Conditions:	Monitor the value directly to the application

Table 2.9 Measure heart rate Uses Case

Use Case Name:	Measure SPO2.
Scenario:	The user wants to activate all elements of the system.
Actors:	Baby , Database
Pre-Conditions:	Child wearing a bracelet.
Post-Conditions:	Monitor the value directly to the application

Table 2.10 Measure SPO2 Uses Case

Use Case Name:	Measure body temperature.
Scenario:	The user wants to activate all elements of the system.
Actors:	Baby , Database
Pre-Conditions:	Child wearing a bracelet.
Post-Conditions:	Monitor the value directly to the application

Table 2.11 Measure body temperature Uses Case

Use Case Name:	Store vital signs.
Scenario:	The user wants to store vital signs include(body temperature ,SPO2 and heart rate) for his baby

Actors:	Baby , Database
Pre-Conditions:	Measure heart rate , Measure SPO2 , Measure body temperature
Post-Conditions:	All records are kept at history page in Application

Table 2.12 Store vital signs Uses Case

3.5.6 Sequence diagram

Scenario for sequence diagram

1. Sign up Scenario

The user can sign up to the system by entering their first name , last name, username and password and re-type password then the system will check the entry in the next step. The user will rewrite any wrong data, in the next step the user have an Id and will be signed in the system and able to see the main page of the system as shown in Figure 2.39

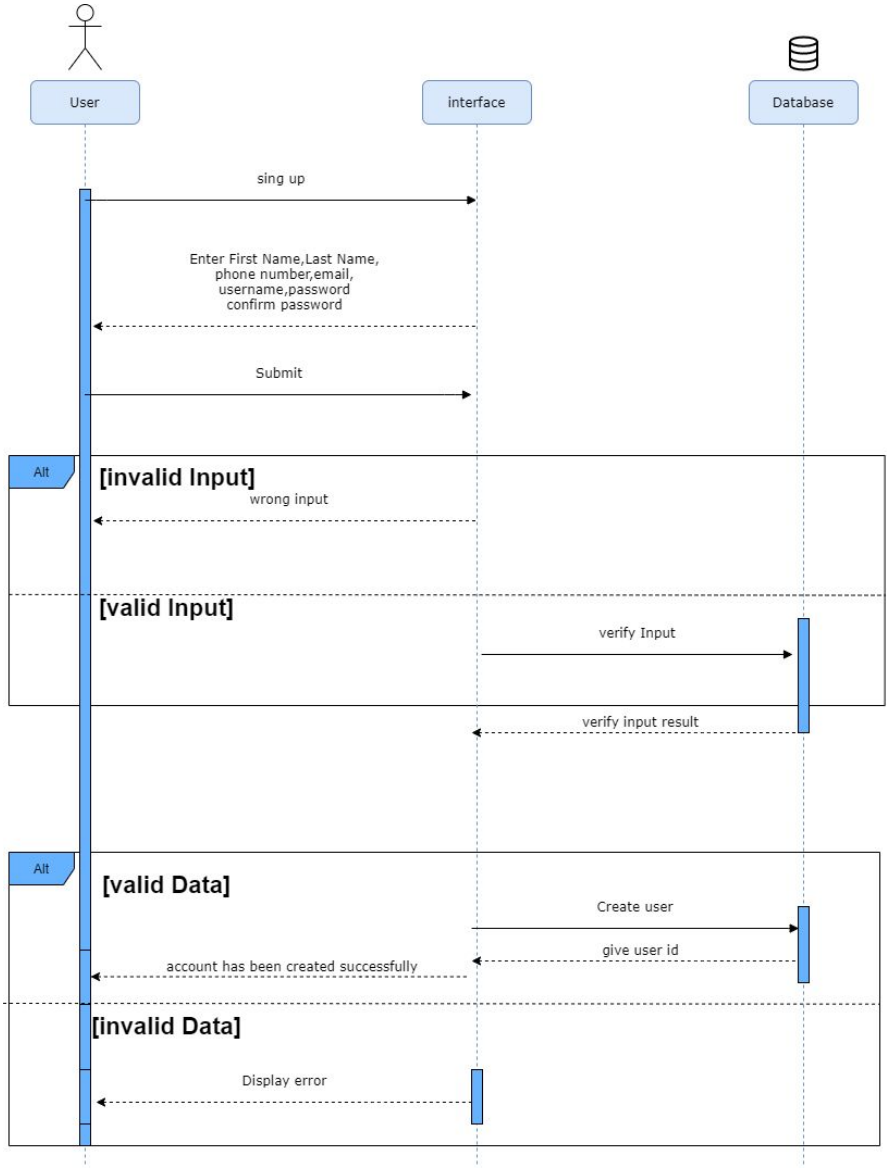


Figure 2.39: Sign up sequence diagram

2. Login Scenario

If any user wants to Login to the system, they should enter their Email and password. The system will check if the entry is correct or not, in case the entering is not correct they need to rewrite the user name or the password to be able to see the main page of the system as shown in Figure 2.40.

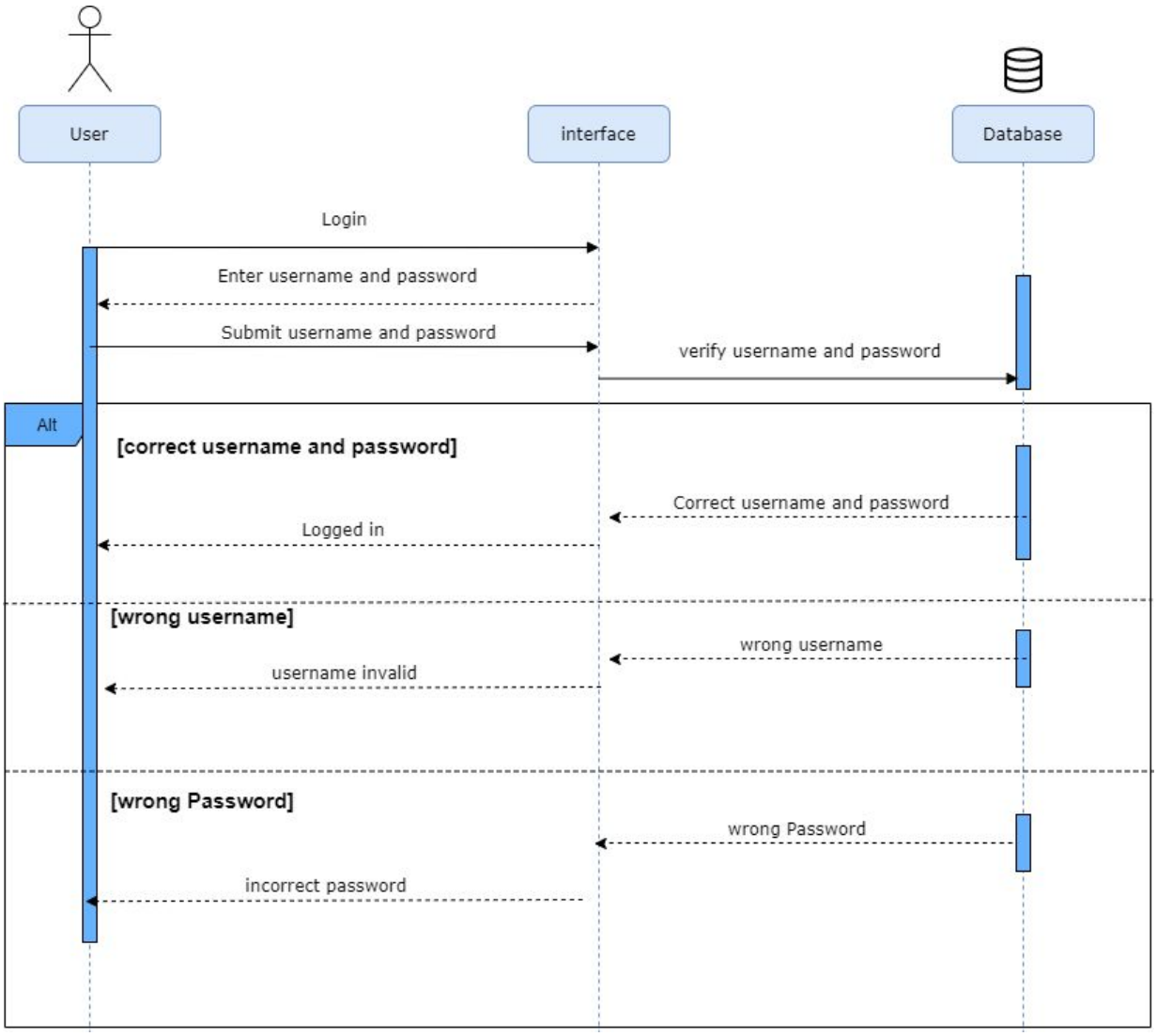


Figure 2.40: Login sequence diagram

3. Create baby account Scenario

When the User wants to create a baby account to the system, they should fill these fields: Name, date of birth, gender, and upload image. In the next step the system will check the entry; in case of a wrong entry the user will rewrite it. In the next step the Baby will have an ID, so the user will be able to see the vital signs for his baby as shown in Figure 2.41.

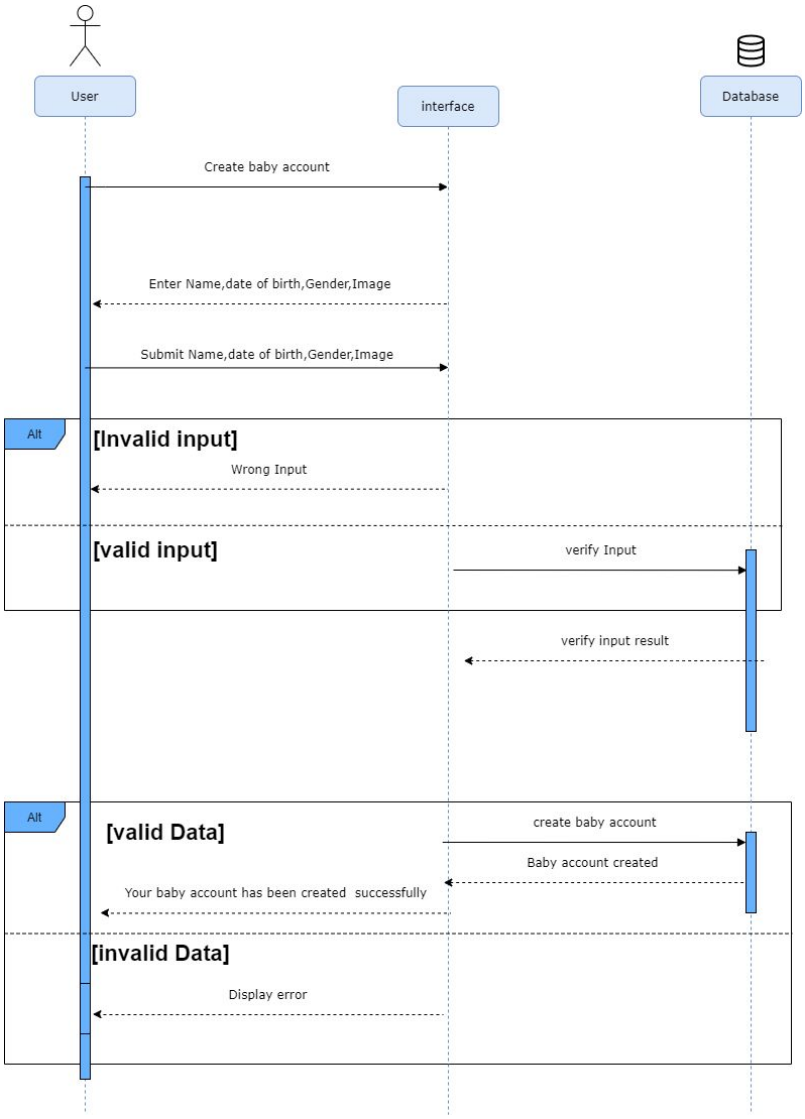


Figure 2.41: Create baby account sequence diagram

4. Edit account Scenario

When the User wants to edit the account: The user should click the edit, the user can edit the first name, last name, phone number, and email. If there's something wrong the system will show an error message, if there's not, the system will update the information that has been entered as shown in Figure 2.42.

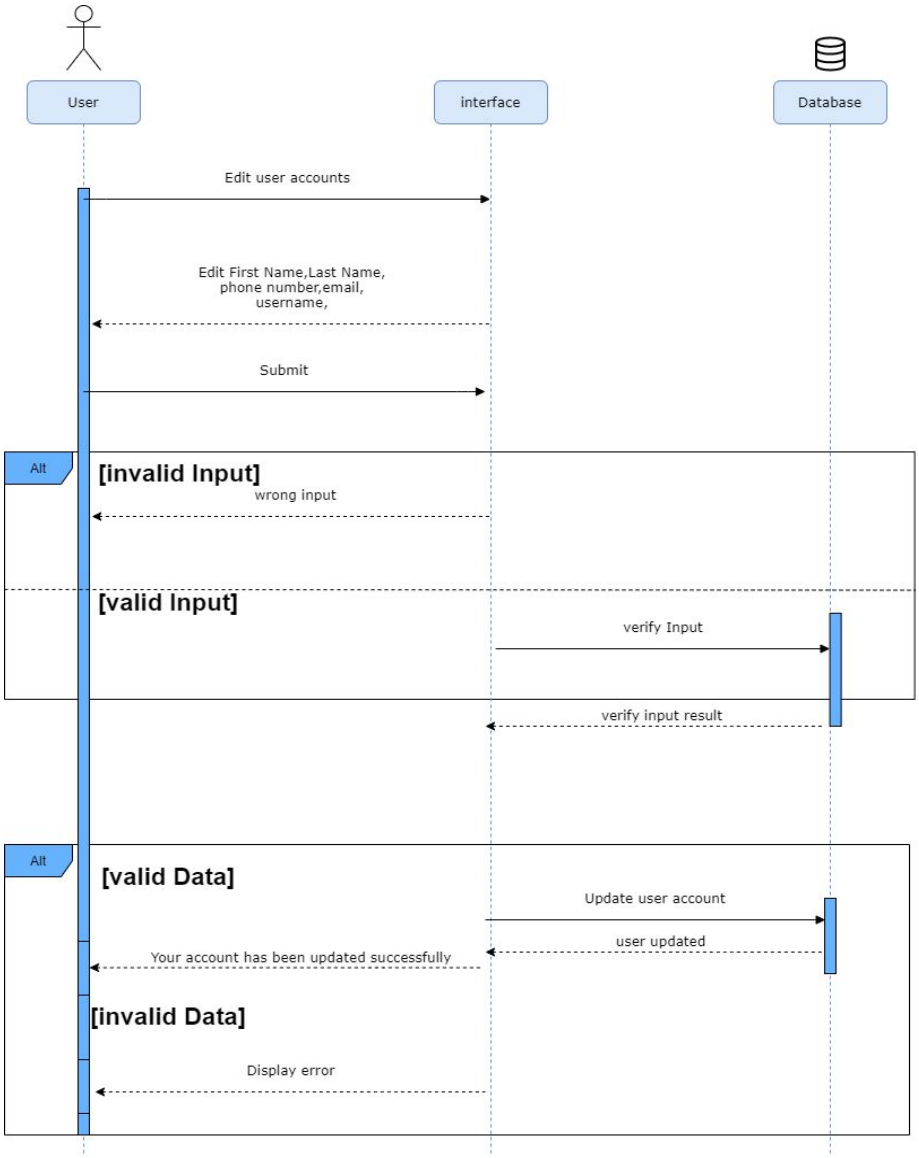


Figure 2.42: Edit account sequence diagram

5. Edit baby account Scenario

To edit the baby account: The user has to click the edit Button to enter the updated information. The user can edit the Name, date of birth, Gender and upload Image. If something is wrong, the system will display an error message, and if there is no error, the system will update the information as shown in Figure 2.43.

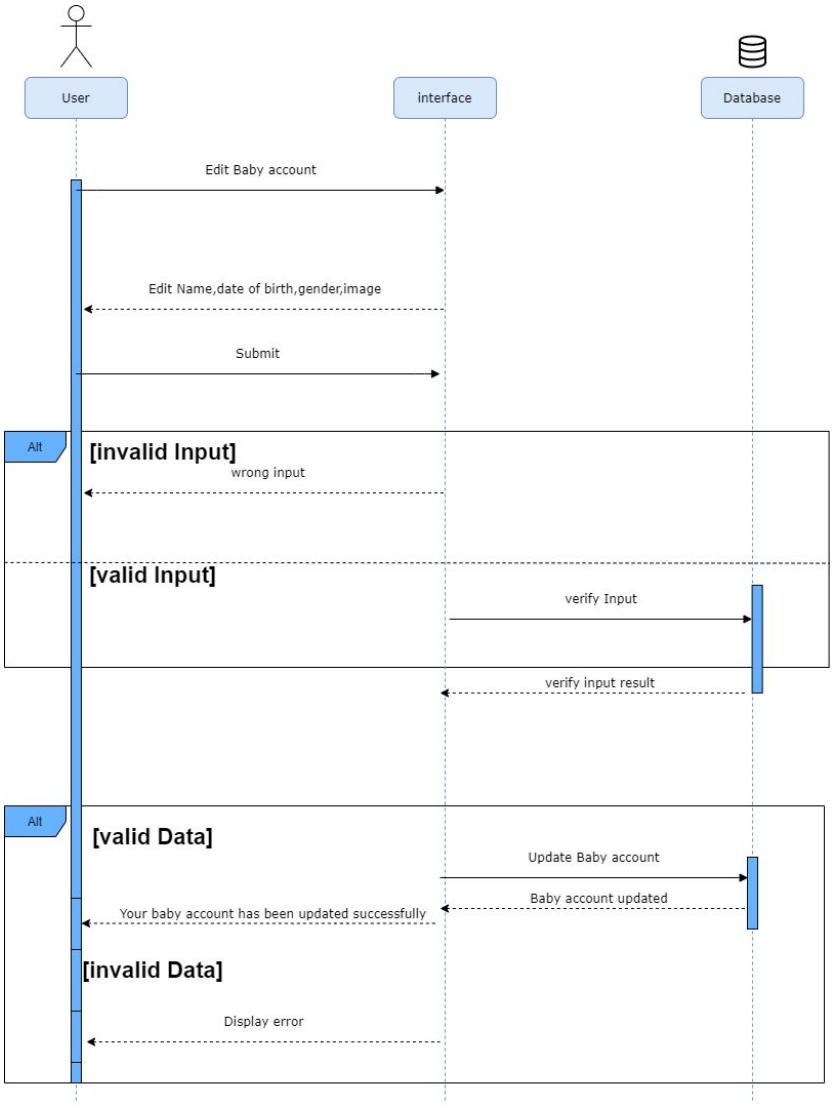


Figure 2.43: Edit baby account sequence diagram

6. Home page Scenario

The user can see the following from the home page: temperature, oxygen level, and heart rate. In case of an emergency or critical situation, the application will send a notification to the user as shown in Figure 2.44.

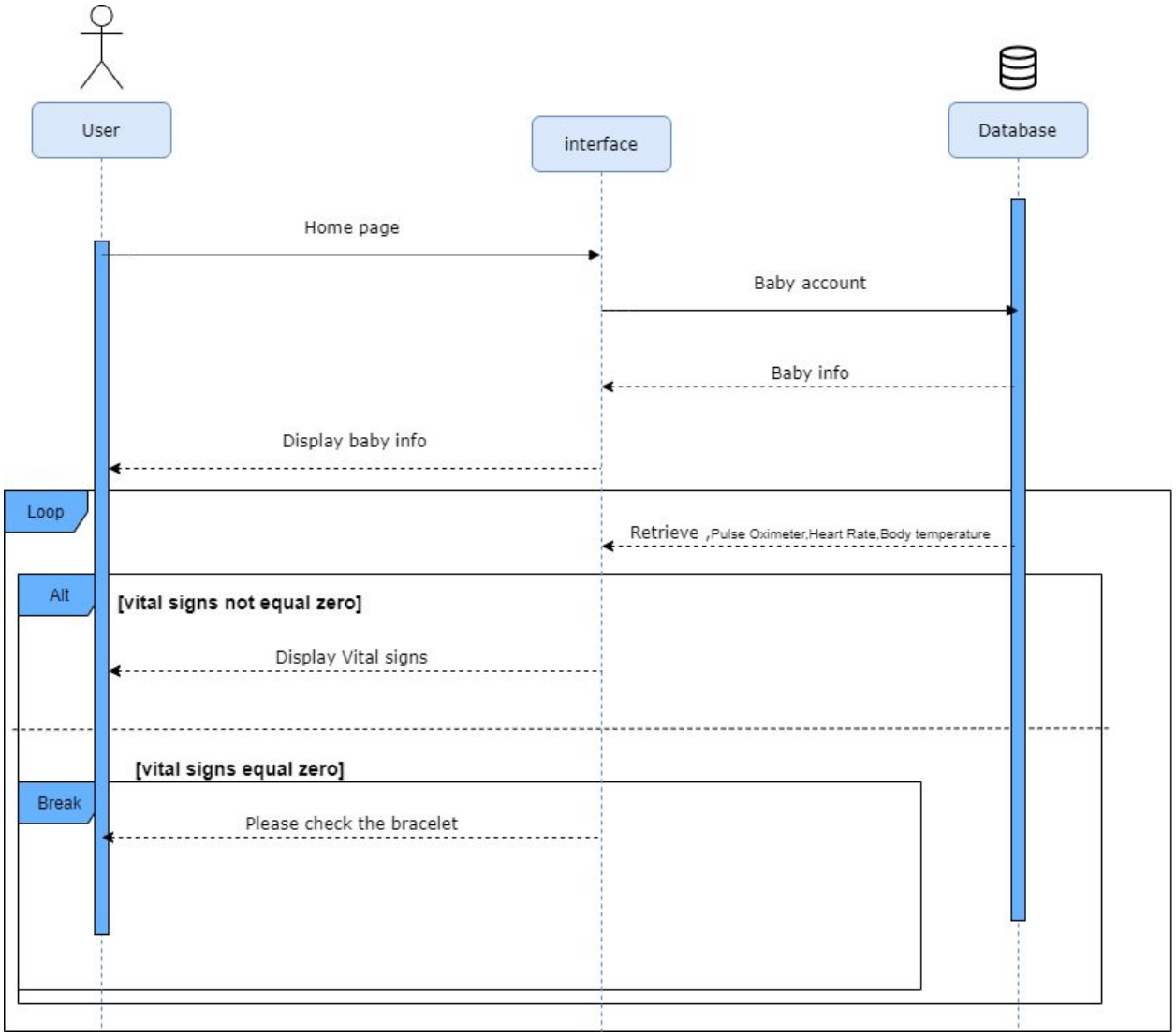


Figure 2.44: Home sequence diagram

7. Statistics Scenario

If the user wants to see the child's previous readings, he can see it, by clicking on the Statistics, then on the time period and it will appear as a graph as shown in Figure 2.45.

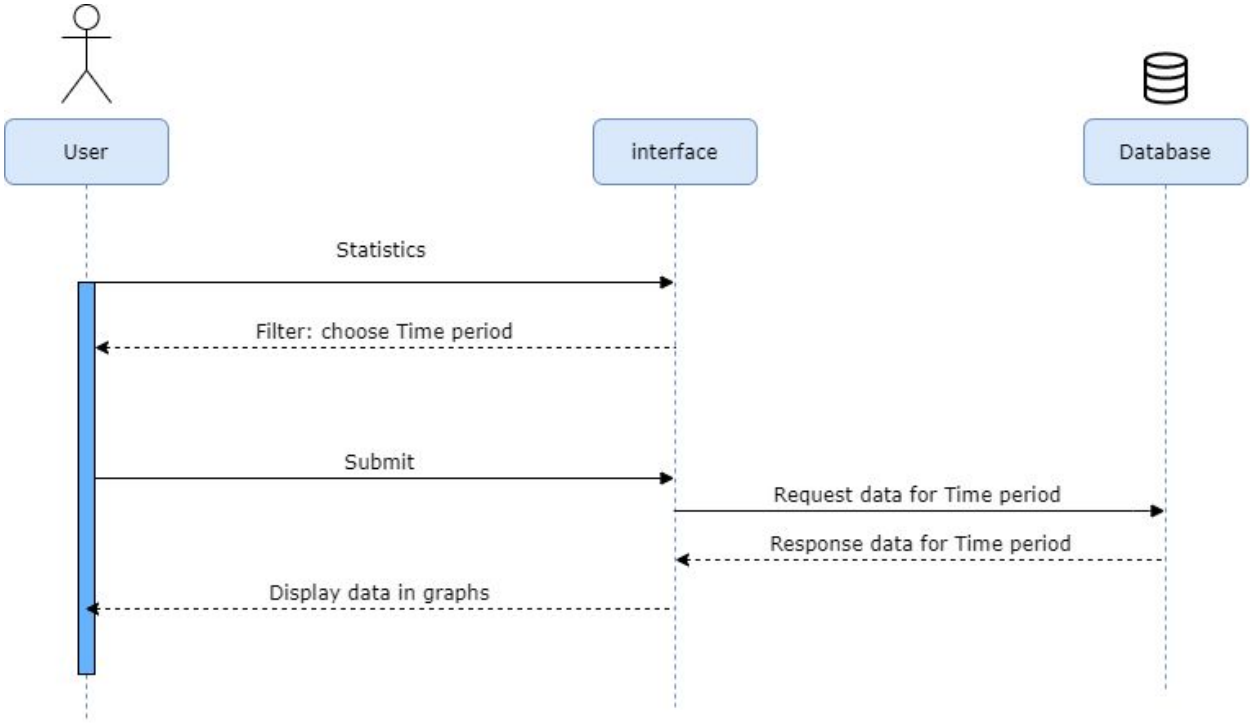


Figure 2.45: Statistics sequence diagram

8. Forgot password Scenario

If the user forgot the password, he can set a new password by entering the email, a notification will be sent to his mail to reset the password as shown in Figure 2.47.

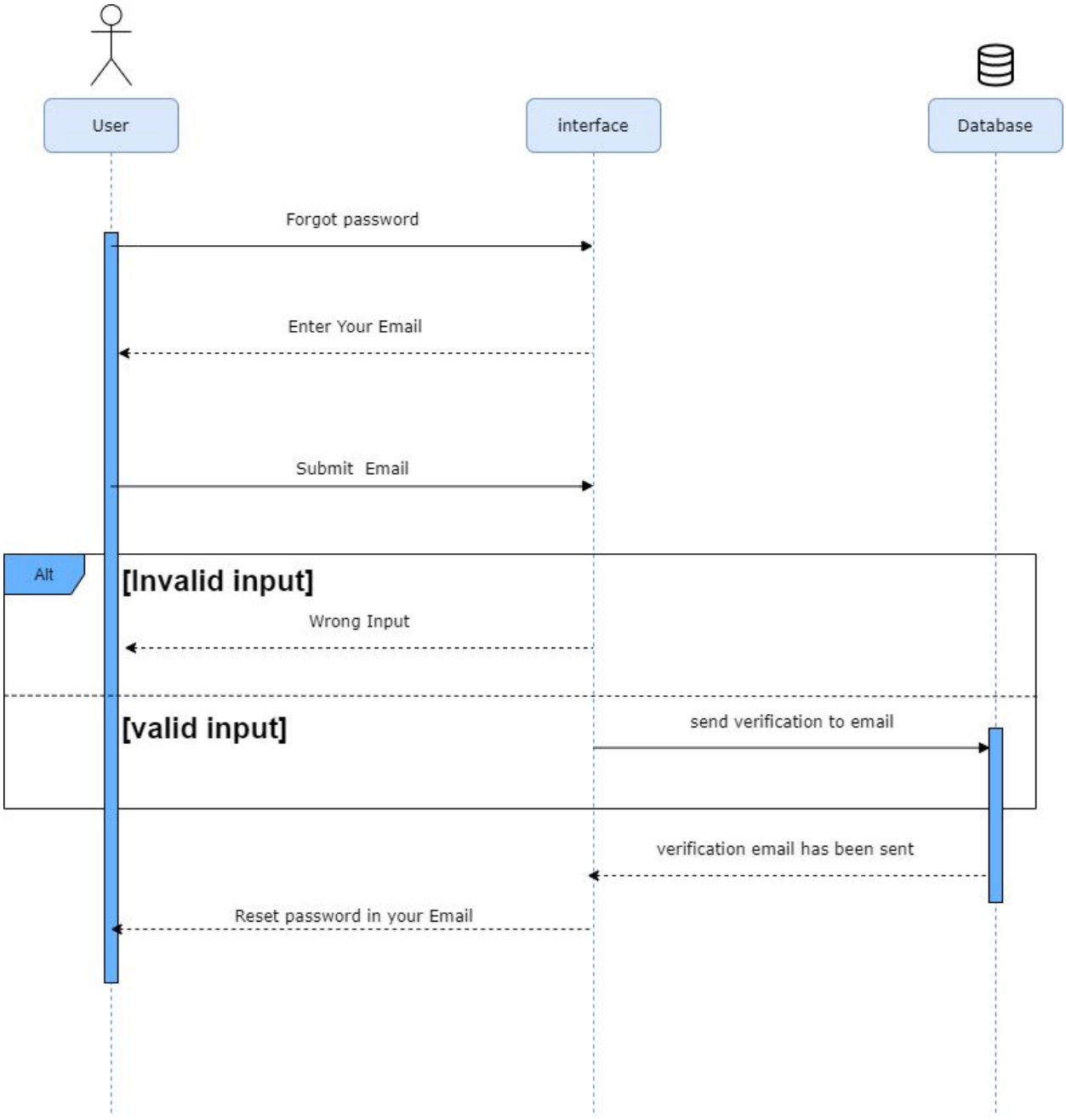


Figure 2.471: Forgot password sequence diagram

3.5.7 Activity diagram

An activity diagram visually presents a series of actions or flow of control in a system as shown in the Figure 2.48 and 2.49

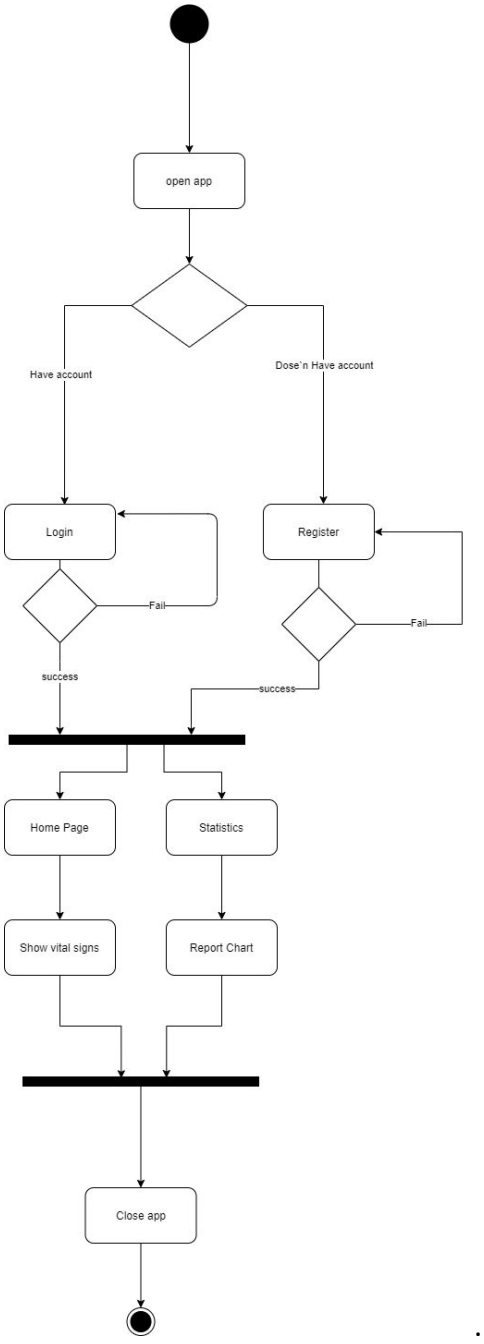


Figure 2.48: Activity model of Application

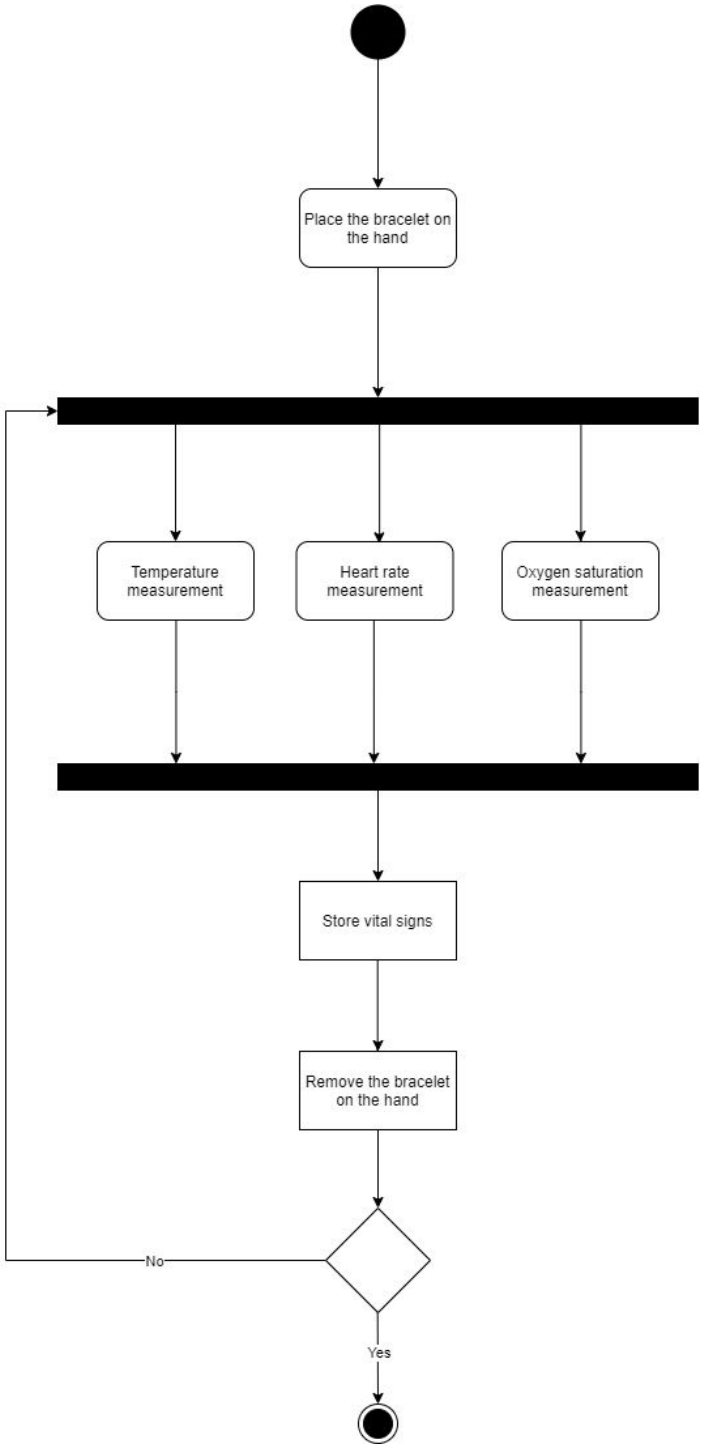


Figure 2.49: Activity model of bracelet

3.5.8 ER Diagram

The entity relationship schema (ERD) shows the relationships of entities that are stored in a database. The entity in this context is an object, made up of data as shown in the Figure 2.50

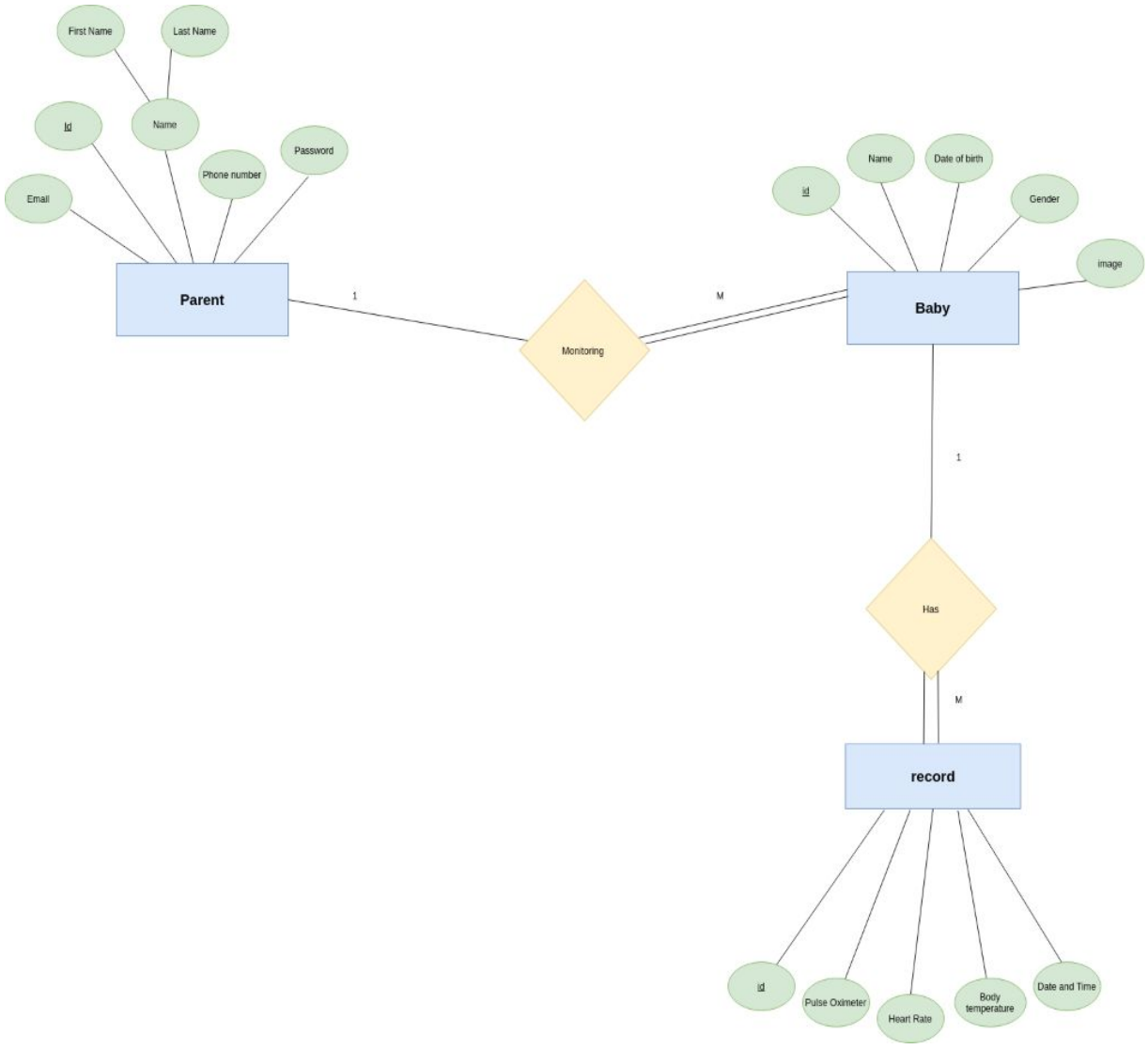


Figure 2.50: ER Diagram

3.5.9 Schema

The term "database schema" can refer to a visual representation of a database, a set of rules that govern a database, or to a complete set of objects belonging to a particular user as shown in Figure 2.51

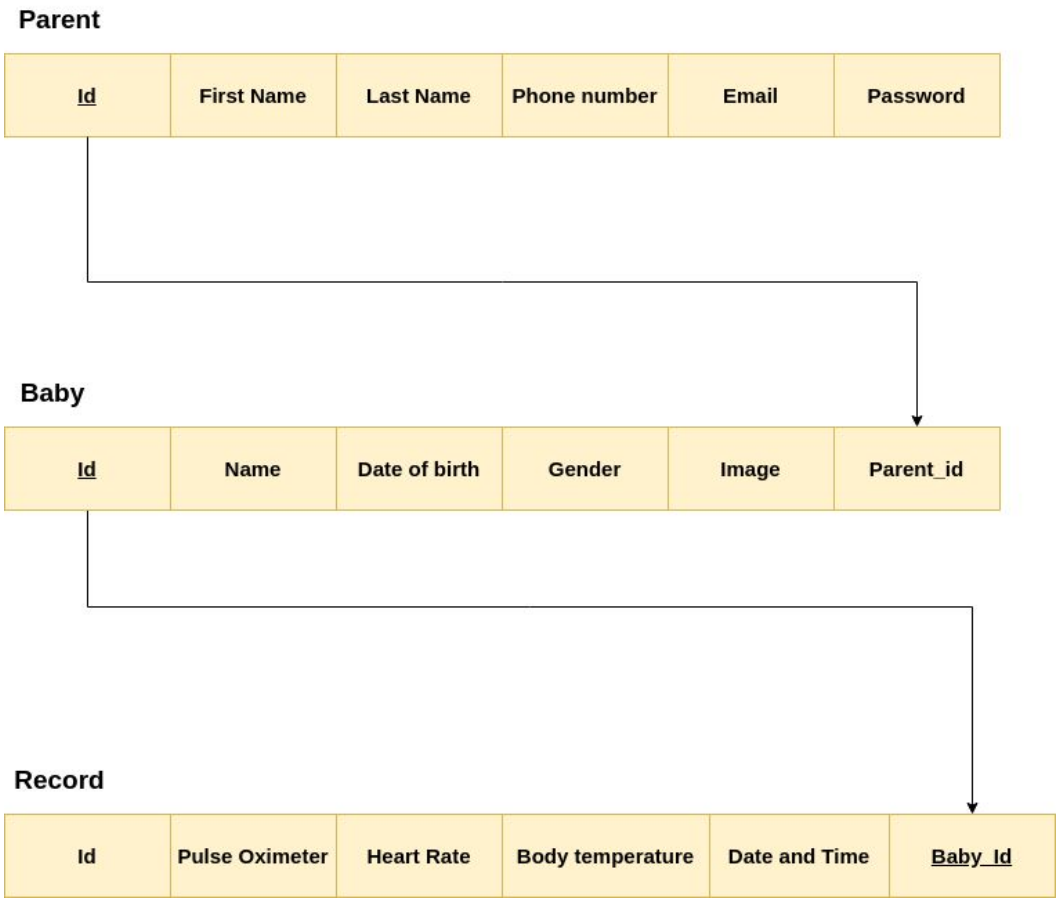


Figure 2.51: Scheme

3.5.9 Nosql DataBase(Firebase tree)

All Firebase Realtime Database data is stored as JSON objects. You can think of the database as a cloud-hosted JSON tree. Unlike a SQL database, there are no tables or records. When you add data to the JSON tree, it becomes a node in the existing JSON structure with an associated key as shown in Figure 2.52,2.53,2.54

1-User Tree

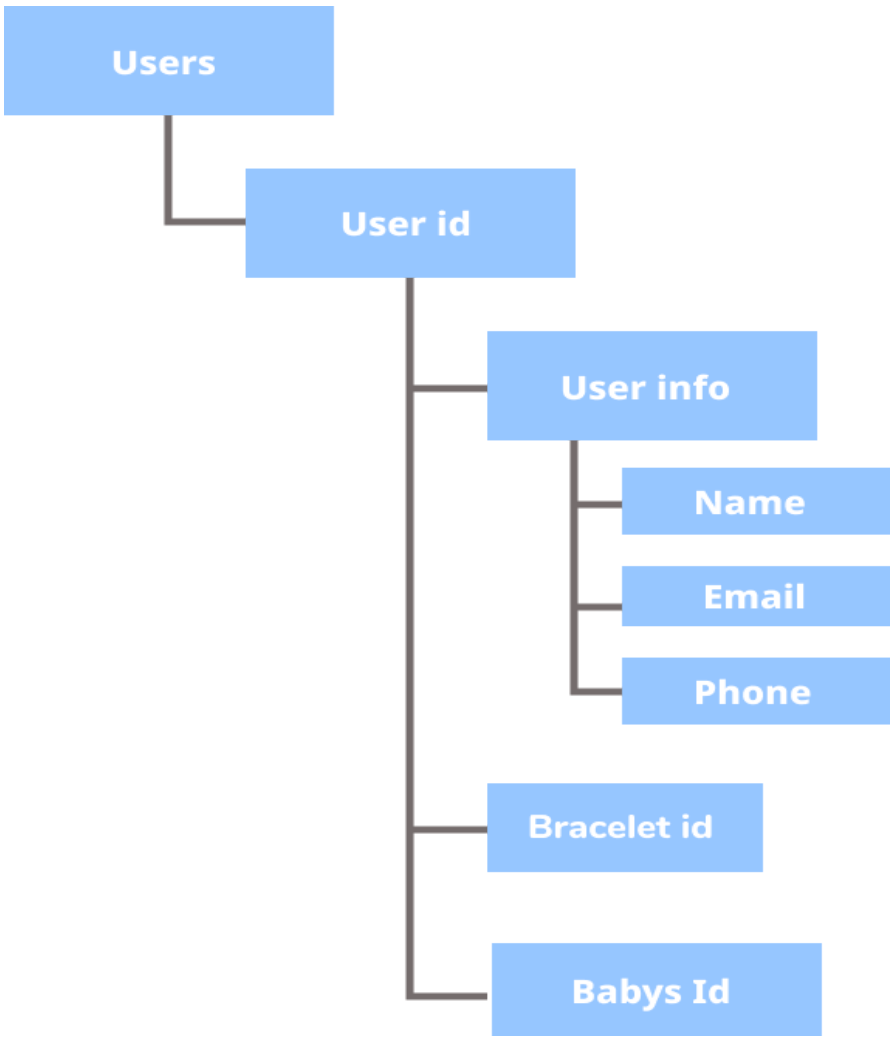


Figure 2.52: Users Nosql

2-Bracelet tree

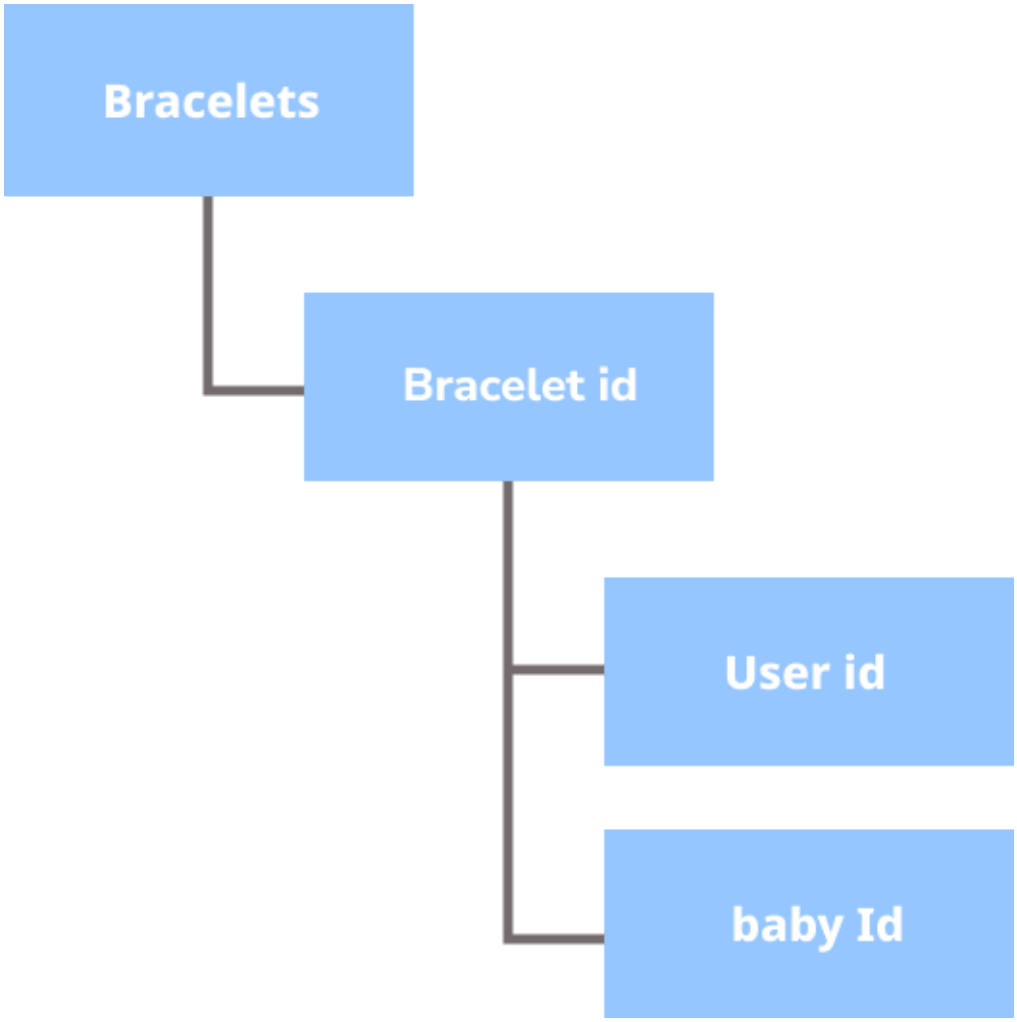


Figure 2.53: Bracelet Nosql

3-Babys tree

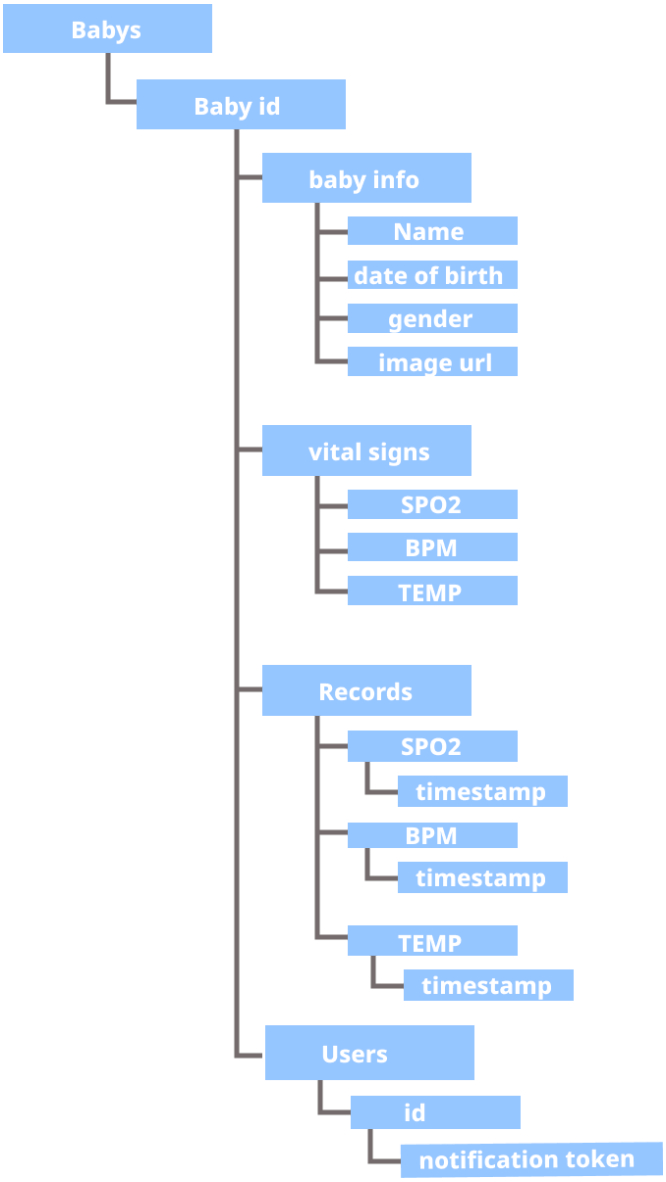


Figure 2.54: Baby's tree

3.5.10 User interface—navigational paths

These are the initial interface where the all user will use based on previously considered requirements that solve issues exited in the system, and these interfaces will be faster and easy to use by all user. As shown in Figure 2.54, 2.55, 2.56, 2.57, 2.58, 2.59, 2.60, 2.61, 2.62, and 2.63

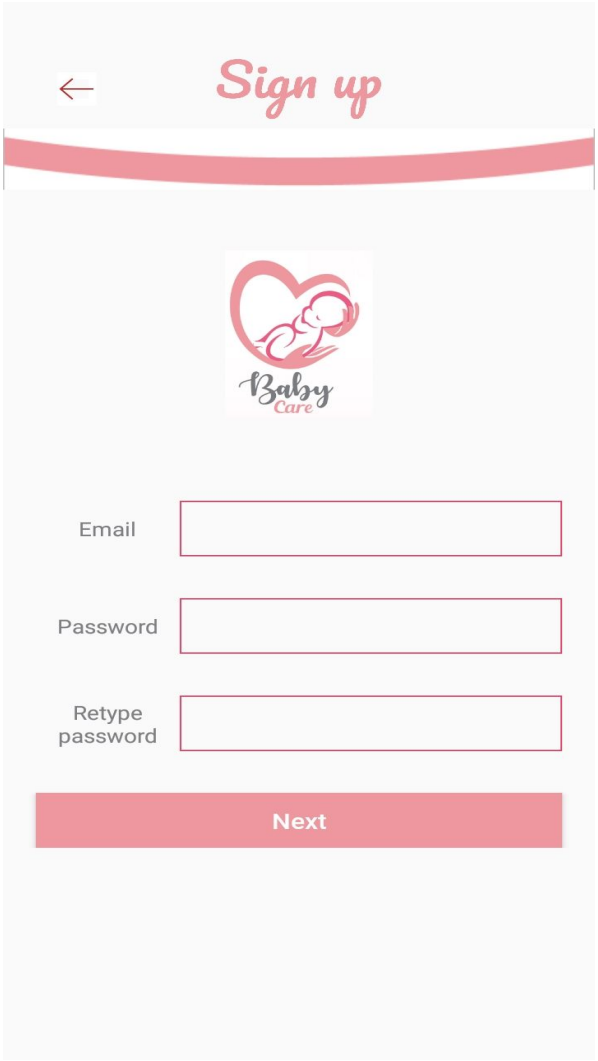


Figure 2.54: Sign up

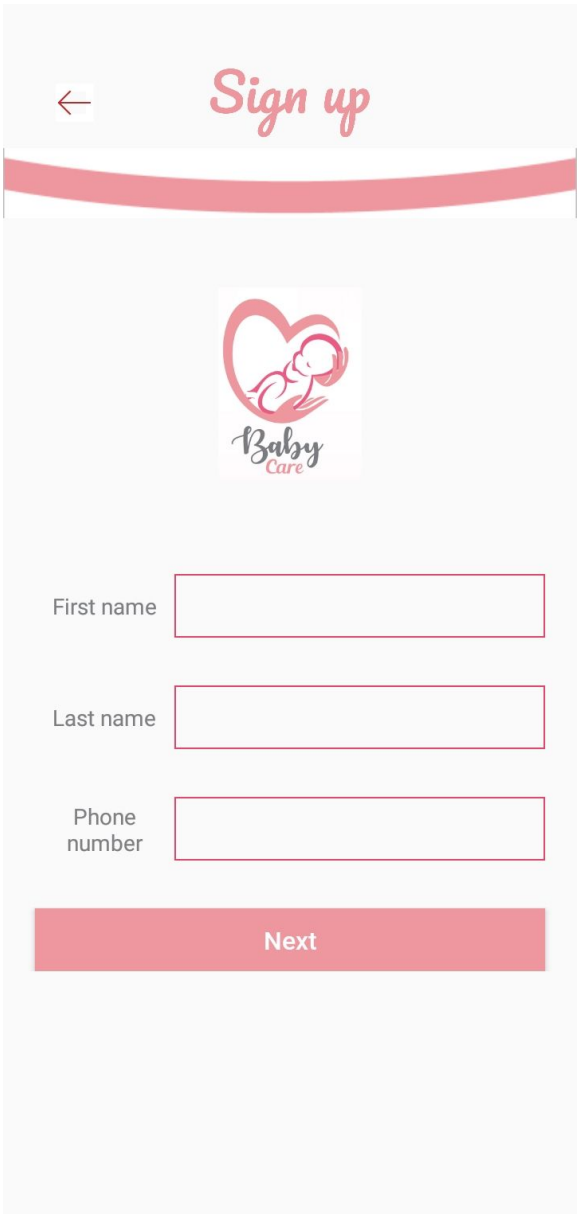


Figure 2.55: Sign up

Figure 2.56: Enter Bracelet id

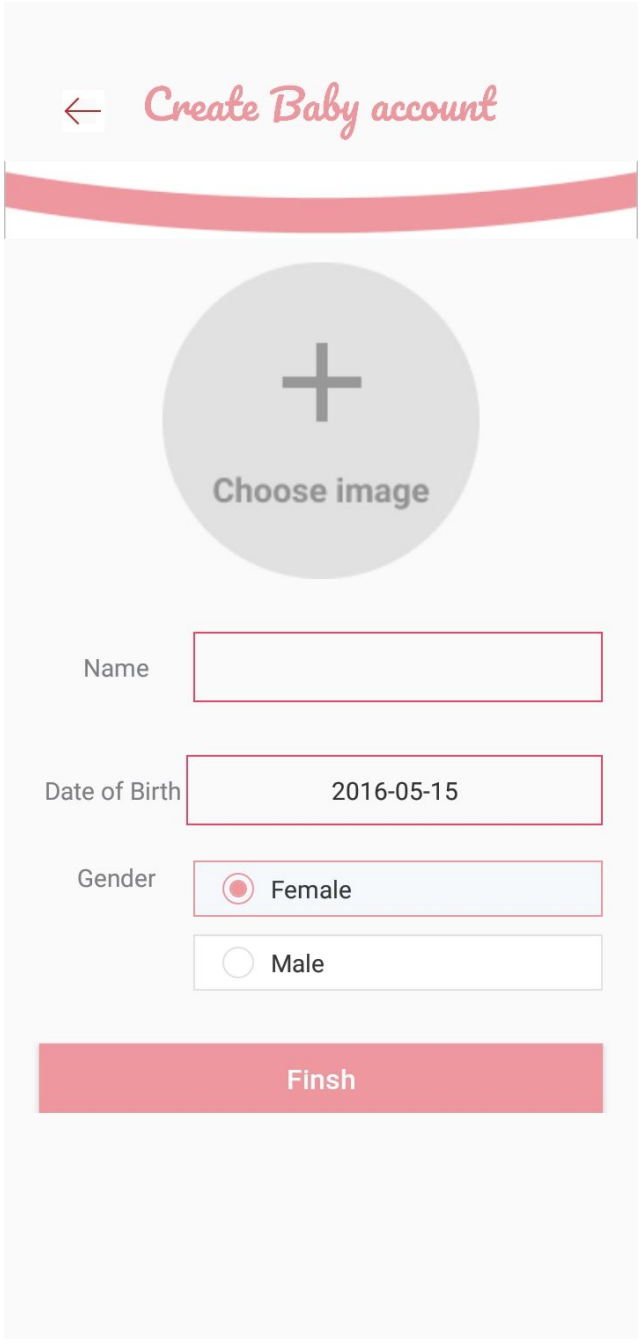


Figure 2.57: CreateBaby account

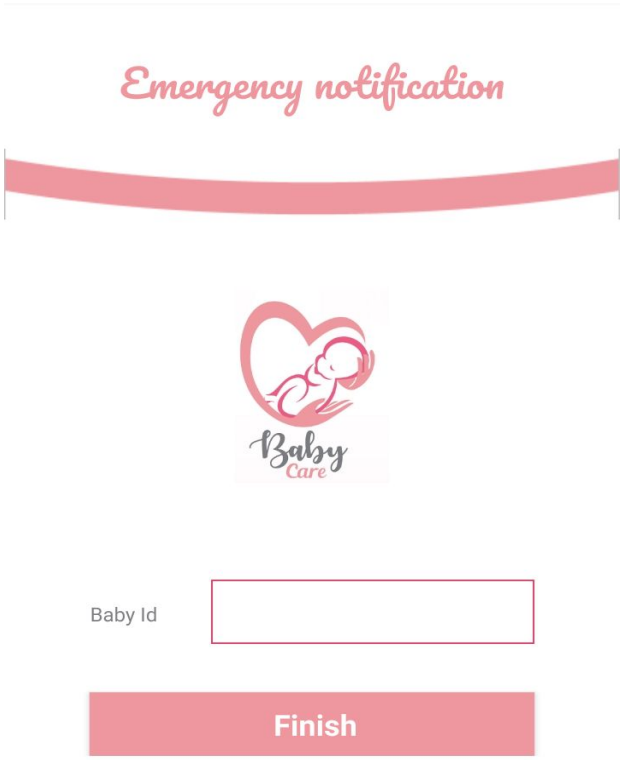


Figure 2.58: Emergency notification

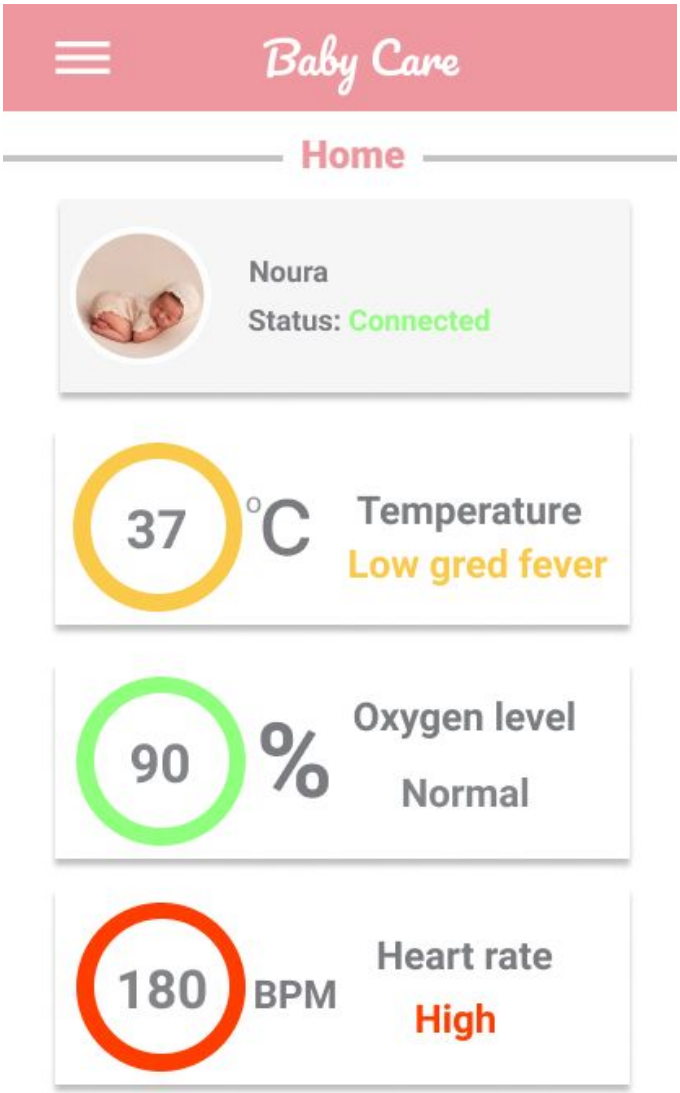


Figure 2.59: Home Screen

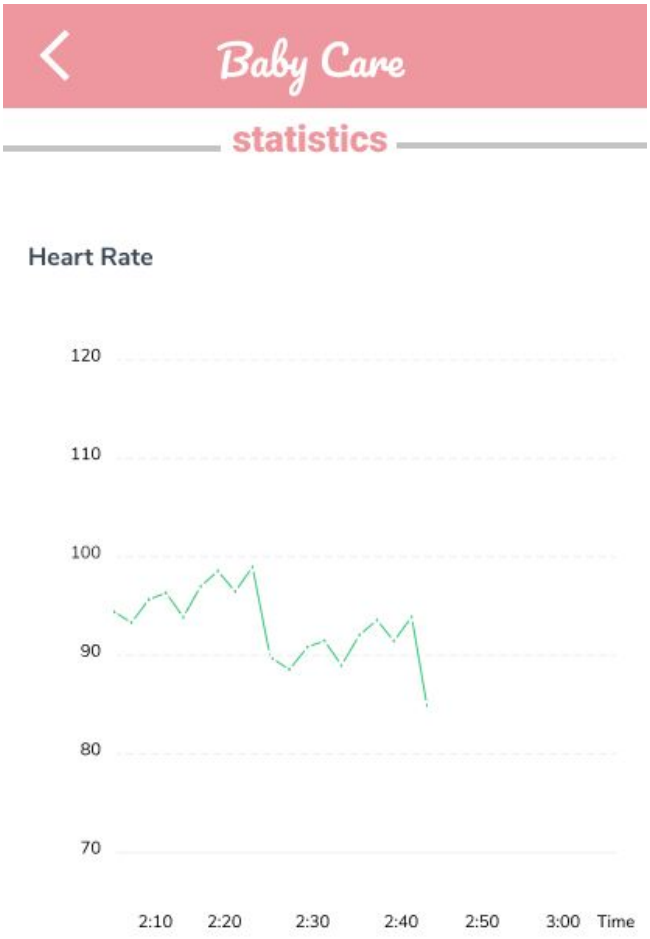


Figure 2.60:Statistics

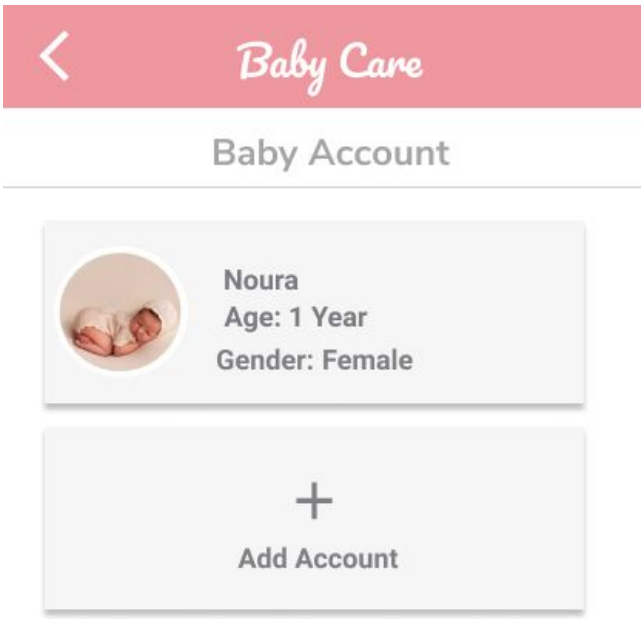


Figure 2.61: Baby Accounts

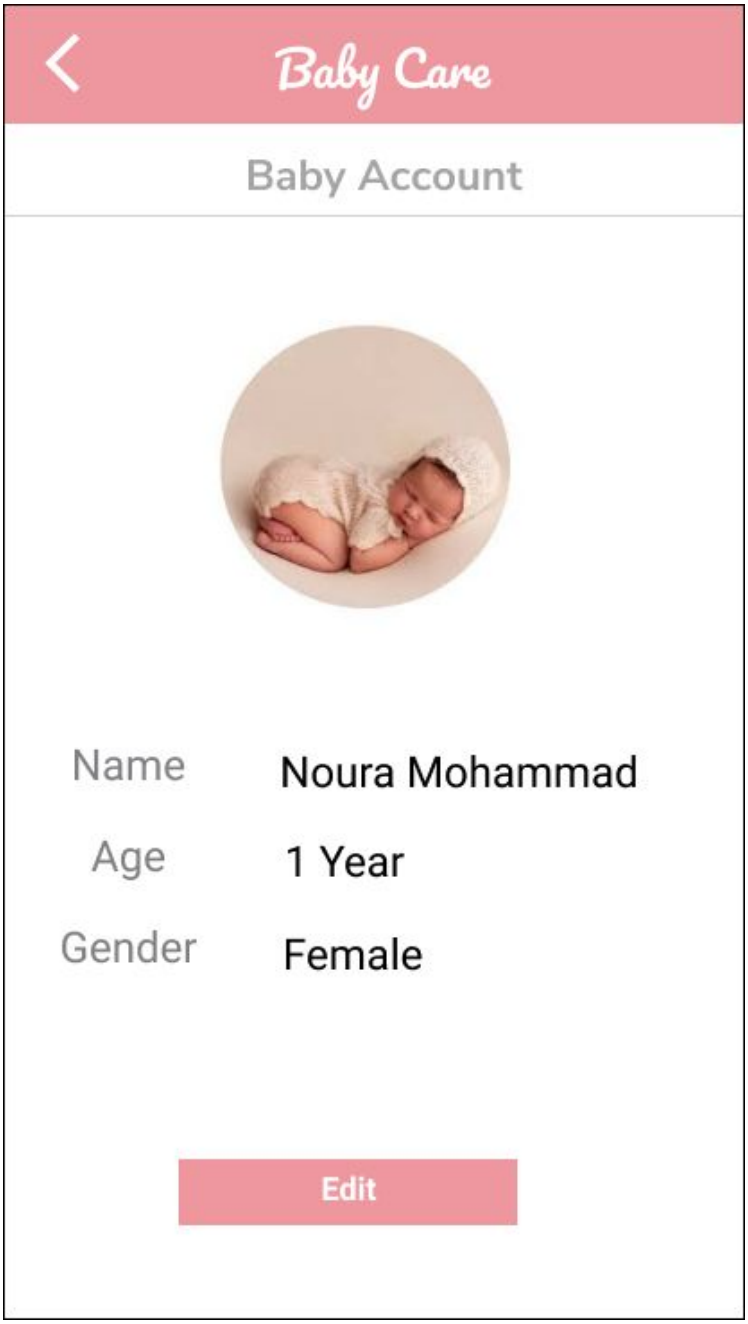


Figure 2.62:View Baby Accounts

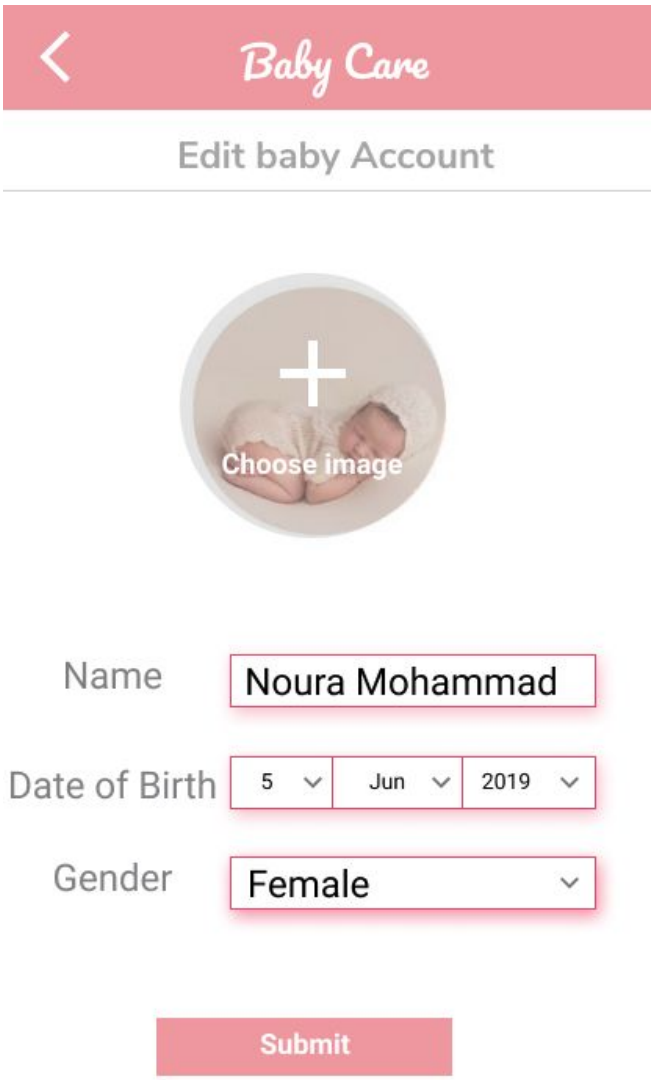


Figure 2.63:Edit Baby Accounts

Chapter III:
System Design Document

1. Introduction

When we designed the "Baby Care Monitoring System", we took into consideration to find the best and easiest way to make this system easy to use for all Mothers. Therefore, we designed a clear fit all the requirements and provide a ready environment for all users to make all necessary data, related to this system, available to users.

1.1 Design goals

The design goals of the Baby Care Monitoring System are:

- Effectiveness: By achieving all the requirements we gathered from mothers and nurseries, we have prepared a system that includes 15 user interfaces, which are simple and easy to use, and users who do not have significant technological expertise will be able to meet their needs and achieve its goals.
- Efficiency: Indicates how the system supports users in performing their tasks in the system. This is achieved through the notification that represents the child in danger (changing the values of values from the normal range) that appears on the mother's phone through the application and providing the mother with detailed information about the child's condition since the bracelet was used

2. Current software architecture

Currently, there is no software architecture used fully dedicated to the child in terms of the manufactured material and light weight, in addition to the safety and Monitoring system that this product provided

3. Proposed software architecture

3.1 Subsystem decomposition

The system will have 15 user interfaces; 8 for the sign up and sign in and Edit account, another 4 to use the system functions.

3.2 Hardware/software mapping

- User interface: using a connection database account to login.
- Bracelet, and mobile phone: to send and receive data.
- Internet connection: to be able to access the Application.
- App using react native for programming language.
- Firebase for create database.

3.3 Persistent data management

The system provides the administrator full ability to change and update the information in database.

3.4 Access control and security

The system can only be handled by authorized users. Only authorized users can access the system, this is done by forcing the use the ID number and password by each user. Moreover, there will be a way to recover the password and username in case they were forgotten using the email or mobile phone that was used to register.

3.5 Global software control

In Baby Care Monitoring System, The users interact with the classes of the UI subsystem. After interacting with these classes, events are created and dispatched to the related objects.

3.6 Boundary conditions

The most effective way to recover from an error is to restart the program by closing and reopening it, as all information is stored in the database to maintain a consistent state even

when a system error occurs. Restarting should not have any negative effects on the database - the system should operate normally.

Chapter IV:
Object Design Document

1. Introduction

a baby care bracelet is designed to accurately and completely model the necessary mobile functionality to manage the entire “front end” of a baby care bracelet – including retrieving vital signs in Real Time and data charts, logging in and out, discovering bracelets, connecting via Wi-Fi.

The objective of the system is to be simple, but also to cover every detail and function needed. Baby care will include a simple user interface that allows users to log in and (monitoring the baby) and this can be done around the clock. The software will be connected to the bracelet to receive signals and will also be connected to a system's database.

1.1 Object design trade-offs

As with any software system, several explicit trade-off decisions had to be made in the object design. The decision to build versus buy components for this system was prescribed to us in the project assignment – all code in this system is our own original work, including data and user interfaces.

1.2 Interface documentation guidelines

We have adopted specific interface documentation guidelines and conventions in order to make communication more uniform among the team. First, all JS files are named with singular nouns or noun phrases (camel Case).

The project has five main folders are arranged as follows:

Roots folder and this folder has four js files for app navigation stack and each file have the main function.

Components folder contains five files and each file has a functional component Conceptually, components are like JavaScript functions. They accept arbitrary inputs (called “props”) and return React elements describing what should appear on the screen.

the modals folder contains six files, five of them models contain classes and one helper file contains multiple functions that are used in the app.

Screens folder contains 11 files and one auth folder that have all auth files and all of them have function components
and this is An efficient way to structure React Native projects based on react native documentation

Rules for Naming
each file has a function written in camel Case and named based on its return,
all states in the project named lower case and set for the state camel Case, for example, const [user,setUser] = React.useState
props

1. Packages

@react-native-community/async-storage	An asynchronous, unencrypted, persistent, key-value storage system for React Native.
@react-native-firebase/app	React Native Firebase is the officially recommended collection of packages that brings React Native support for all Firebase services on both Android and iOS apps.
@react-native-firebase/auth	Firebase Authentication aims to make building secure authentication systems easy, while improving the sign-in and on boarding experience for end users. It provides an end-to-end identity solution, supporting email and password accounts, phone auth, and Google, Twitter, Facebook, and GitHub login, and more.
@react-native-firebase/database	The Firebase Realtime Database is a cloud-hosted database. Data is stored as JSON and synchronized in realtime to every connected client. When you build cross-platform apps with our React Native SDK, all of your clients share one Realtime Database instance and automatically receive updates with the newest data.
@react-native-firebase/messaging	React Native Firebase provides native integration of Firebase Cloud Messaging (FCM) for both Android & iOS. FCM is a cost free service, allowing for server-device and device-device communication. The React Native Firebase Messaging module provides a simple JavaScript API to interact with FCM.
@react-native-firebase/storage	Cloud Storage for Firebase is a powerful, simple, and cost-effective object storage service built for Google scale. The Firebase SDKs for Cloud Storage add Google security to file uploads and downloads for your Firebase apps, regardless of network quality. You can use our SDKs to store images, audio, video, or other user-generated content. On the server, you can use **Google**

	Cloud Storage, to access the same files.
@react-navigation/drawer	Common pattern in navigation is to use drawer from left (sometimes right) side for navigating between screens.
@react-navigation/native": "^5.8.9"	React Navigation is made up of some core utilities and those are then used by navigators to create the navigation structure in your app. Don't worry too much about this for now, it'll become clear soon enough! To frontload the installation work, let's also install and configure dependencies used by most navigators, then we can move forward with starting to write some code.
@react-navigation/stack": "^5.12.6"	By default the stack navigator is configured to have the familiar iOS and Android look & feel: new screens slide in from the right on iOS, fade in from the bottom on Android. On iOS the stack navigator can also be configured to a modal style where screens slide in from the bottom.
axios": "^0.21.1	Making HTTP requests to fetch or save data is one of the most common tasks a client-side JavaScript application will need to do. Third-party libraries — especially jQuery — have long been a popular way to interact with the more verbose browser APIs, and abstract away any cross-browser differences.
dayjs": "^1.10.2",	Day.js 2KB immutable date-time library alternative to Moment.js with the same modern API
react-native-svg": "^12.1.0"	react-native-svg provides SVG support to React Native on iOS and Android, and a compatibility layer for the web.
react-native-safe-area-context": "^3.1.9"	The SafeAreaProvider component is a View from where insets provided by Consumers are relative to. This means that if this view overlaps with any system elements (status bar, notches, etc.) these values will be provided to descendent consumers.
Arduino core for ESP8266	brings support for the ESP8266 chip to the Arduino environment. It lets you write sketches, using familiar Arduino functions and libraries, and

	run them directly on ESP8266, with no external microcontroller required. ESP8266 Arduino core comes with libraries to communicate over WiFi using TCP and UDP, set up HTTP, mDNS, SSDP, and DNS servers, do OTA updates, use a file system in flash memory, and work with SD cards, servos, SPI and I2C peripherals.
Firebase ESP8266 Client	Google Firebase Realtime Database Arduino Client Library for Espressif ESP8266 This client library provides the most reliable operations for read, store, update, delete, backup and restore the Firebase Realtime database data.
MAX30100	This Library supports the MAX30100 Pulse Oximetry IC Pulse measurement with the MAX30100 IC
Wire Library	This library allows you to communicate with I2C / TWI devices. On the Arduino boards with the R3 layout (1.0 pinout), the SDA (data line) and SCL (clock line) are on the pin headers close to the AREF pin. The Arduino Due has two I2C / TWI interfaces SDA1 and SCL1 are near to the AREF pin and the additional one is on pins 20 and 21. As a reference the table below shows where TWI pins are located on various Arduino boards.

Table 4.1 Packages

Chapter V:
SoftwareDeployment andConfiguration Management Plan

1. Introduction

Software configuration management is a set of processes, policies, and tools that organizes the development process. Our main objective(scope) is a monitoring system that helps parents to monitor their infants body temperature, oxygen saturation and heart rate through a smart phone application that is connected to an electronic bracelet placed on the infants wrest which is constantly providing readings to the application giving the parents the ability to monitor their infant's vital signs from anywhere.

2. Management

Software project management is planning and leading on how the software project will go, and it is primarily concerned with the production aspect, and break down the tasks between the team members.

2.1 Organization

We went through the “System Development Cycle”. which provided a clear view of the the entire project, resource requirements, timelines, and the objectives that need to be delivered.

In these unusual circumstances, we must-have tools to merge our code, so we have been using git and GitHub to manage our tasks and merge our code, and track progress.

the project had three Milestones each Milestone has tasks and each task have been going through Cycle the leader create tasks in (to-do list) and each team member take a task and move it to (in progress list) after a team member finished a task he will move it to (review in progress list) and create a pull request and assignees it to a team member to review it and if it has bugs we create issues in the issue border and assignee it to the pull request after it's done the process the team leader move it to the (merge list) and close the task as shown in figure ()

2.1.1 github project board

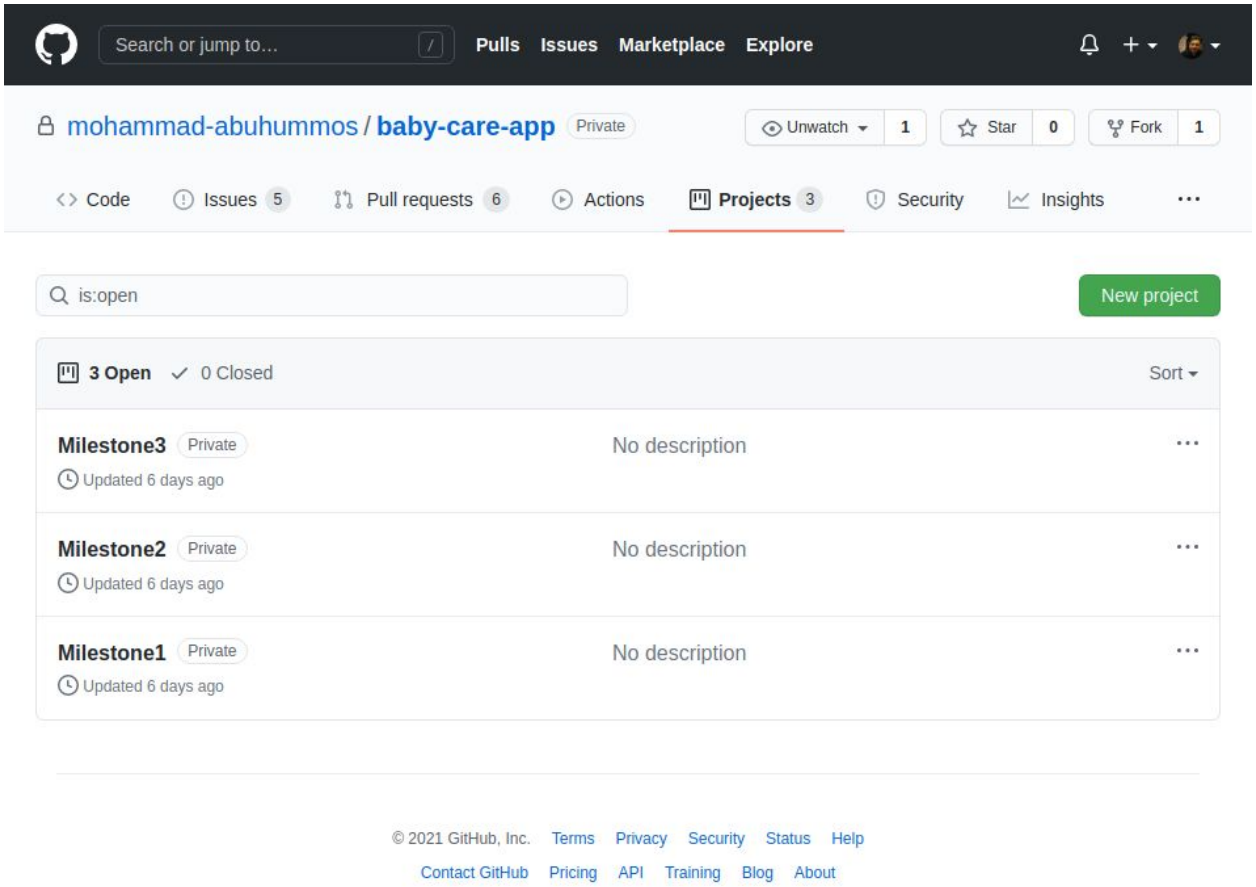


Figure 5.1: github project board

2.1.2 github milestones board

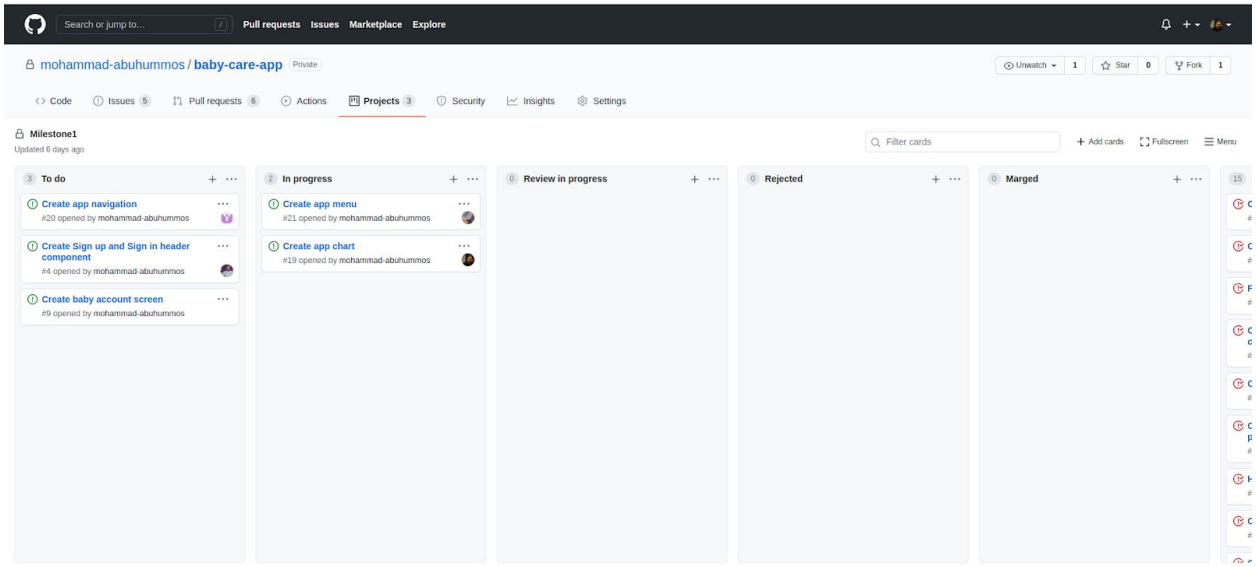


Figure 5.2: github milestones board

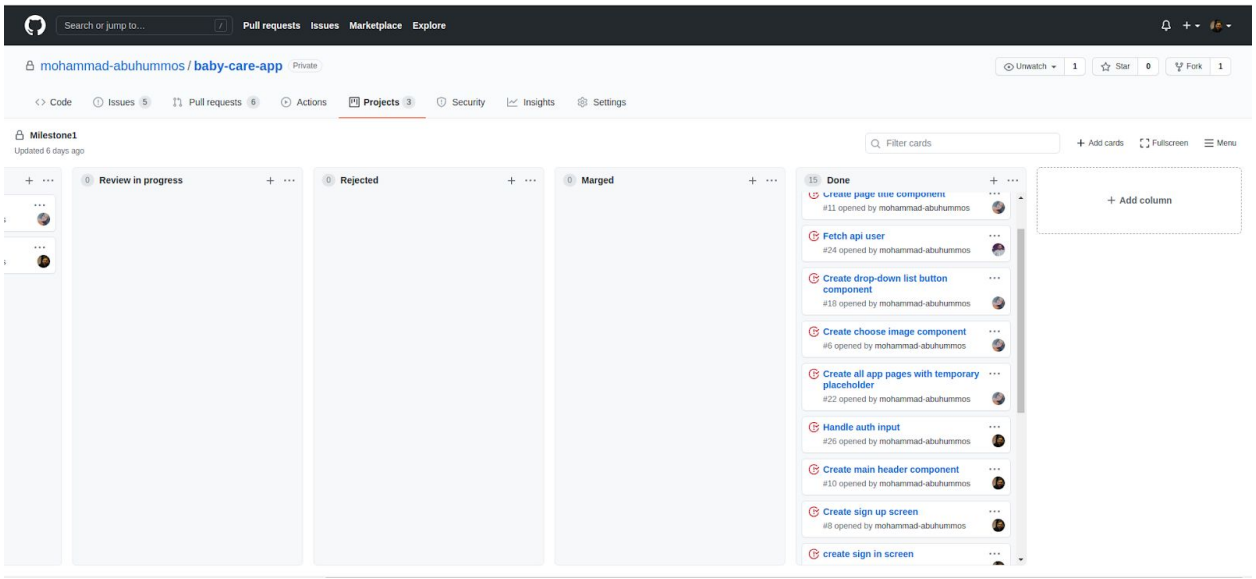


Figure 5.3: github milestones board

2.1.3 github issue board

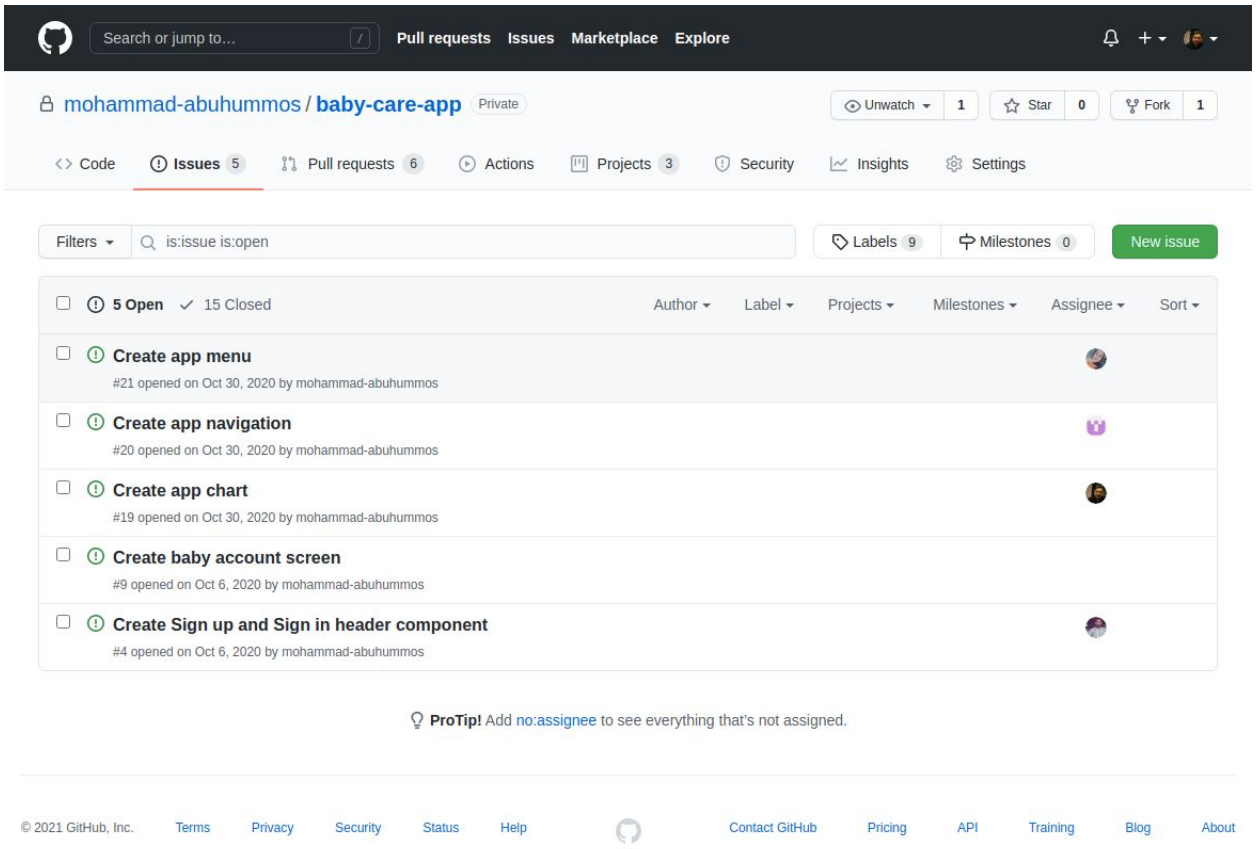


Figure 5.4: github issue board

2.1.3 github pull request

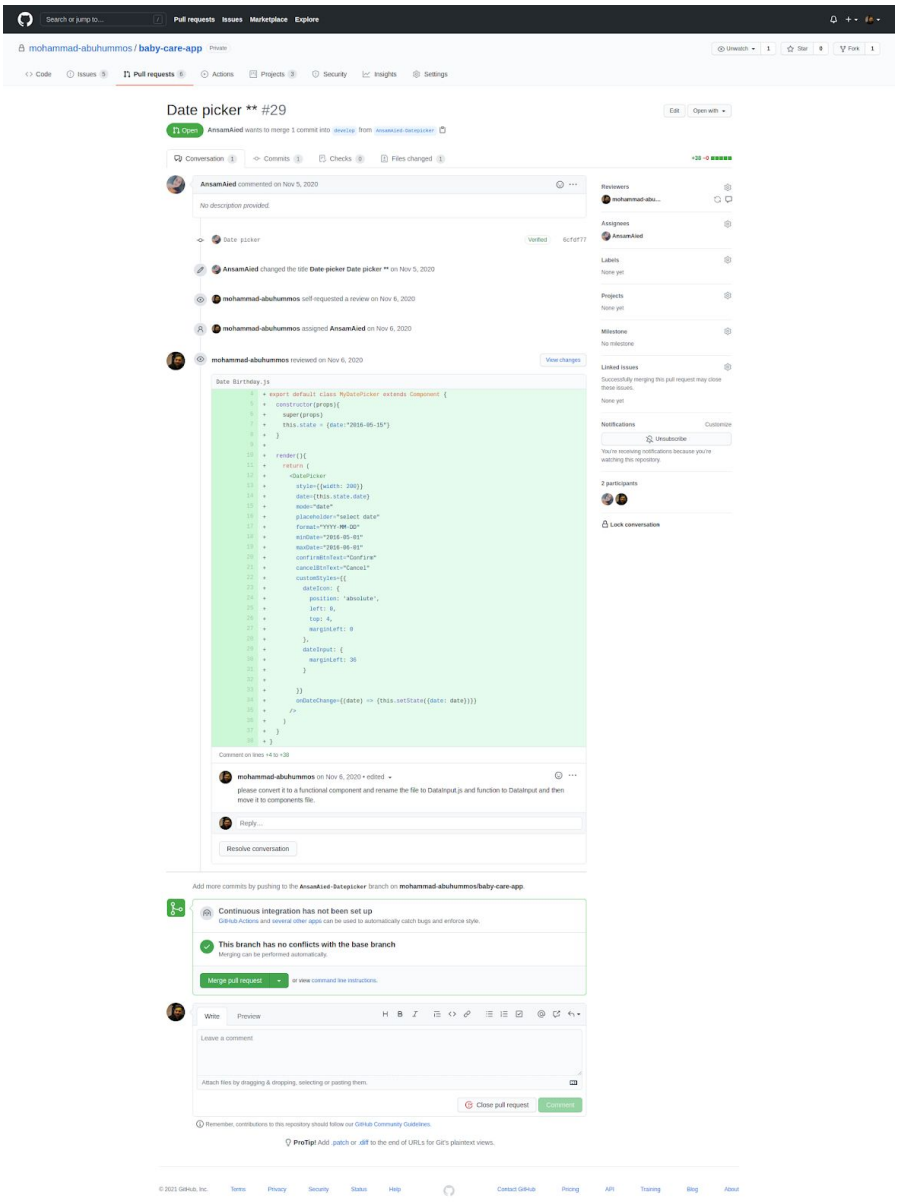


Figure 2.5: github pull request

2.2 Responsibilities

Efficiency:

Sending the values monitored by the bracelet to the application successfully and in a timely manner

Real-time:

Ensures timely response by receiving and handling the bracelet values and determining the child's current condition

User friendly:

The software interface is easy to use, it is not difficult to learn or to understand.

Reliability:

Probability of failure is minimized in the Baby Care system, where it is trusted and relied on.

Robustness:

The bracelet is made of a lightweight material and is not harmful to children's health

3. Activities

The mother is required to put the bracelet on the child's wrist, make sure that the internet is available, download an application (Baby Care) on a phone, and create a special account for her that includes information about her child so that she can monitor her child and receive notification in case of danger

4. The schedule

Starting with our software development, we connected the sensors (LM34 temperature sensor and MAX30102 pulse oximetry and heart-rate sensor) and created the bracelet, connected it to the Wi-Fi and turned it on, and started to receive the required values on the application designed with the language React Native

5. Resources As we listed before in (Chapter 1) in “Method, tools, and techniques”.

6. Plan Maintenance

The software maintenance plan technical approach addresses the full product life cycle, where it includes all of the team members participation in each phase of the life cycle and software maintenance, and it adapts based on the requirements, risk level, lessons learned from feedback, and continuous improvement. Team members hold meetings using the Zoom app and put tasks on Github app to review software upgrade needs, plans, and status. The team will be fully responsible for promotions and updates.

Chapter IV:
Test Plan

1. Introduction

The goal of this document is to develop a test plan for the time baby care system This document defines all the procedures and activities required to prepare for testing of the functionalities of the system which are specified in the Vision document. The objectives of the test plan are to define the activities to perform testing, define the test deliverables documents, and to identify the various risks and contingencies involved in testing.

2. Approach

This section describes the overall approach of the testing which ensures that each feature and

The combination of the features are adequately tested. The major tasks that are used are:

2.1. Unit testing

Unit testing is a test method that verifies that individual source code units are working

correctly. The goal of unit testing is to isolate each part of the program and show that individual parts are correct. Testing tool. It will be used to test the unit.

2.2. Load testing

A pregnancy test is a process of creating an order on a system or device and measuring its

response. Generally, refers to the practice of modeling the expected use of a program by

simulating the many users who access the program. As such, this test is best suited for multi-user .

2.3. System Testing

Once the system is fully established, it must be tested against the requirements of the

software and system specifications to verify whether it provides the required features. A system

the test can include a number of specialized test types to see if all functional and non-functional

requirements have been met.

2.4. Performance Testing

The system must meet the performance requirements as stated in the Vision document.

The performance will be evaluated based on system response time and database commands.

2.5. Manual Testing

Manual testing will be performed to ensure that different parts of the code are validated

using test cases created.

3. Testing materials (hardware/software requirements)

When a new version of the system is transmitted to the test group after a suspension of testing has occurred, all previous tests will be rerun to ensure program changes have not inadvertently affected other portions of the program.

4. Test cases

4.1 Accuracy test

The bracelet was tested on a sample of healthy children, where they were 3 children, The results were attached to the bracelet readings for (pressure, temperature, and oxygen) for each of the children subjected to the experiment.

1)

Name:Sand Ahamd

Gender: male

Age: 6 Years

Email:Ahmad.a.88@gmail.com

Spo2

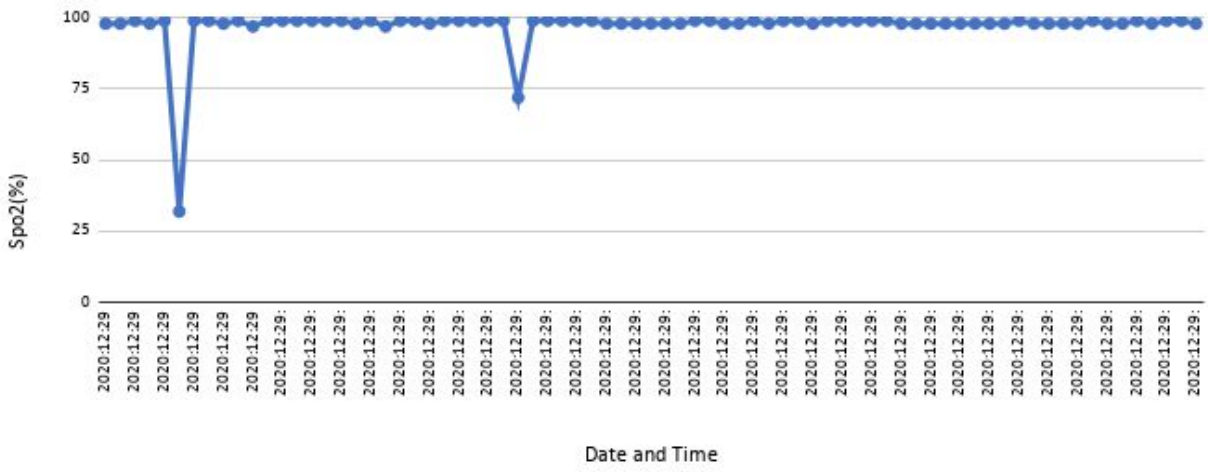


Figure 6.1: Sand Ahmad

Temperature

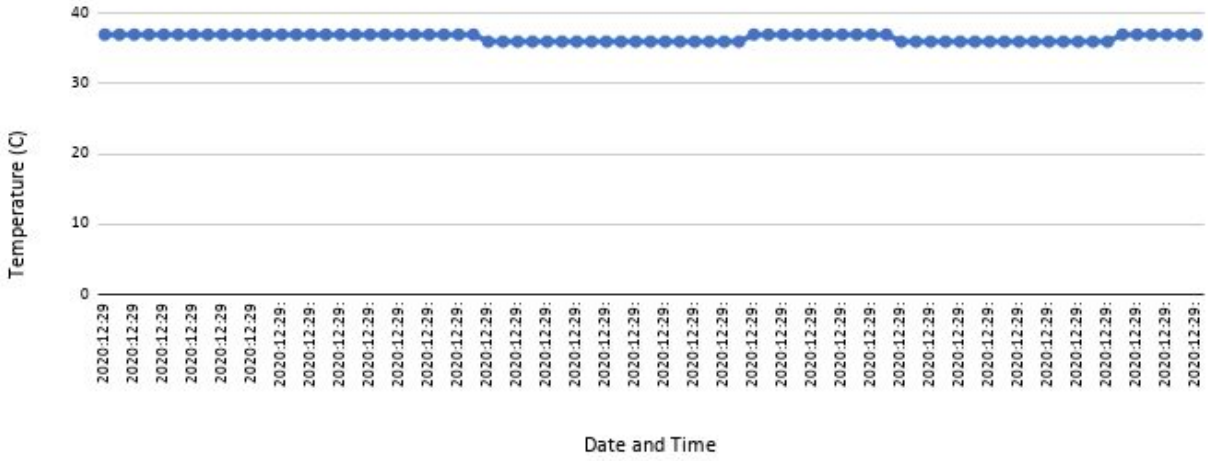


Figure 6.2: Sand Ahmad

bpm

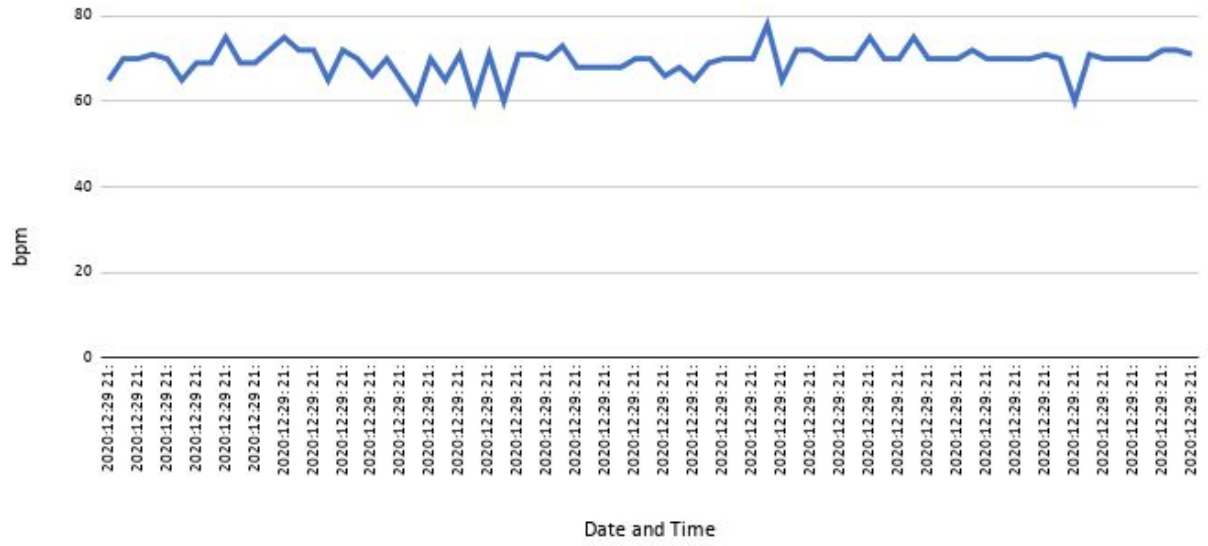


Figure 6.3: Sand Ahmad

2)

Name: Farah eyed

Gender: Female

Age: 3 Years

Email:eyad.armous@gmail.com

Spo2

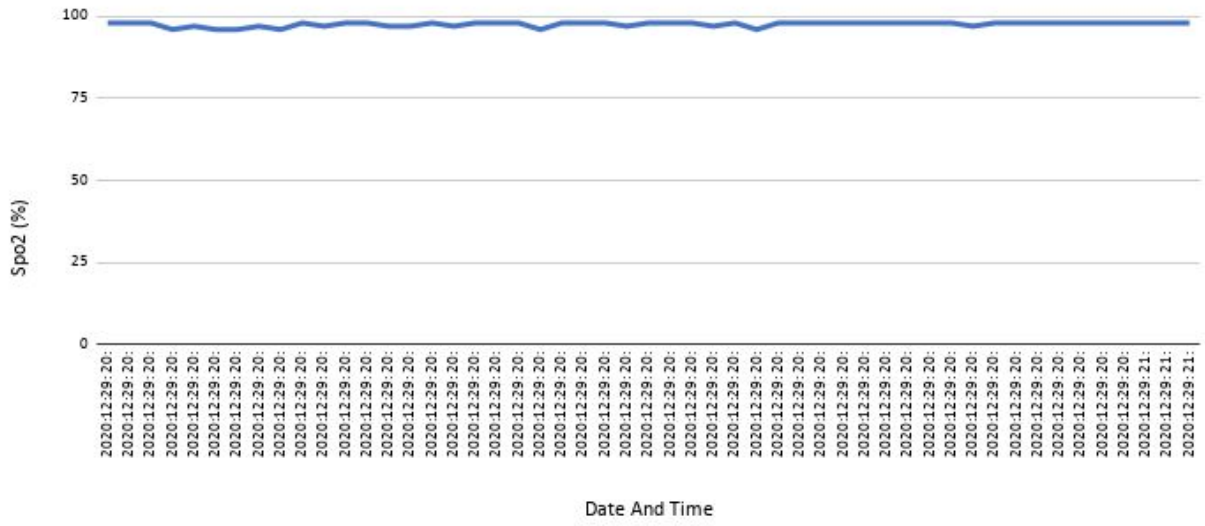


Figure 6.4: Farah eyed

Temperature

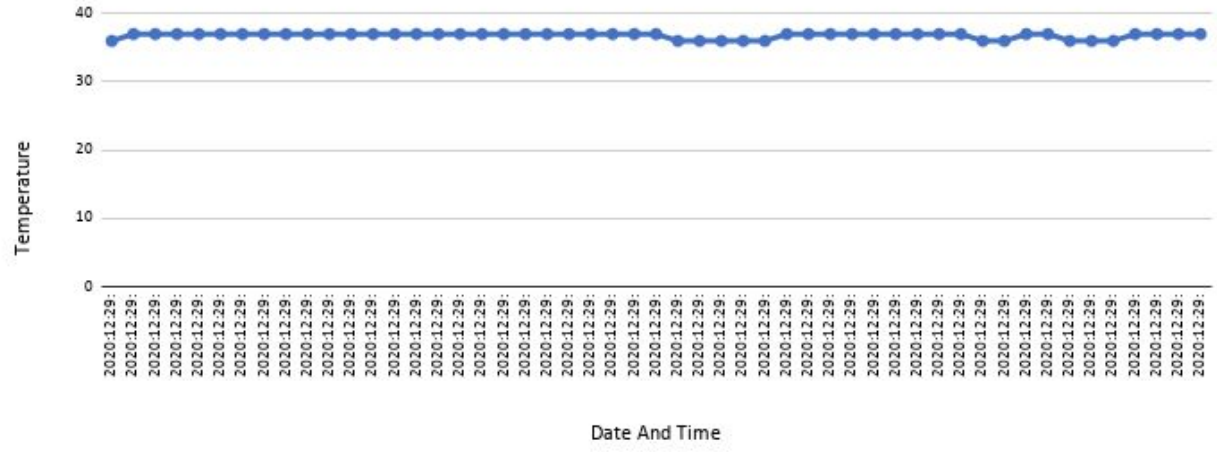


Figure 6.5: Farah eyed

bpm

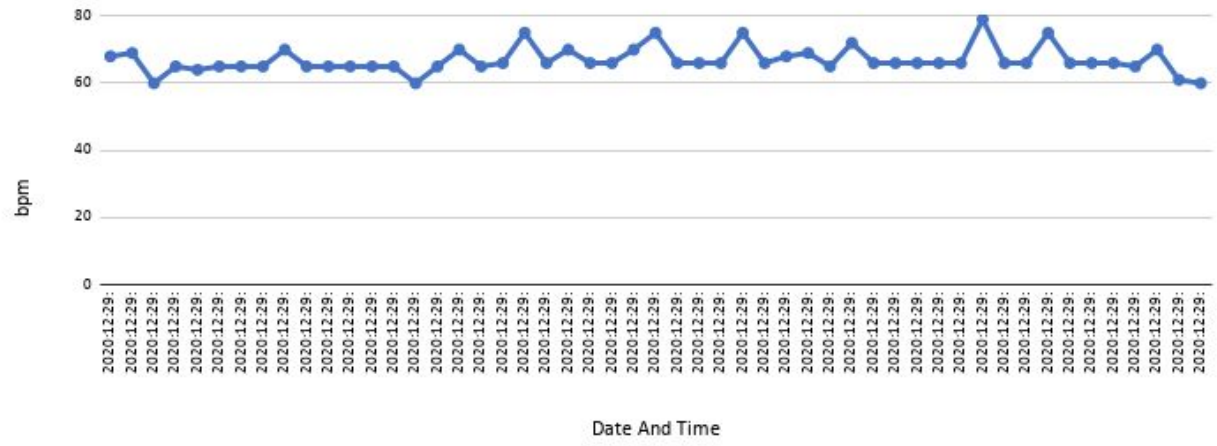


Figure 6.5: Farah eyed

3)

Name: karam Salem

Gender: male

Age: 7 Years

Email:Salem.armous@gmail.com

Spo2

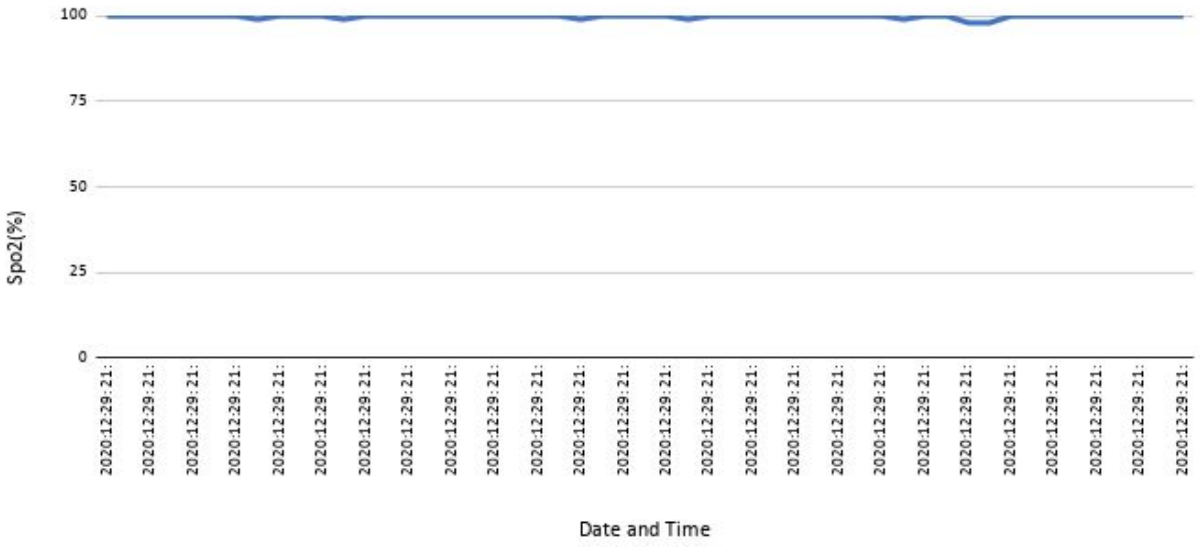


Figure6.6: karam Salem

Temperature

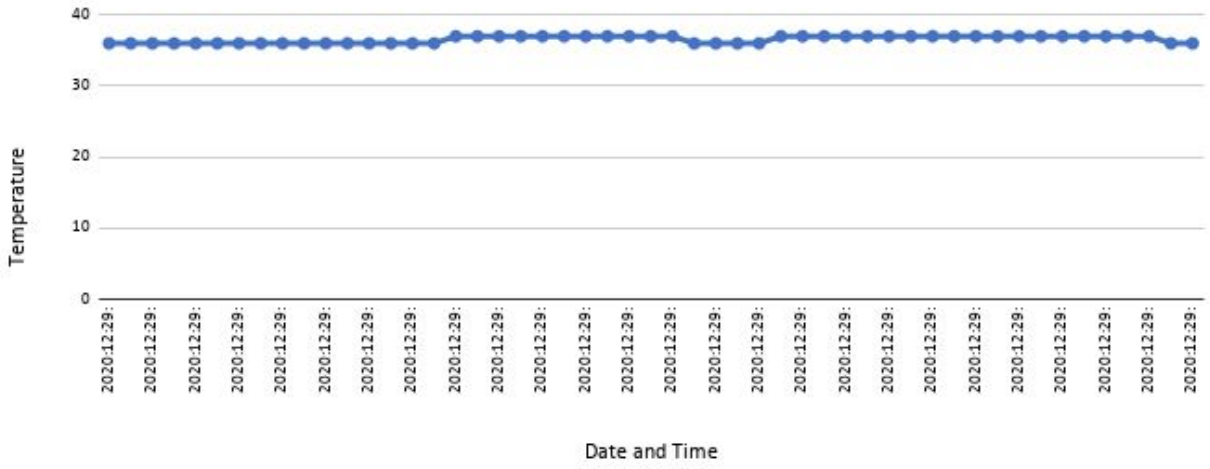


Figure 6.7: karam Salem

bpm

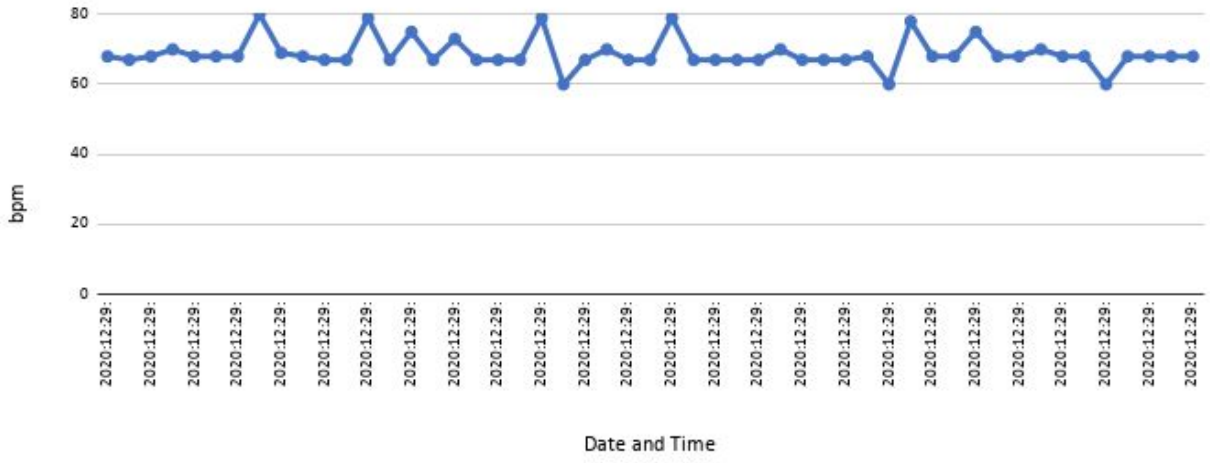


Figure 6.8: karam Salem

Bracelet test state cases

Network Test

while SSID and password were not found, the bracelet will not be initiated, and the bracelet will blink blue and the network with the name baby care Bracelet will appear in the networks so the user can send password and SSID to the bracelet.

Baby set Test.

while baby id is not set the bracelet will not be initiated and the red light in the sensor will not work until the baby is selected. in the app will appear status for baby.

bracelet initializing

After all is set up the bracelet will be initialized and if something goes wrong the red light will not appear

App test cases

Login

State	Test case	User input	Pass criteria
state_1	user login	The user enters the required data	redirect to home page
state_2	user login	user enters a wrong data.	Display message nvalid information password or email is incorrect.

Table 6.1:Login

Enter Bracelet id

State	Test case	User input	Pass criteria
state_1	Enter Bracelet	The user enter the Bracelet id.	redirect to sign up.
state_2	Enter Bracelet	user enter a wrong Enter Bracelet id .	Display message invalid Bracelet id.

Table 6.2:Enter Bracelet id

Signup

State	Test case	User input	Pass criteria
state_1	User signup	The user enters the required data.	redirect to Create baby account.
state_2	User signup	user enters a wrong data.	Display message nvalid information with specification the wrong data.

Table 6.3: Signup

Edit baby account

state	Test case	User input	Pass criteria
state_1	Edit baby account	The user enters the required data.	redirect to Home screen.
state_2	Edit baby account	user enters a wrong data.	Display message nvalid information with specification the wrong data

Table 6.4:Edit baby account

Home screen

state	Test case	User output	Pass criteria
state_1	Baby status	Baby id	Status connected
state_2	Baby status	wrong not equal bracelet baby id	Disconnected and display message please select baby
state_3	Vital signs status	Vital signs equal to zero	Display message please check the bracelet.
state_4	Vital signs status	Vital signs not equal zero	Display Vital signs status

Table 6.5:Home screen

Carete baby account

State	Test case	User input	Pass criteria
state_1	Create baby account	The user enters the required data.	redirect to Home screen.
state_2	Create baby account	user enters a wrong data.	Display message nvalid information with specification the wrong data.

Table 6.6:Carete baby account

Chapter VII:
Conclusion and Future Work

Future Work

For our future work, we are hoping that this application becomes more than just a graduation project for starters, and listed below are our main ideas:

1-Smaller bracelet to make it more comfortable and practical

2-build custom microcontroller that fit sensors needs

2 - Make it more accurate

3- Searching for the best pieces to make them waterproof

4 - We make it suitable for more ages

5 - Expanding the scope of its work and developing it

Conclusion

We have proven through our work on this bracelet 80%, with a high focus on development. One of the difficulties we faced is that its size is a little large, but despite that, it is accurate readings and we hope in the future to develop it well.