

Project Report

H₂O4H

Smart Water Bottle

Group - 13

H₂O - Water 4 - For H - Health



Univercity Of Sri Jayawardanapura
Faculty Of Technology
Department Of Information Communication Technology

GROUP DETAILS

Project Title

“H₂O4H – A smart water bottle that makes drinking habit Smart.”

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Declaration

we certify that this report does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university, and to the best of my knowledge and belief, it does not contain any material previously developed, published, or written by another person except where due reference is made in the text.

All team members.

Acknowledgement

Through this acknowledgement, we are expressing our gratitude to all the people who have helped us and are associated with this project and have made this a worthwhile experience. The project is made under the guidance of Dr.Senaka Amarakeerthi, (Senior Lecturer, Department of information and communication technology) Firstly, we thank senior lecturer Dr. Senaka Amarakeerthi and Mr. Iroshan Aberathne, who gave us this opportunity to learn new things and implement them in our Project on “Smart Water Bottle”.

His continuous guidance with practical approach and valuable suggestions regarding the project helped me in visualize the project design. Without his guidance and efforts, it would not have been possible to come up with this project so effectively and efficiently. His kind cooperation helped us complete our project work. We also sincerely express our thanks to our team members and other friends who have shared their opinions as well as experience with us. Their support was with us throughout. We have worked hard and tried our best efforts and to complete this project and make this report an informative one.

Thanks for all encouragement!

All team members.

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List of Abbreviations

<i>AC</i>	<i>Alternating Current</i>
<i>AI</i>	Artificial Intelligence
<i>APC</i>	Automatic Power Control
<i>CLI</i>	Command Line Interface
<i>DBMS</i>	Data Base Management System
<i>DDS</i>	Digital Data Storage
<i>DSP</i>	Digital Signal Processing
<i>Gb</i>	Giga Bits
<i>GND</i>	Ground
<i>GUI</i>	Graphical User Interface
<i>IC</i>	Integrated Circuit
<i>IDE</i>	Integrated Development Environment
<i>IEEE</i>	Institute of Electrical and Electronic Engineers
<i>IoT</i>	Internet of Things
<i>LED</i>	Light Emitting Diode
<i>MCU</i>	Micro Controller Unit
<i>QoS</i>	Quality of Service
<i>Rx</i>	Receive
<i>SDLC</i>	Software Development Life Cycle
<i>SQL</i>	Structured Query Language
<i>SD</i>	Secure Digital Card
<i>Tx</i>	Transmit
<i>UDS</i>	Ultrasonic distance Sensor
<i>URL</i>	Uniform Resource Locator
<i>USB</i>	Universal Serial Bus
<i>V</i>	Voltage
<i>WLAN</i>	Wireless Local Area Network

Introduction and Background

Water is a vital nutrient for our mental and physical health. Not having enough water, can cause symptoms such as headache, fatigue, disorder in blood pressure, urinary infections, and muscle and skin problems. Although these facts are known to many, recent studies indicate that we tend to ignore drinking enough water required for our body.

For example, the results of two surveys conducted in the US showed that more than 30 percent of adults and almost 50 percent of children and adolescents are inadequately dehydrated. Thus, it is key to remind people to drink water regularly to prevent the negative effects of dehydration. This situation provides a great opportunity for changing user behavior through technology. Addressing this, we first designed a smart bottle concept, Grow, which tracks daily water intake and gives positive feedback to motivate drinking water regularly.

We as human beings' water is a more important factor in our healthy life. according to the medical recommendation 6L of water is needed to human body per day but if we drink that volume of water simultaneously that is not useful our body. Some research confirms that most efficient way is drinking 200ml water per hour. When we are busy with our day today life, drinking water may be forgotten. So, our group decides came up with solutions, called "H₂O4H Smart water bottle". "H₂O4H" Water bottle can measure that user usage of water within one hour. Suppose user drink water lower than 200ml then water bottle can give a signal to the user about it. This bottle can take the attention of the user that if a user is not drinking water.

Project requirements

System Requirements The functionalities and non-functionalities are identified by a System Requirements statement that is needed by a system in order to satisfy the customer's Requirements. User needs are effectively met by gathering system requirements. Cost of Implementation can be reduced if the developer has a better idea about system requirements. Developers can be saved the time by knowing system requirements before implementing the System. They are the first and foremost important part of any project, because if the system Requirements are not fulfilled, and then the project is not complete.

Function requirements

- a) User could be connected application and Smart water Bottle.
- b) User could be seen the usage of the water consumed (daily, monthly, weekly)
- c) Smart water Bottle can be measured the amount of water a user is drink
- d) The amount water that user drink can be sent to mobile app
- e) User can be seen the water level of bottle
- f) A reminder should be given to the user from the bottle regarding drinking water
- g) A reminder should be given to the user from the mobile app regarding drinking water

Non - Function requirement

- a) User friendly interface
- b) More Security
- c) Shape of bottle
- d) Usability
- e) Maintainability
- f) Performance

Business Analysis Process

A cost estimate is the approximation of the cost of a program, project, or operation. The cost estimate is the product of the cost estimating process. The cost estimate has a single total value and may have identifiable component value.

For a given set of requirements, it is desirable to know how much it will cost to develop the software to satisfy a given requirement, and how much time development will take.

The cost of a project is a function of many parameters. Foremost among them is the size of the project. Other factors that affect the cost are programmer ability, requirement of the software, hardware, and human resources.

<i>Components</i>	<i>quantity</i>	<i>Price(Rs)</i>
<i>Adriano Nano board</i>	01	Rs.1000.00
<i>Memory card 4 GB</i>	01	Rs. 550.00
<i>Jumper wire</i>	50	Rs.150.00
<i>SD card module</i>	01	Rs.720.00
<i>Bluetooth module</i>	01	Rs.820.00
<i>Bread board</i>	01	Rs 720.00
<i>Ultrasonic Sensor</i>	01	Rs .650.00
<i>RTC Module</i>	01	Rs. 500.00
<i>Make bottle</i>	01	Rs.2000.00
<i>Total</i>		Rs.6570.00

Table 1.1

Tools/Platform, Hardware, and software requirement Specification

Hardware requirements

<u><i>Name of the components</i></u>	<u><i>Specification</i></u>
<i>Bread board</i>	
<i>SD card</i>	4GB SD card
<i>RTC Module</i>	
<i>Ultrasonic Sensor</i>	
<i>Jumper wires</i>	
<i>Battery</i>	Lithium ion 5v
<i>PC</i>	4GB RAM, i5 processor, 1TB HDD,

Table 2.1

Software Requirements

<u><i>Name of the components</i></u>	<u><i>Specification</i></u>
<i>Operating System</i>	Android
<i>IDE</i>	Android studio / Arduino IDE
<i>Language</i>	JAVA / C
<i>Database</i>	SQL

Table 2.2

Identify Stakeholders

Smart bottles are technologically advanced bottles that have wireless communication capabilities for connecting to electronic devices, for instance, wearable or smartphones, and a simulated memory that can provide alerts via a sound system. Smart water bottles, also known as interactive water bottles, are used to update the hydration level in the human body. A smart water bottle has an electronic sheet which collects information, such as age and weight of the individual, in order to trace the amount of water intake and time, and alert the user to drink water before the body gets dehydrated, depending on the information collected by the bottle. The market for smart water bottles is expected to witness significant growth during the forecast period due to these factors.

Several factors such as rising disposable income and increasing awareness among users regarding maintaining the hydration level in the body are anticipated to drive the smart water bottle market during the forecast period. Growing awareness about health among people all over the globe is significantly driving the growth of the global smart water bottle market.

Moreover, governments across the world are taking initiatives to decrease plastic waste production and promote the use of recyclable materials. Additionally, technological innovations in the field of machine learning and Internet of Things (IoT) have resulted in the emergence of mobile apps that give information to users regarding their daily required water intake and hydration levels. Smart water bottle have all these qualities, which is expected to drive the demand for these bottles during the forecast period.

Smart water bottles are expensive due to the technologically advanced product, and are not affordable by the lower income and middle income category population. This is expected to be a restraining factor for the growth of the smart water bottle market during the forecast period.

Timeline

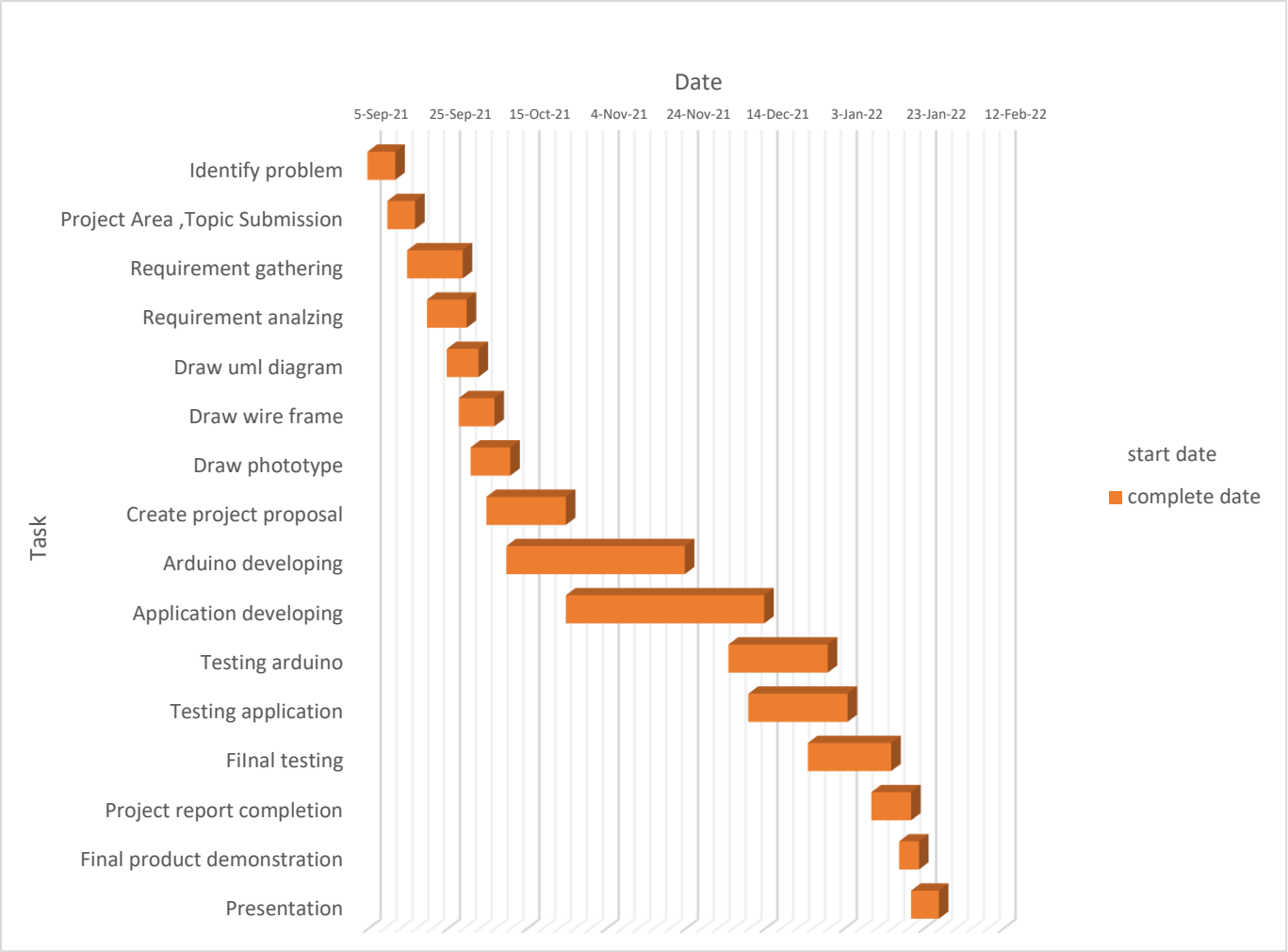


Table 1.3

Figure 1.1

System Design process

Use case diagram

Then we done requirement gathering and make use case diagram to star the development process.

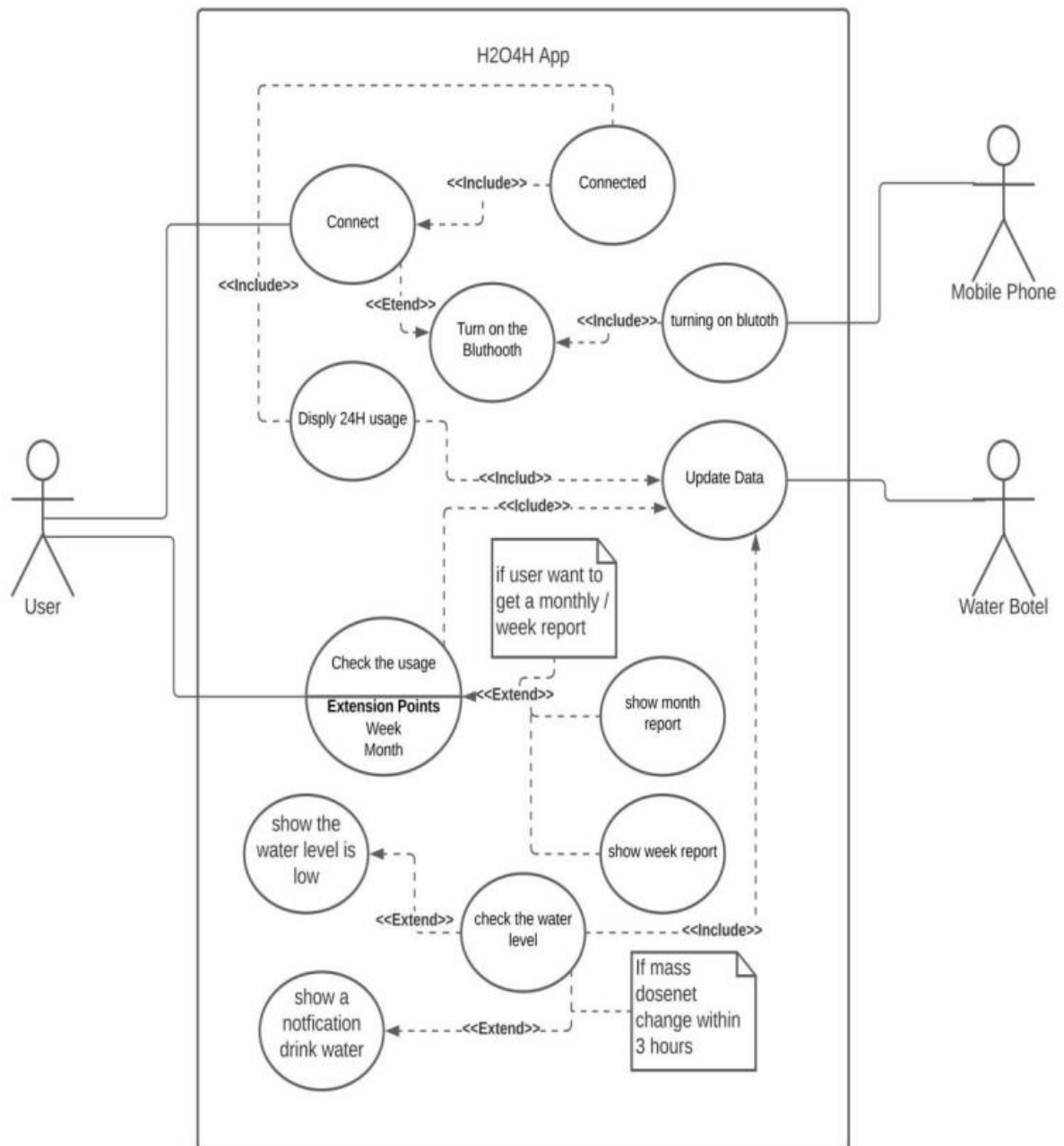


Figure 2.1

Activity Diagram for System

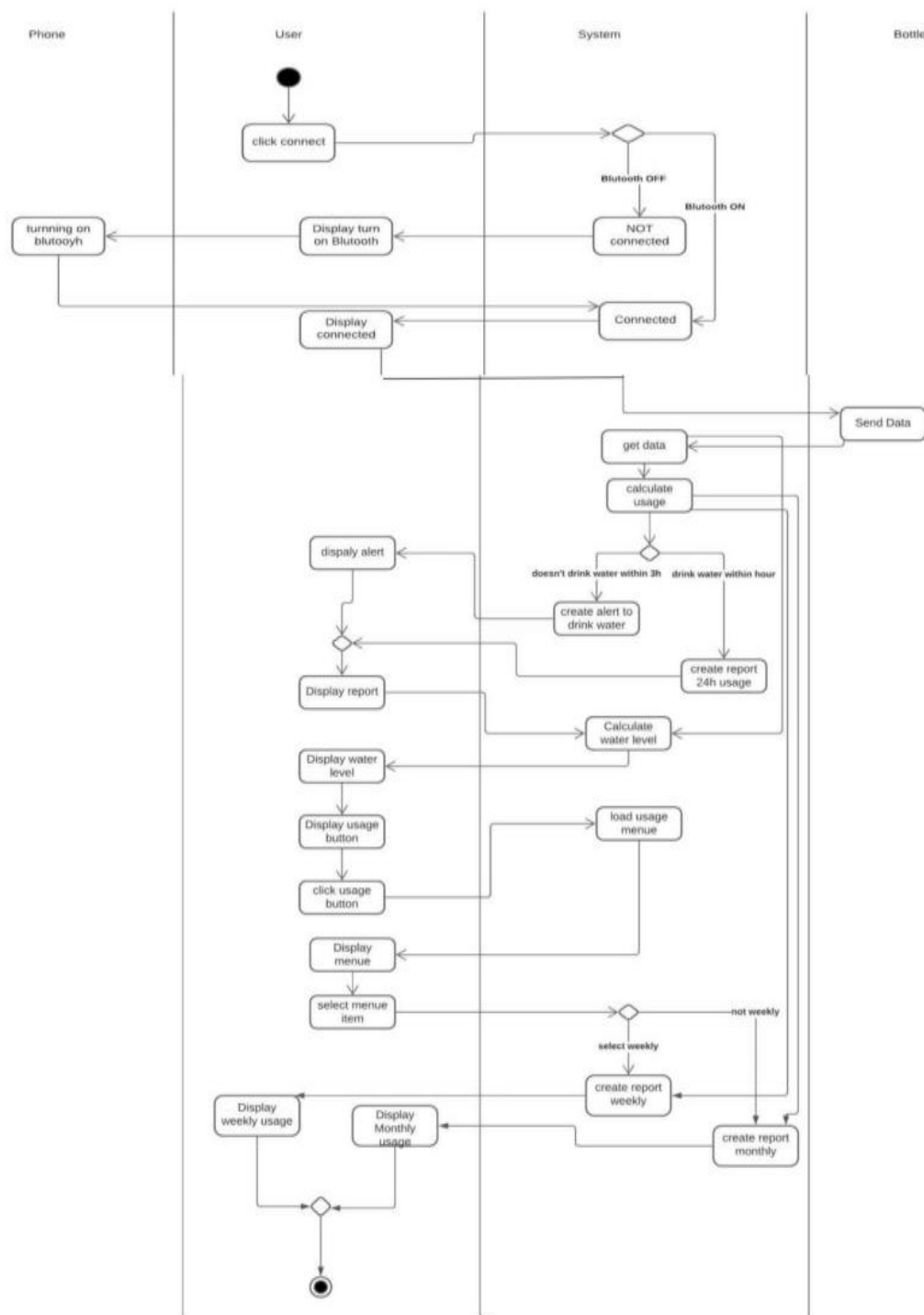


Figure 2.2

Development process

There are several development models, but we choose the iterative model, because the requirements of the complete system are clearly defined and understood and using this model we can easily working with prototype early on the project. Major importance of iterative model is requirements are defined while some functionalities and requested enhancements can be evolving with the development process.

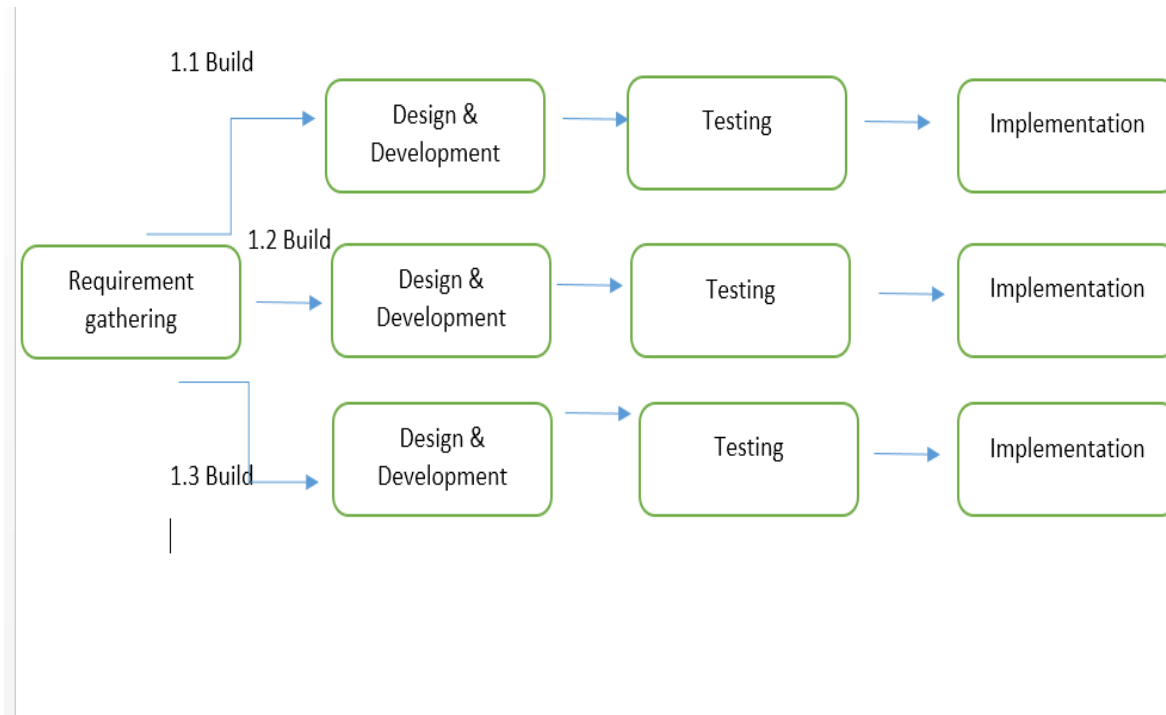


Figure 2

When bottle was made using Arduino we tried several ways to measure the water level accurately. The first attempt load sensor was being tried, the sensor was bulky and too large to fit in the water bottle. Then water level sensor was used to calculate the height of the water level in the water bottle but sensor wasn't have the enough length to do it and it isn't accurate for measure water level we moved to used the ultra-sonic sensor to get the height of the water level and it was successfully get values of the water level and it easy fit water bottle top of the water bottle. If we didn't use the iterative model, we could not do it that way also when we send data to mobile, Two system which are Arduino and nodemcu were built to find out which one is the easy and more accurate cost effective , we discovered if we used the nodemcu board, data could be send to online sever and use that data faction the app but it isn't accurate because of the nodemcu is use Wi-Fi to data transfer, it is not a energy saving method, Bluetooth module with Arduino is the way to go with low power.

Hardware development

In this project we make water bottle, which had capability detect the water quantity inside bottle, recode the water quantity change values and pass the data in mobile application.



Figure 3.1



Figure 3.2

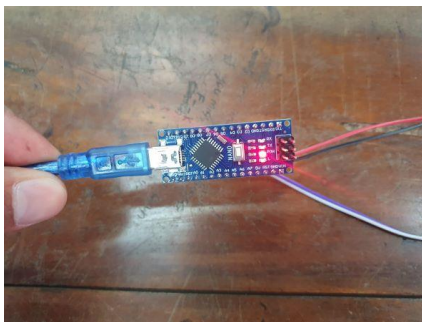


Figure 3.3



Figure 3.4

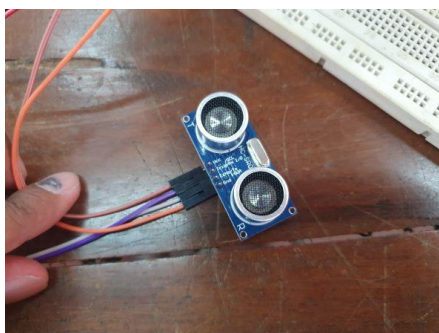


Figure 3.5



Figure 3.6

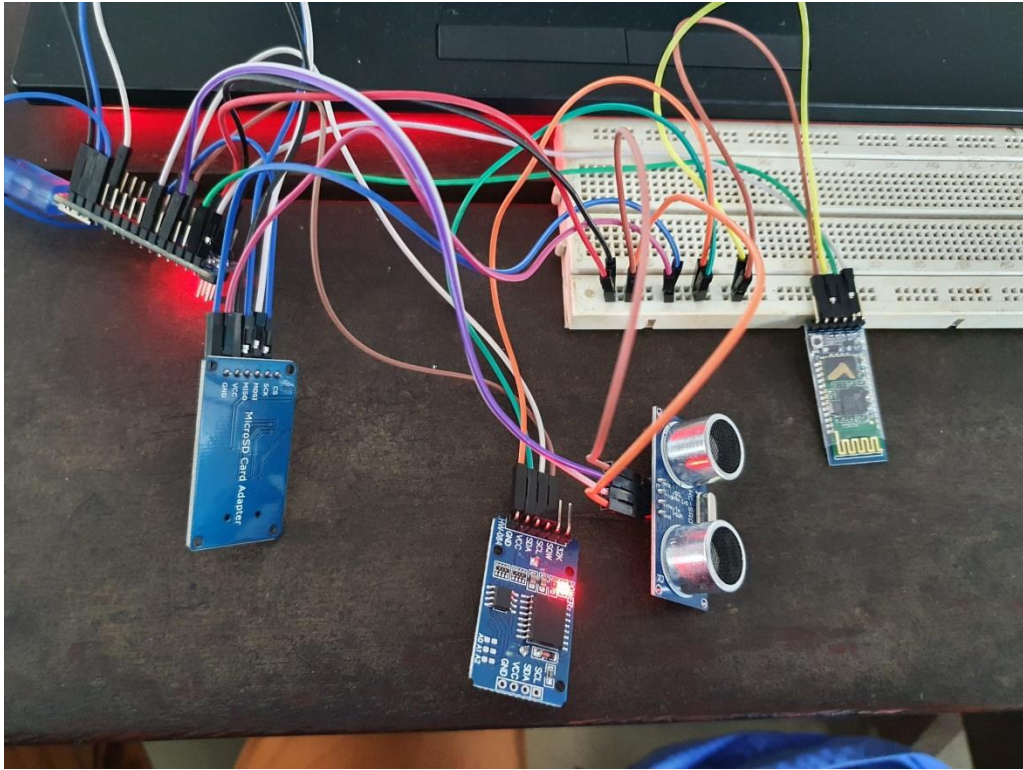


Figure 3.7

Figure 3.6 show all hardware component joined. But get real output we must complied the coding part according to hardware component. Ultra sonic sensor (figure 3.5) was used for the measure the length and write it down with time on SD card module (figure 3.4) when the mobile app isn't connected , if the mobile connected using Bluetooth module HC-05 (figure 3.6) the data that stored in the SD card send to mobile app to using Bluetooth module and send the current data period of 10 second.

Software Development Process

(Mobile application)

To provide sufficient detailed data and information about the system and system elements to enable the implementation as defined in models, System design is used. The process of designing the elements of a system such as the architecture, components, the different interfaces of those components and the data that goes through that system are included in system design.

Wireframes

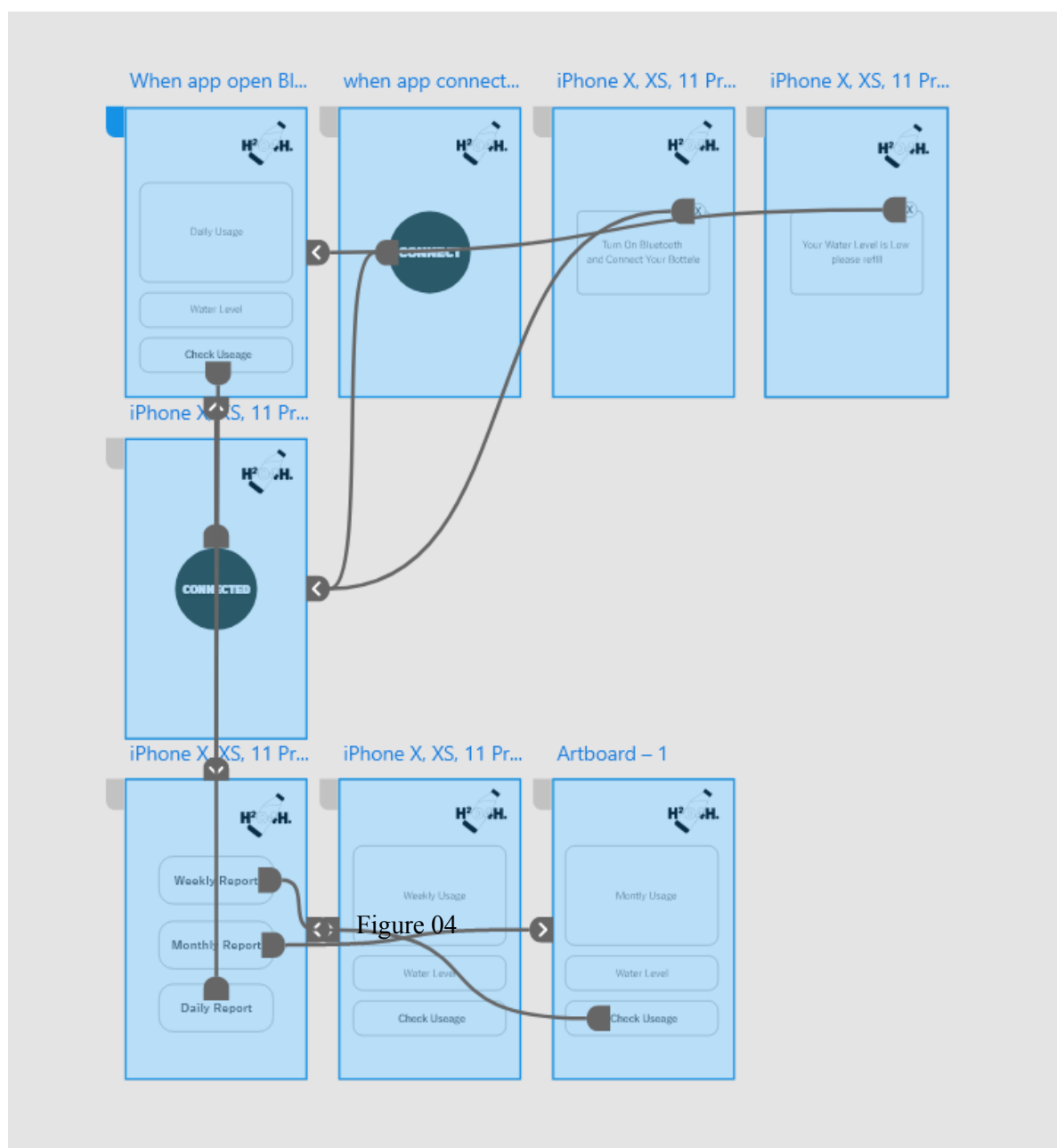


Figure 04

UI Design

Low fidelity wireframes were designed by us as our wish. Then we have discussed and finalized the low fidelity wireframe by getting everyone’s ideas. Next we have planned to design a middle wireframe. Figma was used by us to create the prototype. Mockups were finally designed.it was created in a very simple and understandable way.

Low fidelity prototype of App

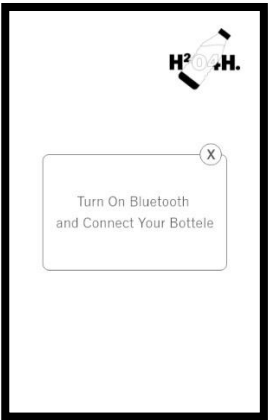


Figure 5.1

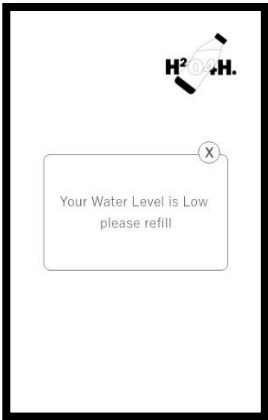


Figure 5.2



Figure 5.3

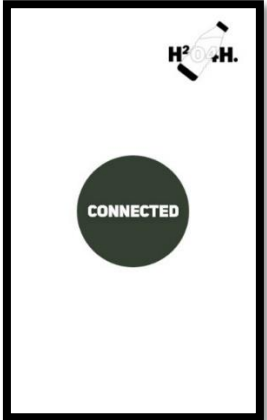


Figure 5.4

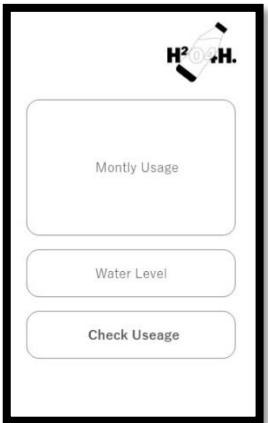


Figure 5.5

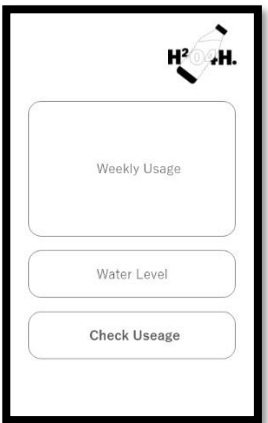


Figure 5.6

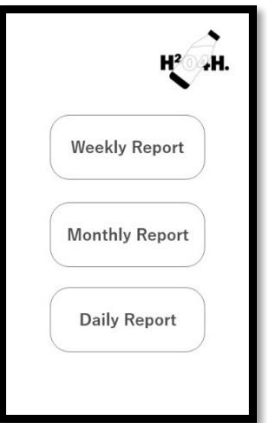


Figure 5.7

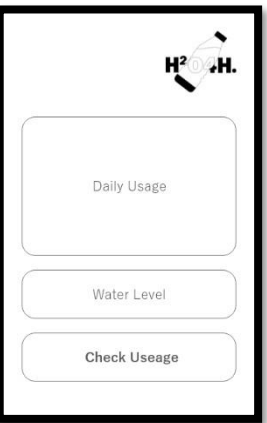


Figure 5.8

High fidelity prototype of App

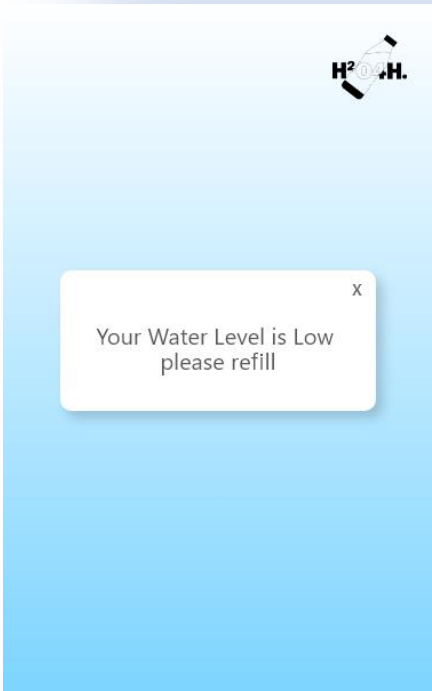


Figure 5.9



Figure 5.10

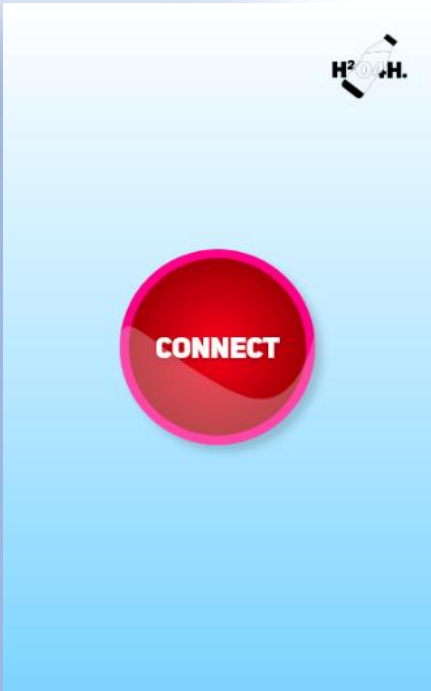


Figure 5.11



Figure 5.12



Figure 5.13

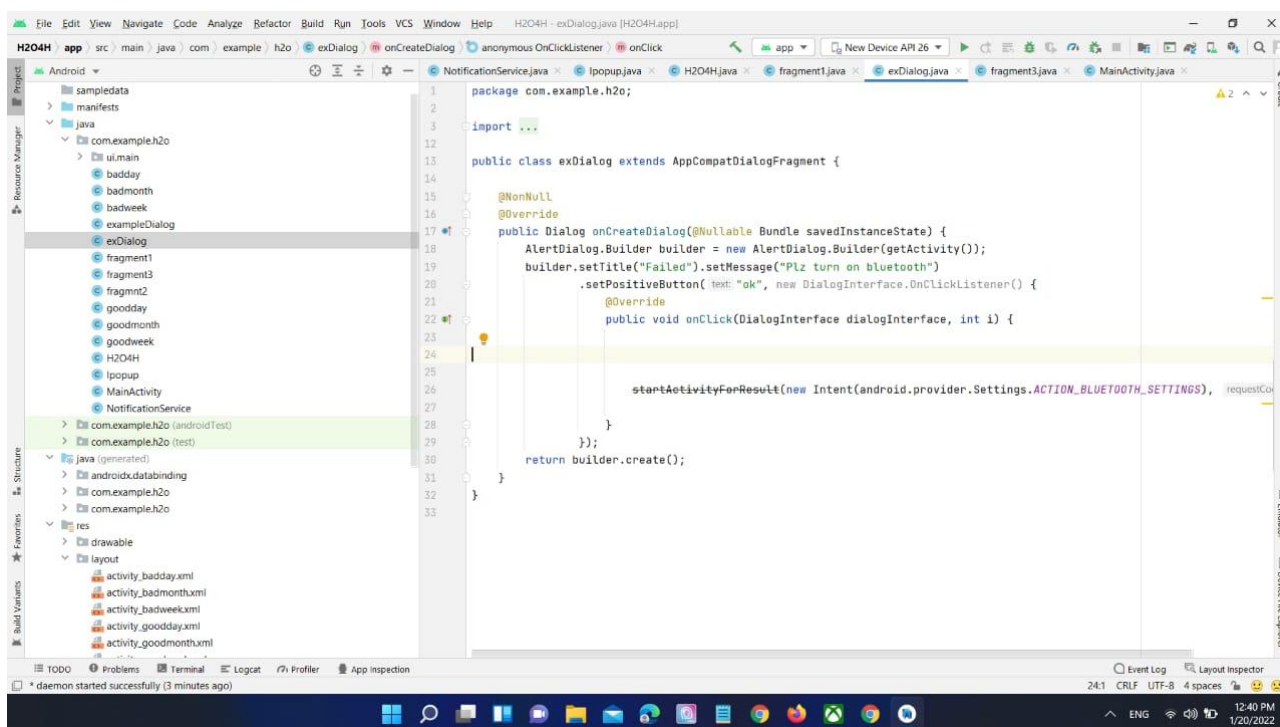
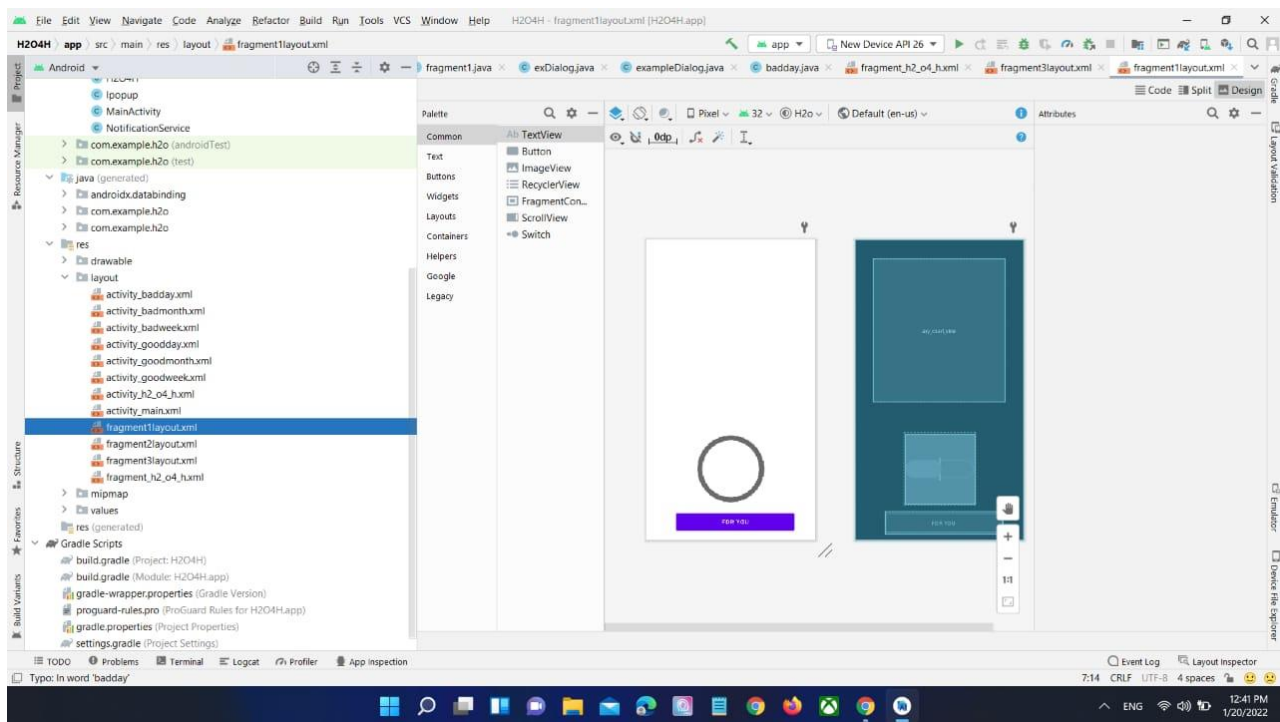
High fidelity prototype of water bottle



Figure 5.14

In above figure 5.2 is the product that goanna be in the market, we hope to use recycled plastic to make the water bottle body and 3D printing will be method that use for make head part of bottle because of the it is easy to make and cost effective in now days.

After that using android studio Mobile was developed.



Software testing process

Testing process help to identified correctness of the project. Testing is needed to show completeness. It helps to the quality of the software and to provide the maintenance idea. Some testing standards are therefore necessary reduce the testing costs and operation time. Testing software extends throughout the coding phase, and it represents the ultimate review of configurations, design, and coding. Based on the way the software reacts to these testing, we can decide whether the configuration that has been built is study or not. All components of an application are tested, as the failure to do many results in a series of bugs.

In this software testing we were done White box testing and Black box testing.

Black box testing.

Black box testing, also called behavioral testing, focuses on the functional requirements of software. This testing approach enables the software engineer to derive the input conditions that will fully exercise all requirements for a program. Black box testing we hope to find the errors like.

- ✓ Behavior or performance errors.
- ✓ Initialization and termination errors.
- ✓ Errors in data structures or external database access.
- ✓ Interface errors.
- ✓ Incorrect or missing functions.

In black box testing software is exercised over a full range of inputs and outputs are observed for correctness.

White box testing.

White box testing is using test case design control, structure of the procedural design to derive test cases using White box testing method, the software engineer can derive the test cases that guarantee that all independent paths within the module have been exercised at least once. Exercise all logic decisions on their true or false sides. Execute all loops at their boundaries and within their operational bounds. Exercise internal data structure to ensure their validity.

Validation

<i>Attributes</i>	On Module/Page	Validation
<i>Name, Phone, Email-id,</i>	Application Login	Should be not null
<i>Current water level</i>	Application	Should match with the bottle database
<i>Daly water consumption</i>	Update details	Must be Retrieved from the database
<i>Weekly report</i>	View week usage details	Should retrieve from the database

Table 3.1

System test report

Test Cases

Test Cases helpful to identified the errors and solve the errors before going to handover the project. Successful in implementation of test cases implies that there is no error in program. Test cases should be lower as they are expensive in case of money & efforts. Primary objectives of test cases are to ensure that if there is an error or fault in program it is exercise by the test cases. An ideal test case set is one that succeeds only if there are no errors in the program.

<i>Test No</i>	Input values	Expected Output	Actual Output	Result
1.	Login in without User name and password	Error notification	Error notification	No Error
2.	If User is new, click on register button	Will go to new form	Will go to new form	No Error
3.	User turn off Bluetooth and try to connect	Error notification	Error notification	No Error
4.	User turn Bluetooth and try to connect	Show the welcome screen	Show the welcome screen	No Error
5	Water level is low	Show notification to re fill bottle.	Re – fill notification	No Error
6	User not drinking enough water during time interval.	Show notification drink water	Dehydration notification	No Error

Table 3.2

Steps for the unit testing are as follows:

- 1) Preparation of the test cases.
- 2) Preparation of the possible test data with all the validation checks.
- 3) Complete code review of the module.
- 4) Actual testing done manually.
- 5) Modification done for the errors found during testing.
- 6) Prepared the test result scripts.

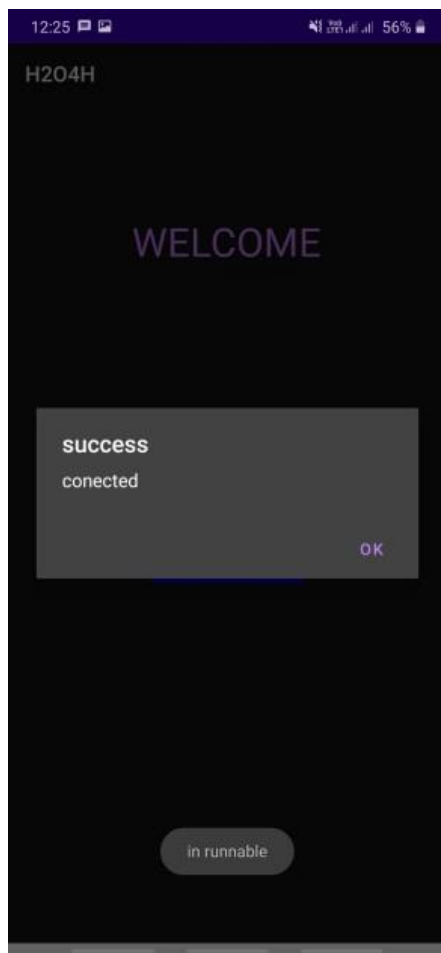


Figure 7.1

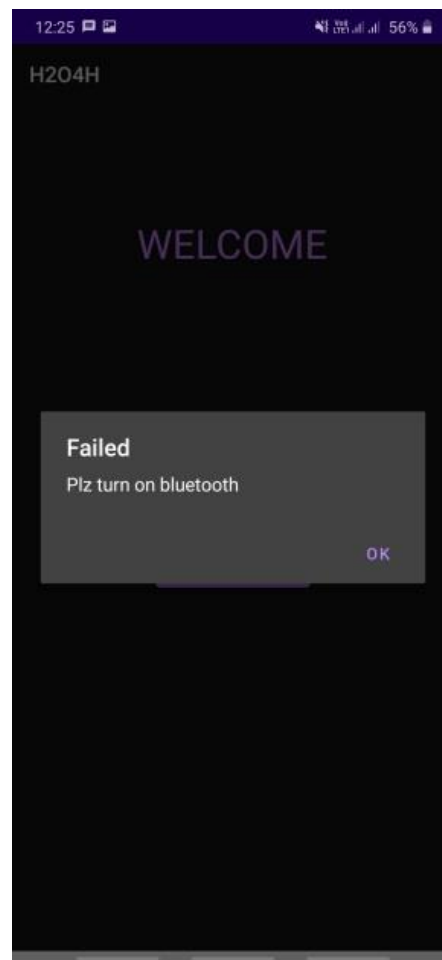


Figure 7.2

Discussion

Complete this project our group facing different challengers. In project proposal we are planned to used load sensor but we can't found it because current situation in country some electronic item can't, but we had to found another method to develop the project, we choose the level sensor.

With implementation level sensor cannot work properly. Because that not enough to get water level in total area inside the bottle. Then our groups discuss the problem and get group all group member's ideas to solved this problem. Final all the members agreed to use ultrasonic sensor, without using level sensor.

Another problem occur, how to passed data through water bottle and mobile application, because we have not make code for Bluetooth module to this process, after that discuss with the group members and other friend in our department we can solved that making the correct code to Bluetooth module.

Working with a group we solve the different problems can not solve as a individual. That is a major importance of the working as group, and compiled our common goal as a "TEAM".

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Appendix

Getting information to completed this project our group using following this links,

- ❖ [https://menafn.com/1099371881/Smart-Water-Bottle-Market-SWOT-analysis-Key-Business-Strategies-Kuvee-Hidrate-Trago-Mills-Courtney-Sippo.](https://menafn.com/1099371881/Smart-Water-Bottle-Market-SWOT-analysis-Key-Business-Strategies-Kuvee-Hidrate-Trago-Mills-Courtney-Sippo)
[https://www.techradar.com/news/what-is-a-smart-water-bottle.](https://www.techradar.com/news/what-is-a-smart-water-bottle)
- ❖ [https://www.transparencymarketresearch.com/smart-water-bottle-market.html#:~:text=A%20smart%20water%20bottle%20has,information%20collected%20by%20the%20bottle.](https://www.transparencymarketresearch.com/smart-water-bottle-market.html#:~:text=A%20smart%20water%20bottle%20has,information%20collected%20by%20the%20bottle)
- ❖ [https://www.arduino.cc/en/software.](https://www.arduino.cc/en/software)
- ❖ [https://create.arduino.cc/projecthub/taifur/arduino-powered-water-bottle-42ee43.](https://create.arduino.cc/projecthub/taifur/arduino-powered-water-bottle-42ee43)
- ❖ [https://www.akasotech.com/resources/water-bottle-that-reminds-you-to-drink.](https://www.akasotech.com/resources/water-bottle-that-reminds-you-to-drink)
- ❖ [https://youtu.be/iI_EJvZUT94.](https://youtu.be/iI_EJvZUT94)
- ❖ [https://youtu.be/qFSbYaMmsSE.](https://youtu.be/qFSbYaMmsSE)