

“HEALTH ON IoT (SWASTHYAM)”

A PROJECT REPORT

Submitted by

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In

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SARVAJANI COLLEGE OF ENGINEERING AND TECHNOLOGY

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CERTIFICATE

This is to certify that the project entitled Swasthyam has been carried out by HARSH P. GANDHI (130420107024), JENISH B. DUDHAT (130420107027), JENISH P. MUNIWALA (130420107028), DIPAK A. MAKWANA (130420107033), students of B.E.IV (CO), Semester-VII, under my guidance in fulfilment of the degree of Bachelor of Engineering in Computer Engineering of Gujarat Technological University, Ahmedabad for the academic year Nov – Dec, 2016.

**Signature of
Guide**

Prof. Jayesh Chaudhary

**Signature of
Head of the Department**

Dr. Pariza Kamboj

Signature of Jury Members

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We also take this opportunity to thank all our lecturers who have directly or indirectly helped us in our project. They provided us a solid background for our studies and research thereafter.

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1. Introduction

The introduction and problem statement of the project, aim and main objective of our problem.

1.1 Problem Statement

In this fast advancing world, where almost everything is available on fingertips, the one thing that still lags behind is health care. many people neglect small things like cold, cough, sneezing, mild fever, etc. which due to changes in air temperature, body temperature, quality of air, heart rate or humidity, which may result into something bigger and worse. So as the proverb goes ‘prevention is better than cure’, using internet of things we look forward to providing people with certain precautions based on readings of some of the sensors and patients past history, which will help them in maintaining their health in a better way even if they neglect visiting clinics for little health problems.

1.2 Introduction

We have proposed a solution based on our project ‘Swasthyam’. In this, we basically provide a wearable device to the user which will be containing 5 sensors namely, air temperature sensor, body temperature sensor, heart rate sensor, humidity sensor, air quality sensor. The readings from the sensors will be fetched based on which the person wearing the wearable device will be alerted with certain precautions which he/she should take in order to prevent health deterioration or even send SMS to a doctor or guardian if certain extreme readings are detected. This will help them have a better insight regarding their health issues. In this, the user will need to fill out certain questions which will be asked regularly to the user so that our device can find out and get better insight of the structure of the user’s body. Using this information and the data which will be collected by the sensors fitted on wearable device, the thresholds’ will be varied accordingly so that the device can give more precise precautions to the user. For example, the basic threshold at which a user can get affected by hyperthermia is

45 degree Celsius but that's not the case for every person. So it all depends on the physical features of a particular person and also on the combination of different readings of sensors.

1.3 Aim and Main Objectives of the Project

Our product 'Swashthyaam' will mainly focus on suggesting precaution as per environmental situations, individuals' past records and their body structures. Our main aim is to maintain health in a better way.

The main objectives of building such systems are as follow:

- To provide interactive and user friendly Graphical User Interface for easy interaction with our device.
- To ask questions to the user when interacting for the first time in order to understand user's body structure on basis of which precautions will be generated.
- To evaluate readings of the air temperature, body temperature, heart rate, humidity and air quality sensors based on which the precautions will be generated for maintaining health in a better way.
- To ask user certain questions in order to get an in depth understanding of his health issues which would, in return, help us in providing better precautions.
- To alert the user when any extreme readings are detected in any one of the five sensors mentioned in one of the previous points.
- To remind the user about his medication on time.
- To send SMS to the guardian/doctor when very extreme readings are detected.

1.4 Problem Specification

Problem specification is the description about system requirements, software requirements, hardware requirements, interface requirements, system features and other non-functional requirements. It is useful in order to help the users to achieve their goals and make their work easier.

1.4.1 Interface Specification

- Interface requirements are particularly useful to achieve high quality of interaction with the software and hardware device. The user interface and functionality are evaluated on the basis of how easily a user can understand and interact with the system without any help from external source.
- Navigation should be designed in such a manner such that at any point a user should be able to access all the possible functionalities.
- Our application provides a very interactive GUI whereby, any user can interactively view the parameters fetched from body temperature sensor, air temperature sensor, humidity sensor, air quality sensor and heart rate sensor and get precise precautions that he/she should take along with many other functionalities.

1.4.2 Technical Specification

Technical specification contains all the details about the implementation. It is concerned with the tools and languages required for implementation of front end and backend. Embedded C, PHP, Java, HTML and CSS are languages required for handling our frontend and SQL is the backend of our system.

1.4.3 System Features

Swasthya provides the following features:

- Provide personalized login
- Provide readings of body and air temperature, humidity, air quality and heart rate
- Suggest precautions
- Interactive GUI
- Easy to use and understand
- In-depth analysis of user's past readings
- Alert button for unforeseen health conditions

1.4.4 Non-Functional Requirement

Performance Product Performance

Product must perform for designed features and functions as per the requirement of the user in actual working environment. For this, Performance of product is mandatory. Product Performance is Given Below:

- System makes analysis of various sensor parameters
- System generates questions for periodic re-evaluation of user's physical structure.
- System asks user about possible symptoms when any sensors senses extreme readings
- Provide precise precautions to the user based on the above 2 points mentioned
- Interactive GUI
- Easy to use and understand
- Medicine Reminder

Safety

Safety is the most important aspect of human centric product. Reasonable factor of safety should be taken into account considering all adverse and factual factors.

Product Safety is Given Below:

- System becomes safe due to personalized login.
- Result will be obtained through individual user login or identify unique machine wise.

Reliability

Reliability is the ability of a system or component to perform its required functions under stated conditions for a specified period of time. Final product should be reliable as required by the user and should perform its desired functions as required for desired time period. Product Reliability is Given Below:

- Dependable on the assessment of the answer (Assessment algorithm)
- Dependable on answer of student

Software Quality Attribute

Good quality of the framework produces robust, bug free software which contains all necessary requirements customer satisfaction.

Class Diagram

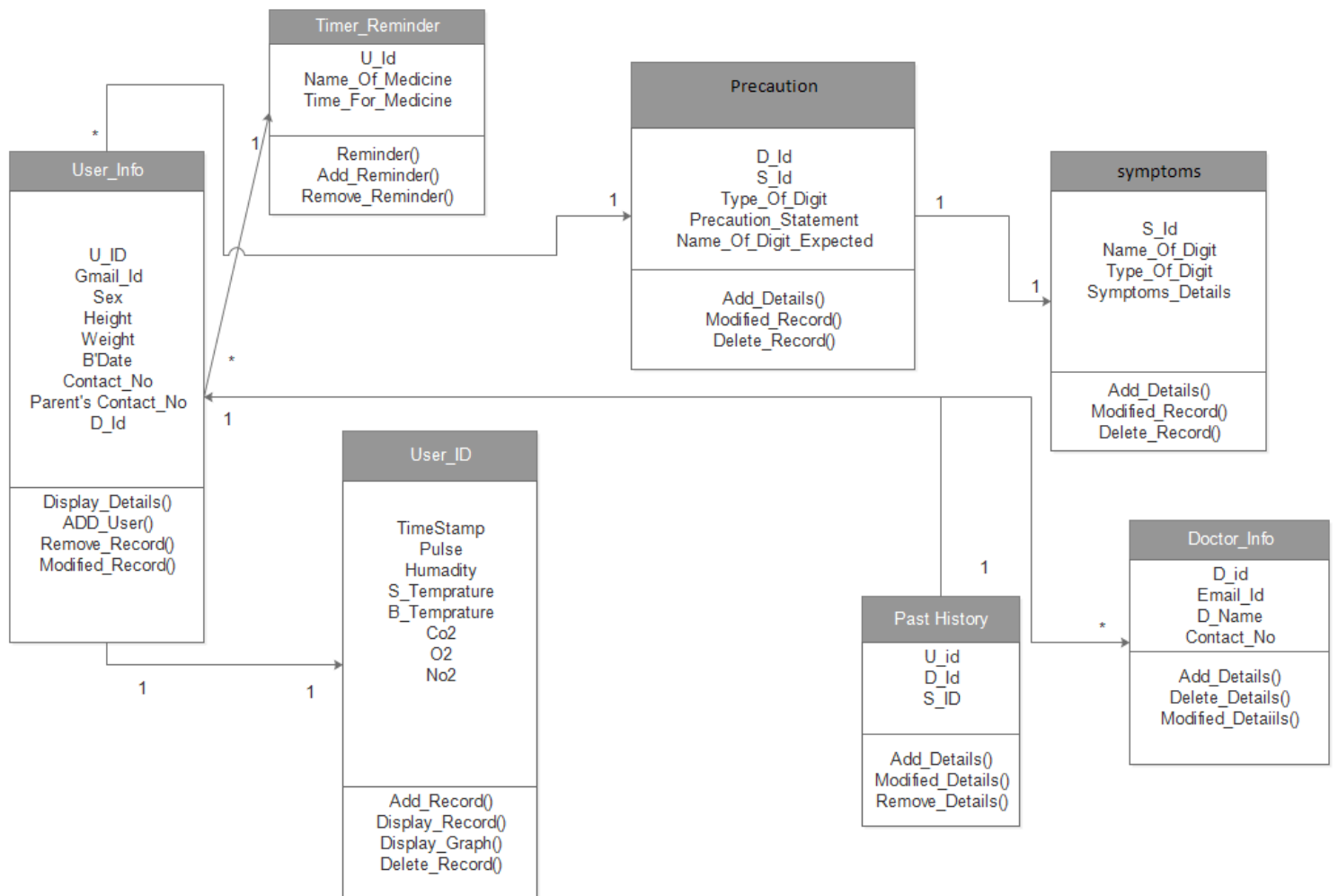


Figure 1.4.4.1 Class Diagram

Activity Diagram

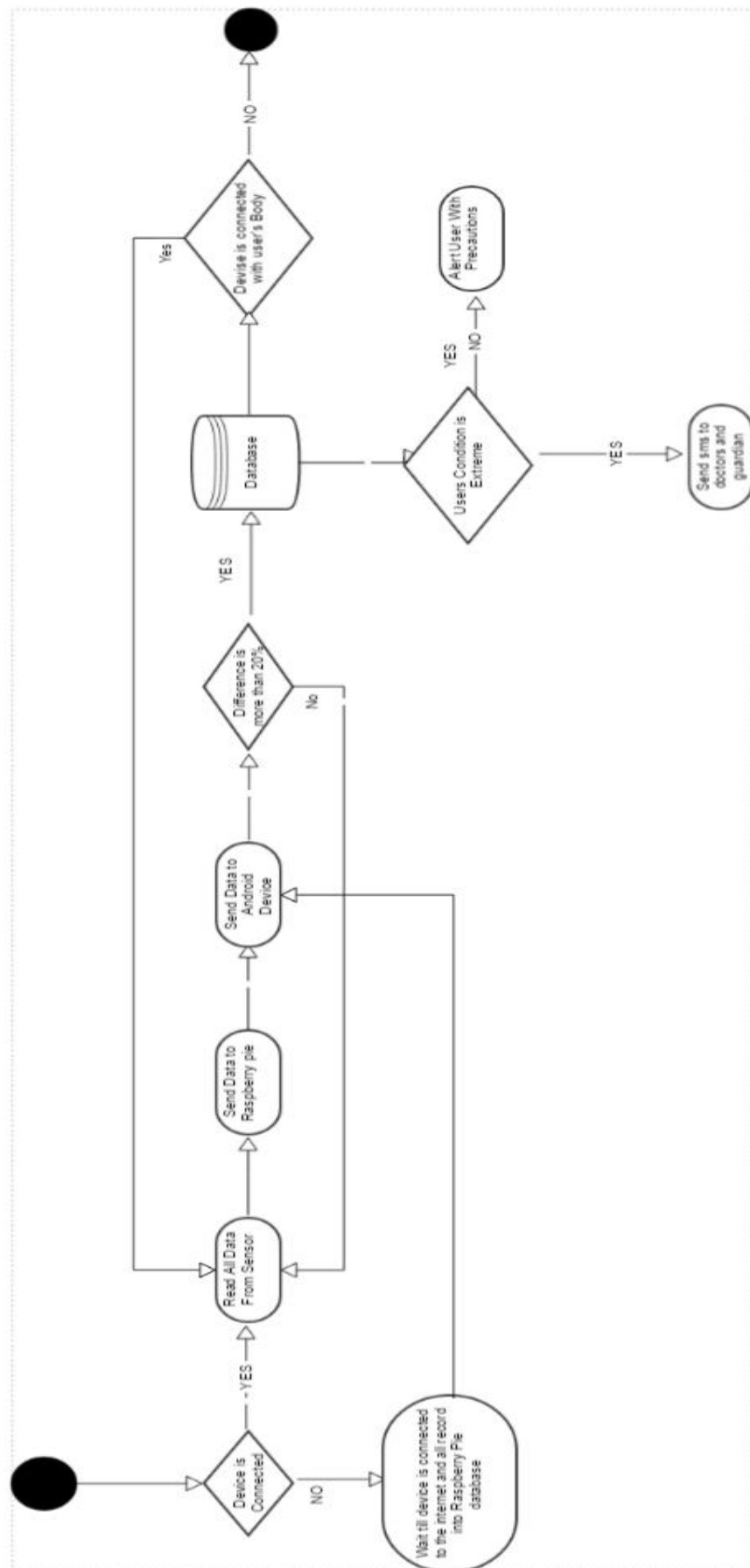


Figure 1.4.4.2 Activity Diagram

Sequence Diagram

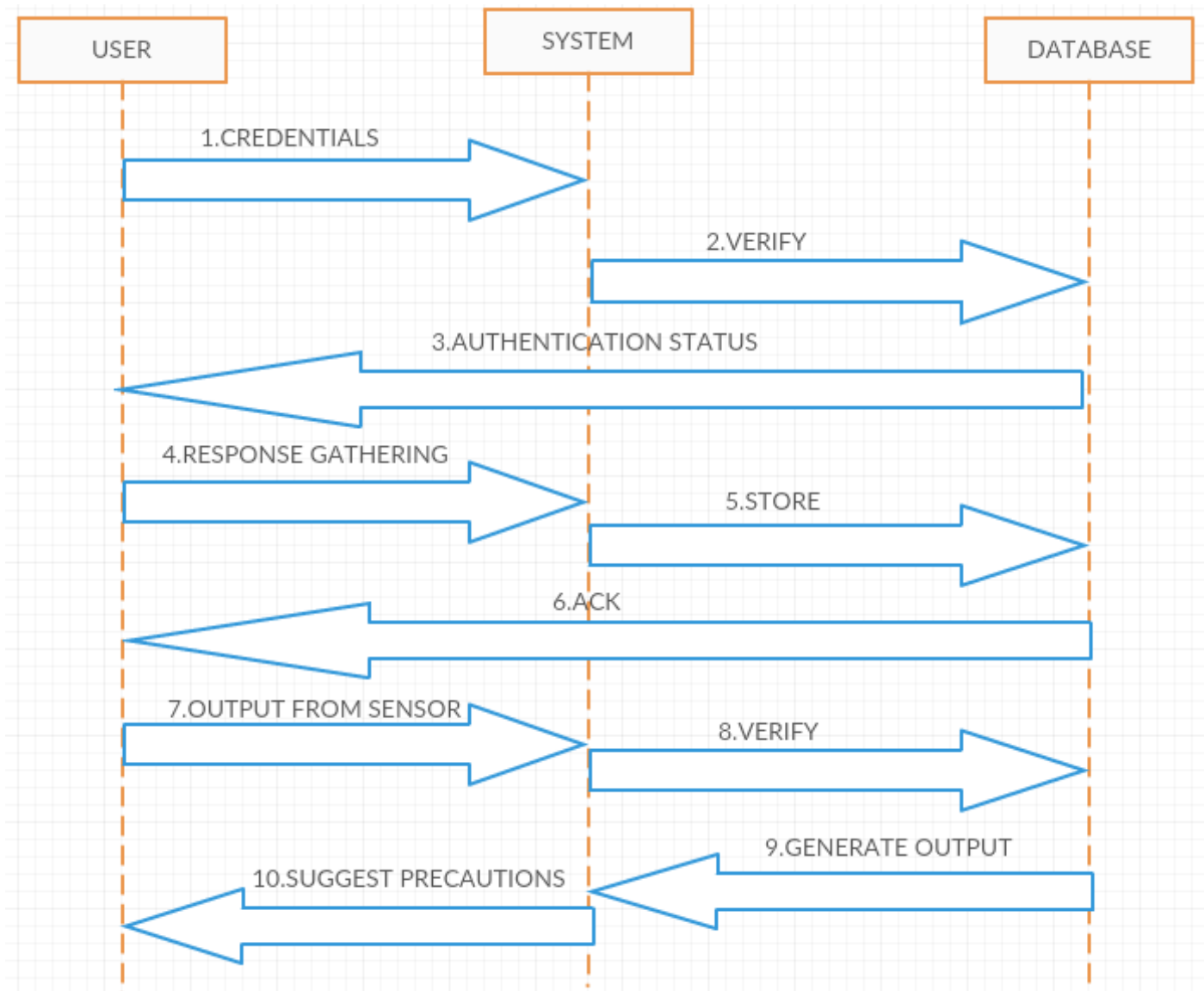


Figure 1.4.4.3 Sequence Diagram

1.5 Brief Literature Review and Prior Art Search (PAS)

We studied the patent of Wireless communication and global location enabled intelligent health monitoring system in which wireless sensor apparatus is used for measuring patient's various body readings. It contains a main processing unit apparatus which contains software that uses real time monitoring method to process various readings of the sensors and if at all any serious signs are detected then it uses location information which will alert a doctor or request an emergency automatically based on the location. A panic button is also provided for patient if the system fails to detect any vital signs so that the patient himself/herself can request an emergency or alert a doctor remotely.

We studied second patent about wireless health monitoring system which makes use of wireless nodes in order to communicate and transfer data collected from sensors which are mounted on wearable device. Using the data collected from wearable device the health monitoring device will process the sensor's readings, which are sent over using wireless nodes, and detect health problems. It also sets different thresholds for different patients based on the BMI of every person as not each and every person can have same health issues at same readings. This is done in order to deal with triggering of false alarms. The thresholds are basically made to vary on the basis of one or more parameters.

1.6 Plan of our work

For the project work we divide our product into number of modules like medicine reminder, response gathering, providing precautions and analysing different parameters based on sensors fitted on wearable device. Each module is described in detail below:

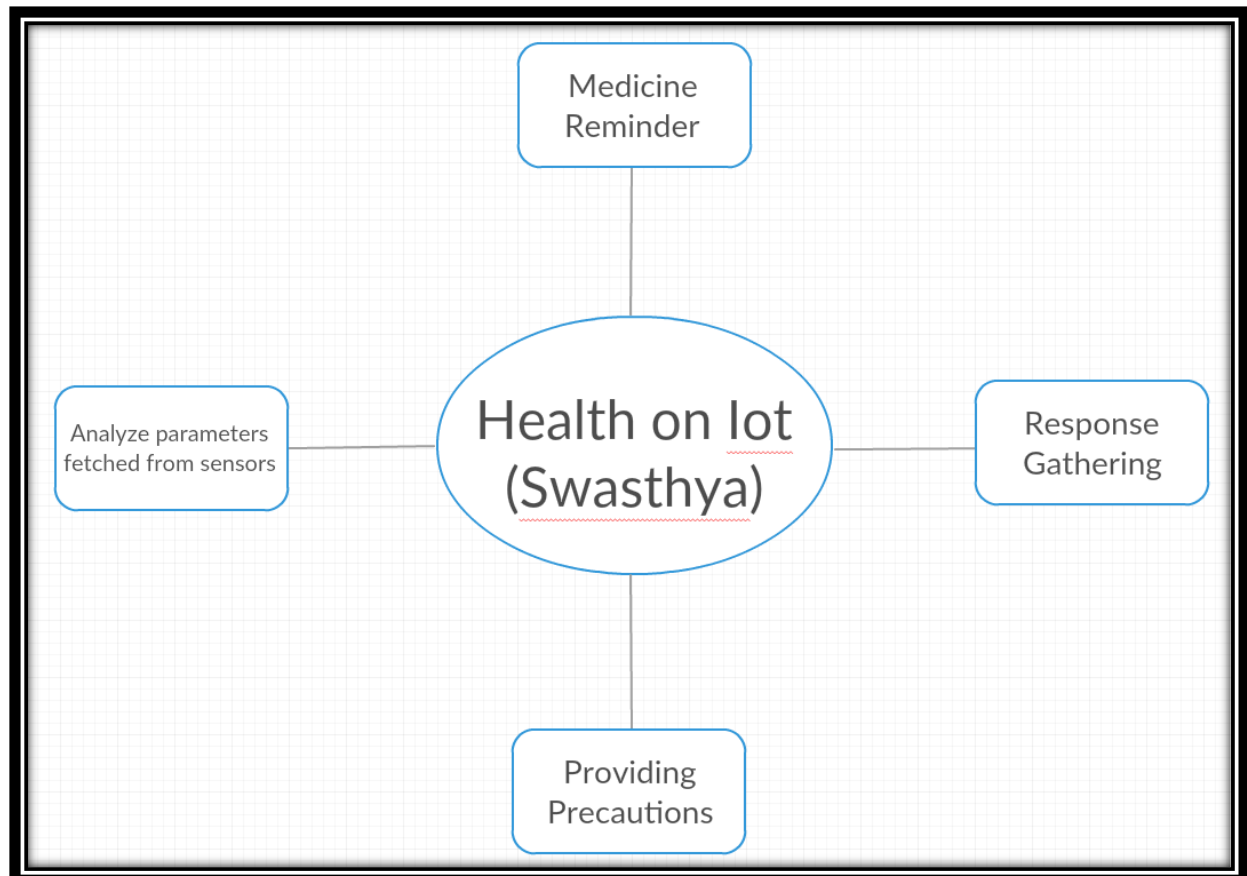


Figure 2.6 Modules

➤ **Medicine Reminder**

- Create a clever and effective way to provide alert for taking medicines.
- Contribute to improve and maintain health standards using technology.

➤ **Response Gathering**

- The information or symptoms regarding the diseases are fed into the system and user can check the diseases regarding their health issues and that response is gathered by the system by processing various parameters fetched from sensors.

- The information about user's past medical history is also gathered for getting a better insight about user's health issues and allergies.

➤ **Provide Precautions as per user**

- There are several sensors which are temperature and humidity sensor, air quality sensor, etc. The outputs of these sensors are used to create precautions according to the environmental situations for humans. Do's and don'ts will be provided by the system.

➤ **Analyze heart rate and skin temperature**

- There are several sensors which are heart rate sensor, skin temperature sensor. The outputs of those sensors are used to check whether the user is ill or not, if the user is infected then the notification/SMS will be sent to the guardian or their doctor.

1.7 Materials/Tools required

Following are the requirements of our system:

- Raspberry pie 3
- Heart rate Sensor
- Skin temperature sensor.
- Air Temperature
- Humidity sensor
- Air quality sensor
- Android Device
- Wi-Fi or Internet services for microcontroller and Android device
- Languages like PHP, Embedded C, etc.

2. Design Analysis, Methodology and Implementation Strategy

Here in this section we mention the details about all canvases that described below:

2.1 AEIOU

It is a concept which includes observation in the different fields like Activity, Environment, Interaction, Objects and Users. To make AEIOU framework we select location as College.

Activity – We observed different activities taking place in routine life and with that busy schedule it is very difficult to take care of individual's health so we have taken few observations along with general impressions which will be used to maintain health in better way. Example of the Elements are mobiles, Computer, etc. Features which are provided through these elements are productivity, personalized login, etc. The events which do not occur frequently are included in special notes.

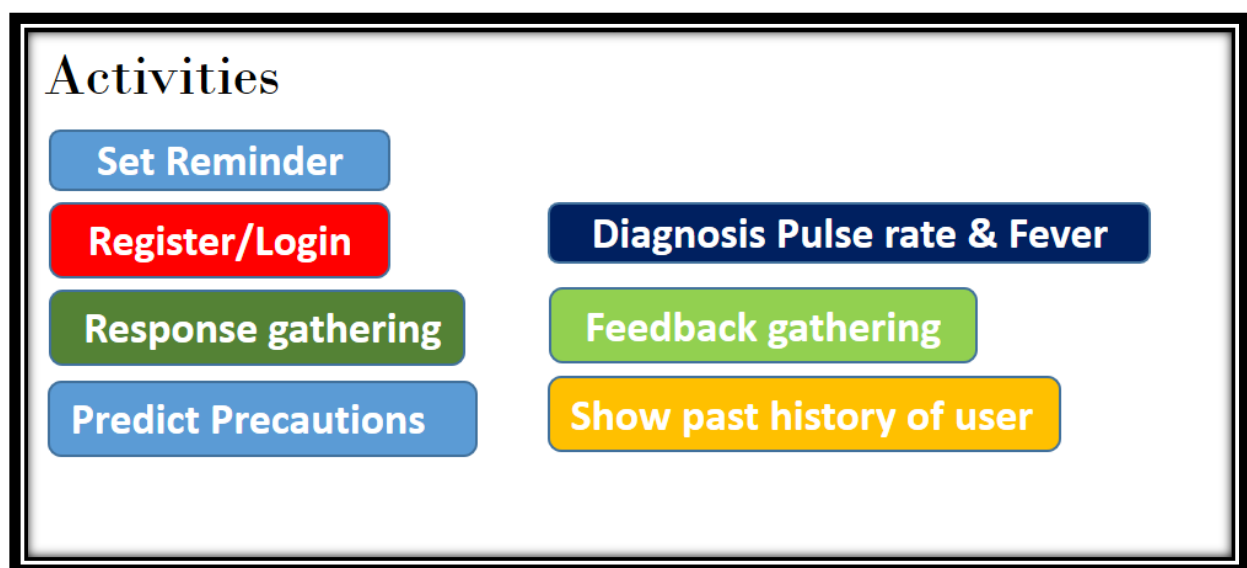


Figure 3.1.1 Activities

Environment – It not only includes natural environment but also surrounding atmosphere depending on time and location. In a specific environment is taken as observation. Elements of different environment are climate change, rain, winter, summer, travelling, etc.

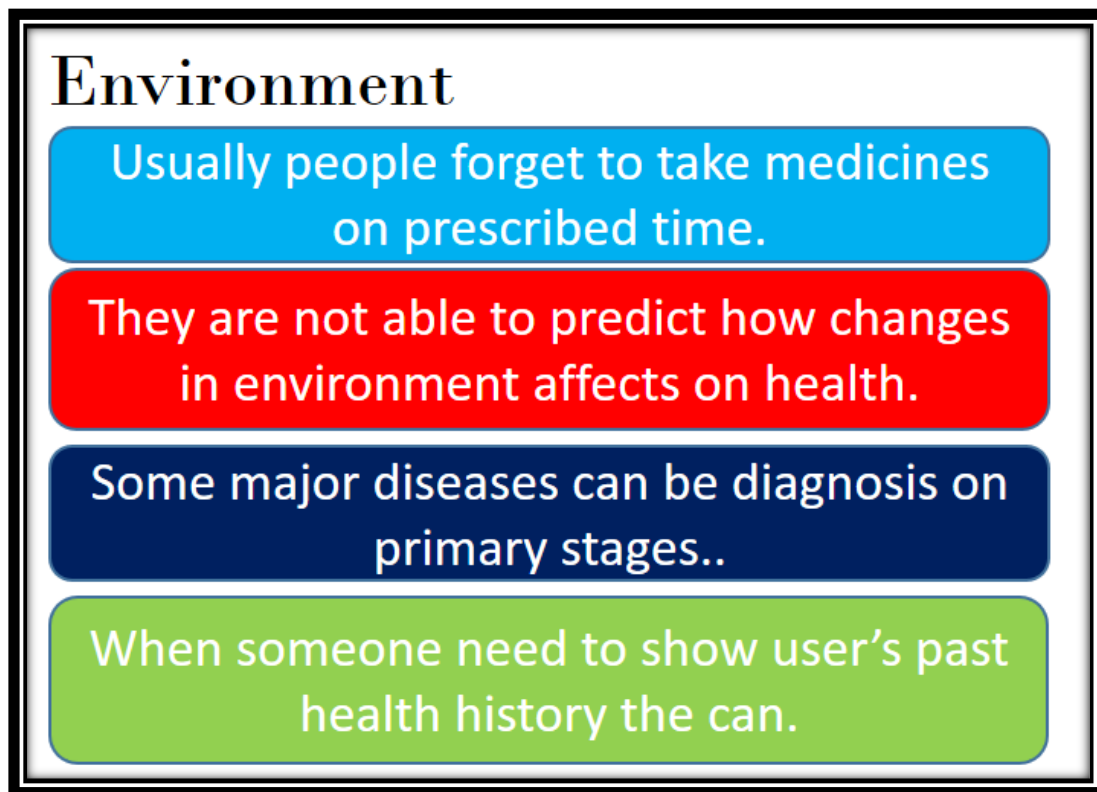


Figure 2.1.2 Environment

Interaction – It takes place between person-gear, person-cell phone, person-website, person-person, person-doctor, etc.in routine nowadays all the persons are spending lots of time on computers and mobile phones so mobile phone, computers, sensors this all features of interaction can use to maintain health in better way.

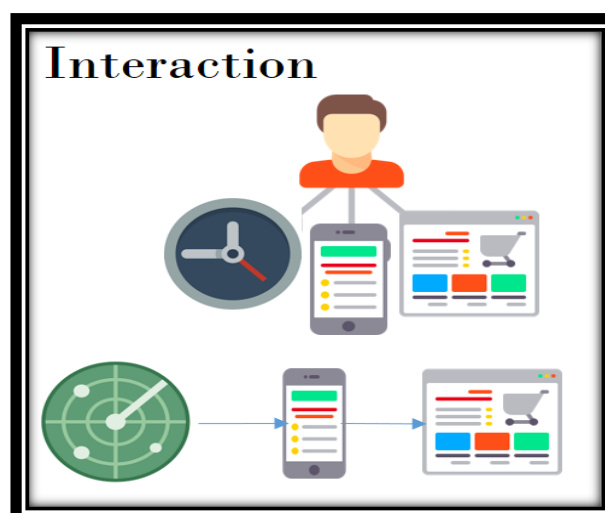


Figure 2.1.3 Interaction

Objects – There are things which are present in our routine life. General impression includes computer, cell phones, electronic devices, Wi-Fi and internet, etc. The observed scenario regarding objects is pile of files, high Wi-Fi connectivity, etc. Elements are basically objects only. Objects are accounts, designing tools, algorithms, PHP, Embedded C, designing languages, IP addresses, database, etc. Features offered by these objects are smart software, expert knowledge, quick and precise precaution, etc.

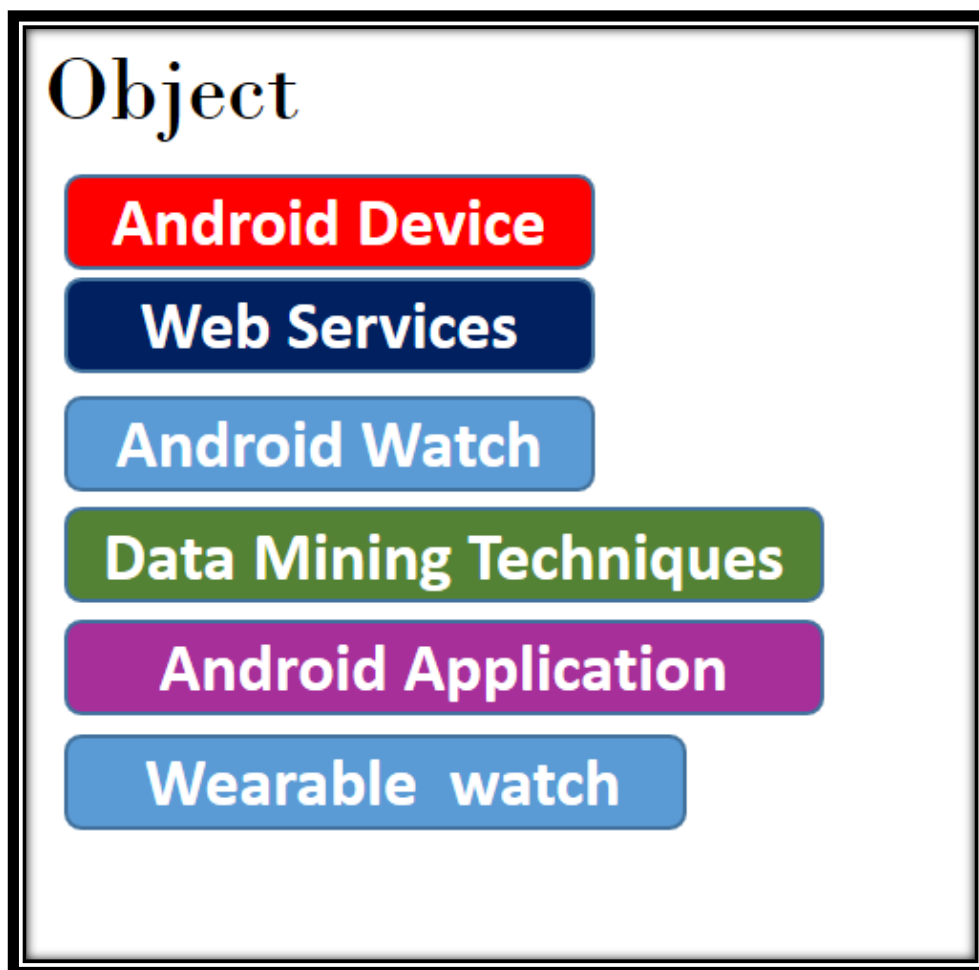


Figure 2.1.4 Object

Users –This is the most important part of this framework. It includes the people who are actually going to use this product. This canvas has list of identified people involved. They are not divided by occupation but they can be divided by age group like youth, senior-citizen, all can use this product. It also includes roles and responsibilities of the users i.e. user have to fill feedback to increase preciseness of decision making, user have to be a part of response gathering, etc.

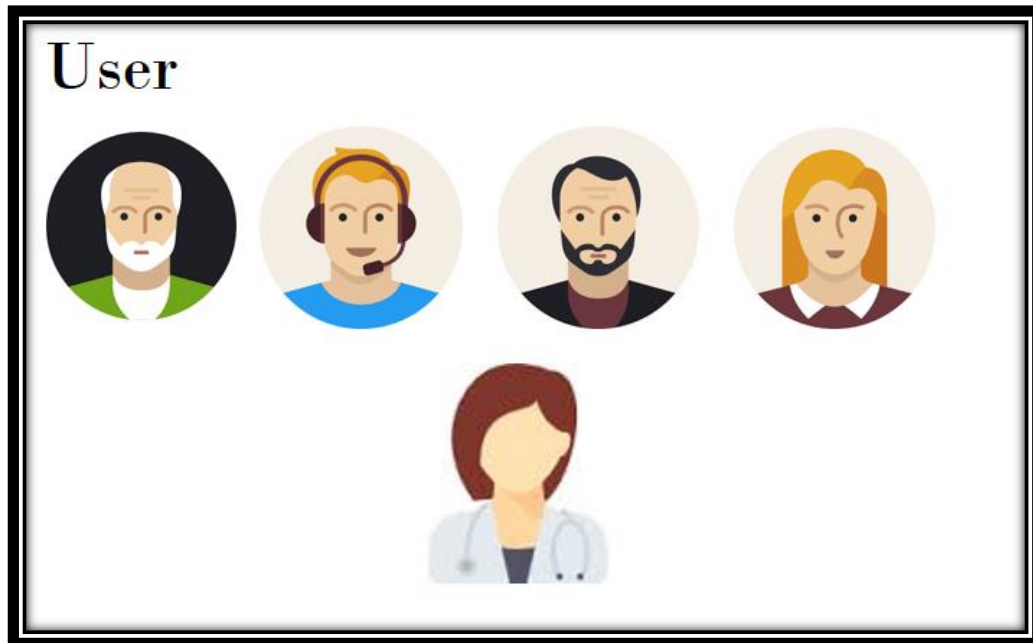


Figure 2.1.5 Users

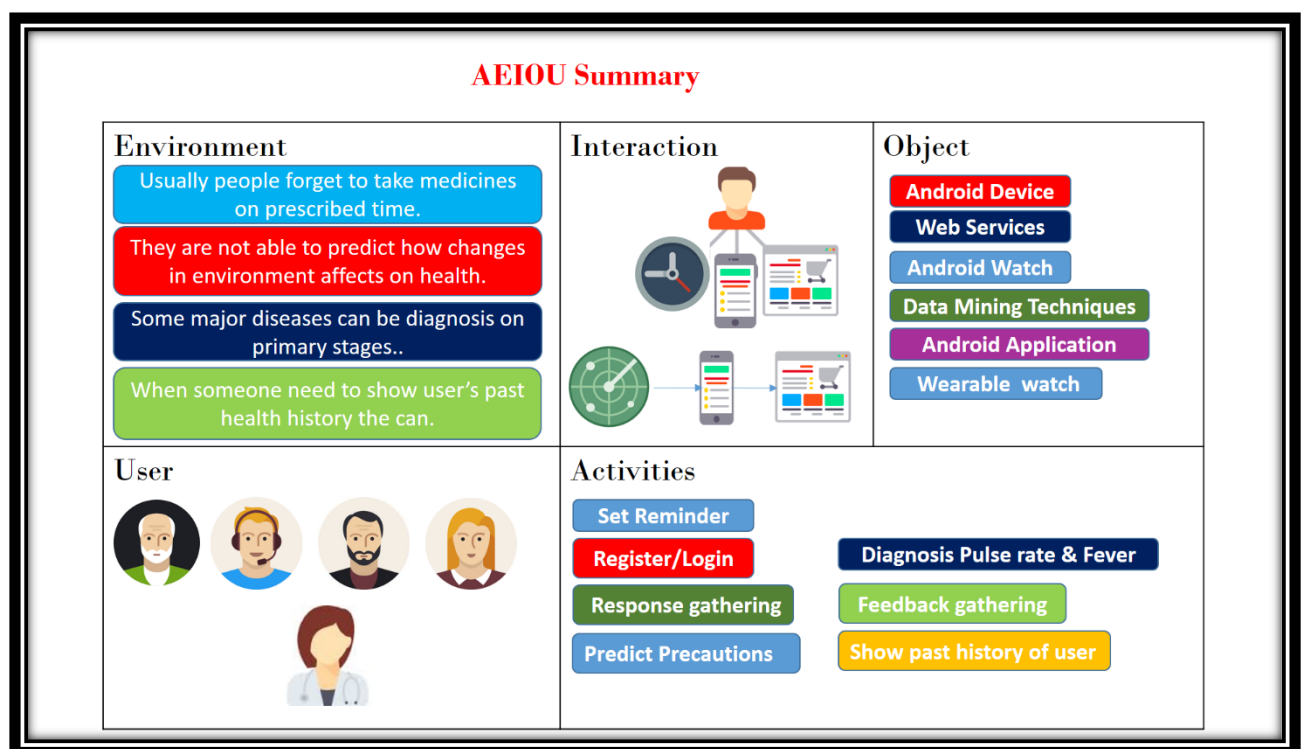


Figure 2.1.6 AEIOU Canvas

2.2 Empathy Mapping

In empathy canvas, first of all we select **health and medicines** as our domain. In this canvas, we choose **user** as **human** who can afford this system either **young person** or **senior citizen**.



Figure 2.2.1 User

Stakeholders are given below:

- Doctors
- Senior citizen
- Youth

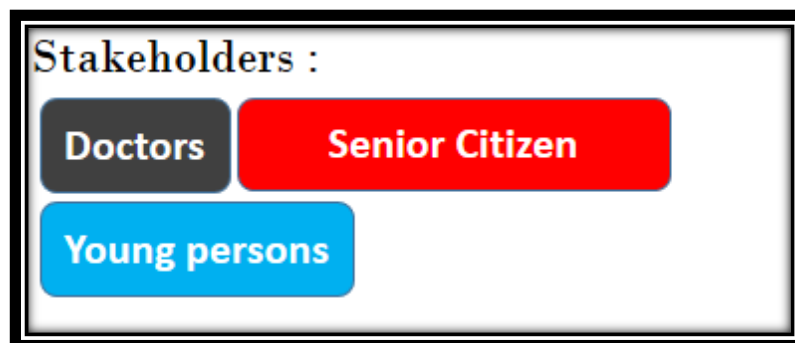


Figure 2.2.2 Stakeholders

Activities of the user which they will perform in their day-to-day life are listed below:

- Response gathering
- Predict precautions
- Show past history of user
- Set reminder
- Diagnosis pulse rate and fever
- Feedback gathering, etc.

Activities :

Response gathering

Predict Precautions

Show past history of user

Set Reminder

Diagnosis Pulse rate & Fever

Feedback gathering

Figure 2.2.3 Activities

😊Happy 😊

when we all family members go outside somewhere for some reason then My grandfather is at home alone and we all are worried about his health but after using this device we can monitor his health from anywhere and any time and if some medical emergency will come then this device directly notify us and also inform our family doctor

😊Happy 😊

We know that some diseases are seasonal and when season arrives possibility of those diseases occurs but in routine life one can not identify that transformation period but system will identify that transformation so user can take necessary precautions and remains healthy.

😞Sad 😞

During execution of application if some technical problems will be occurred or system will stuck then user will not get precautions and it's biggest failure of system.

😞Sad 😞

We know that some diseases are seasonal and when season arrives possibility of those diseases occurs but in routine life one can not identify that transformation period but if system also failed to identify then user will not able to take necessary precautions and their health will be affected.

Figure 2.2.4 Story Boarding


Group no: Designed for: Swasthya(Health On IoT) Date:	Designed by: Harsh Gandhi (130420107024) Jenish Muniwala (130420107028) Version: 1.0.0.0 Jenish Dudhat (130420107027) Dipak Makvana (130420107033)
User : 	Stakeholders : <div> <div>Doctors</div> <div>Senior Citizen</div> <div>Young persons</div> </div>
Activities : <div> <div>Response gathering</div> <div>Predict Precautions</div> <div>Show past history of user</div> <div>Set Reminder</div> <div>Diagnosis Pulse rate & Fever</div> <div>Feedback gathering</div> </div>	
<p>😊Happy 😊</p> <p>when we all family members go outside somewhere for some reason then My grandfather is at home alone and we all are worried about his health but after using this device we can monitor his health from anywhere and any time and if some medical emergency will come then this device directly notify us and also inform our family doctor</p>	
<p>😊Happy 😊</p> <p>We know that some diseases are seasonal and when season arrives possibility of those diseases occurs but in routine life one can not identify that transformation period but system will identify that transformation so user can take necessary precautions and remains healthy.</p>	
<p>😞Sad 😞</p> <p>During execution of application if some technical problems will be occurred or system will stuck then user will not get precautions and it's biggest failure of system.</p>	
<p>😞Sad 😞</p> <p>We know that some diseases are seasonal and when season arrives possibility of those diseases occurs but in routine life one can not identify that transformation period but if system also failed to identify then user will not able to take necessary precautions and their health will be affected.</p>	

Figure 2.2.5 Empathy Canvas

2.3 Ideation Canvas

People:-

- Youth
- Senior citizen
- Doctors
- Any age of person who can afford system.

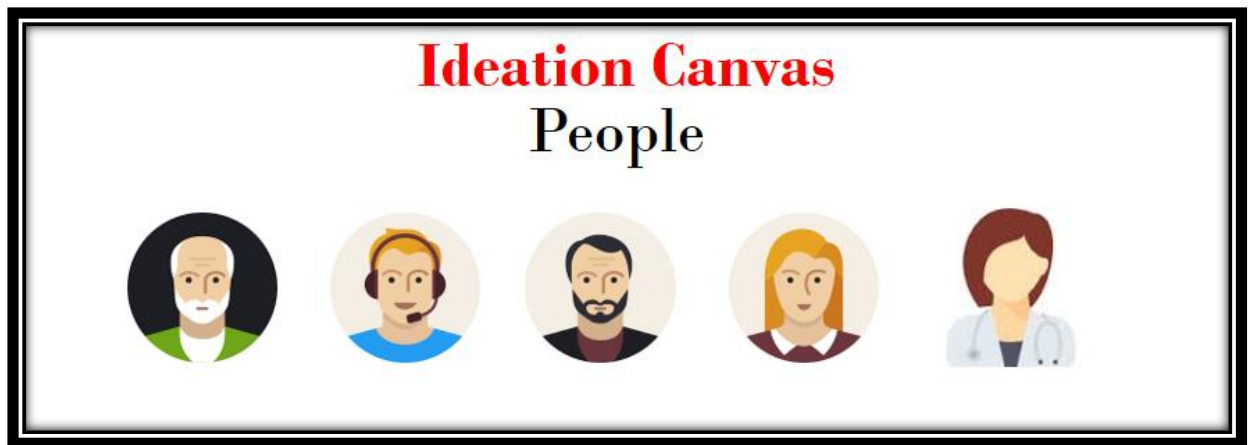


Figure 2.3.1 People

Activities:-

- System can diagnosis air quality
- Environmental humidity
- Environmental temperature
- Body temperature
- Pulse rate

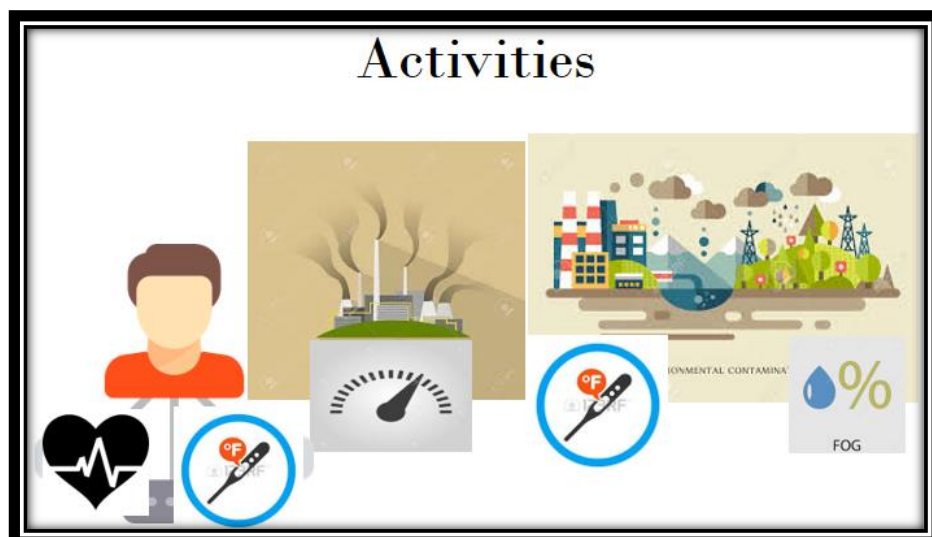


Figure 2.3.2 Activities

Situation/Context/Location:-

- Winter
- Summer
- Climate change
- Emergency 24x7
- Travelling
- Home
- Hospital

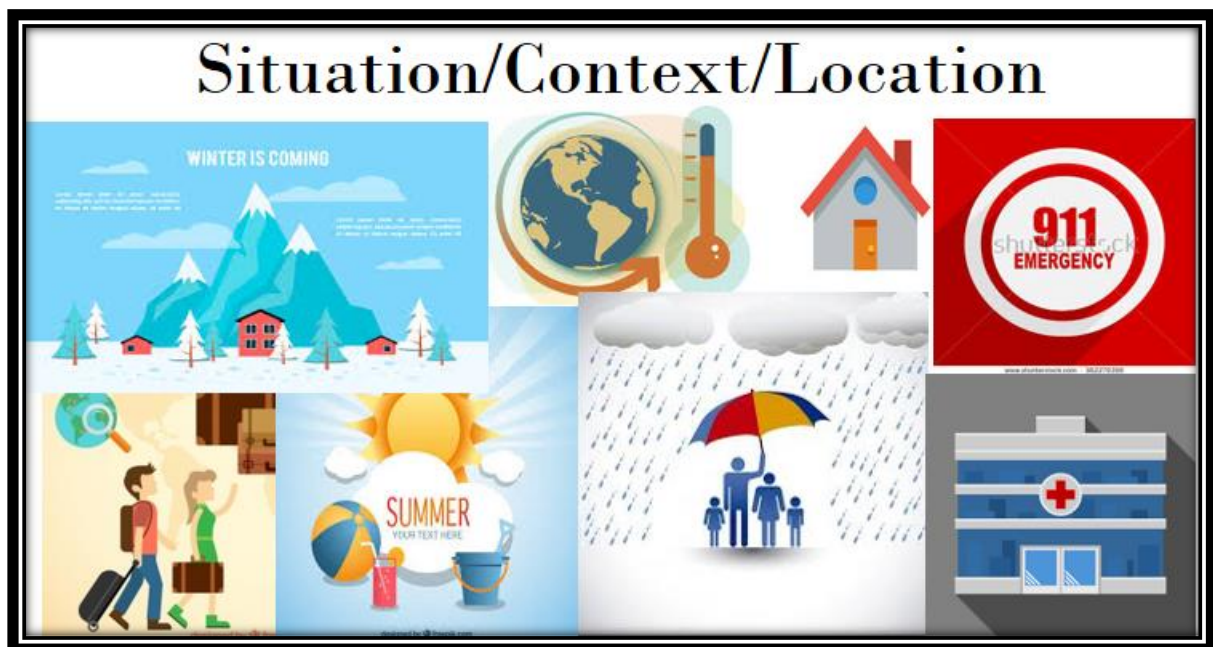


Figure 2.3.3 Situation/Context/Location

Props:-

- Identify threshold values and deal with environmental situation
- Send alert message
- Data mining algorithms
- Maintain tracks of past history
- Response gathering
- Provide precaution
- Medical reminder
- Gathering feedback to be precise and accurate.

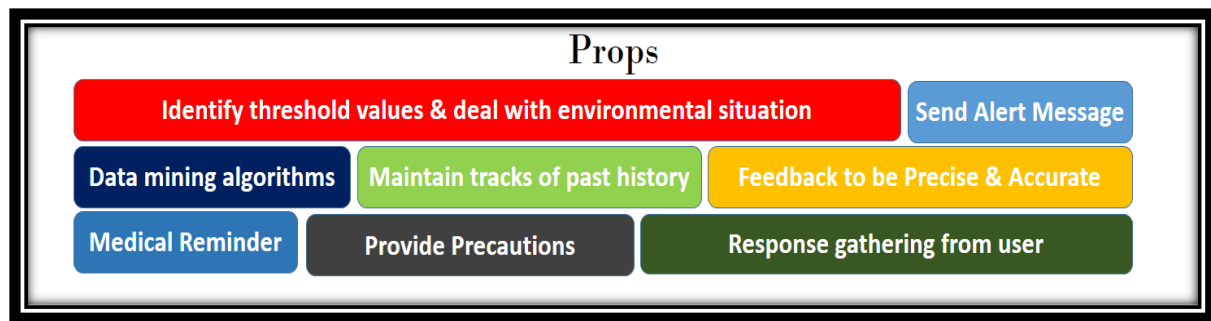


Figure 2.3.4 Props

In ideation canvas we retrieve the data of people and their activities from Empathy mapping canvas. Then we select 1 user from people and relate it to 1 activity and ask the 3 questions 1) Where 2) when 3) Why to find out location or situation or context. By continuously iterating in this way we get the data for Situation/Context/Location. For Props we do the iteration by selecting 1 user, 1 activity and 1 Situation/Context/Location and ask question that what we need to fulfil the problem face by user.

For example:

We choose senior citizen from people and find activity related to him. We choose retrieving perform routine as his activity. Then we ask the question and we find his situation in monsoon. He need **Medical reminder and precaution** for maintaining health in better way.

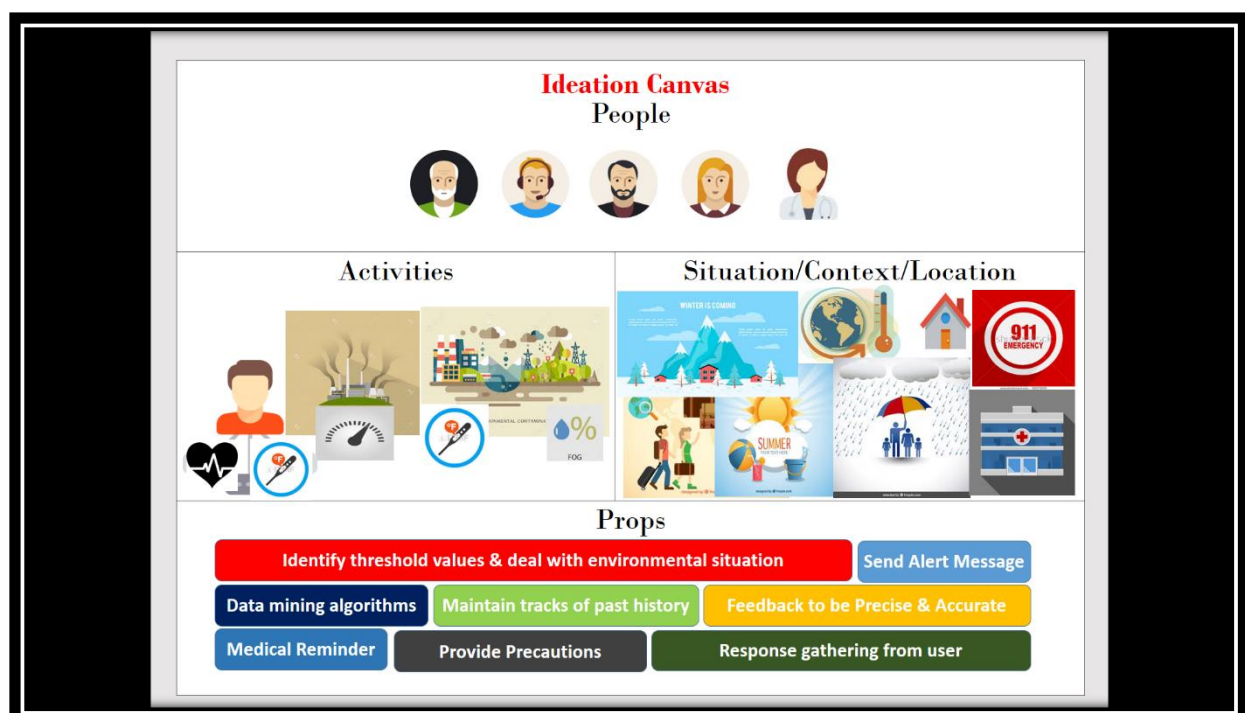


Figure 2.3.5 Ideation Canvas

2.4Product Development Canvas

We will focus on how to maintain health in a better way. (*Subjective*).

In this system first user's identity will be verified through credentials, then his/her dashboard will be opened in which they can see past history, current stats, and fill feedback. Through android phone user can set medical reminder and also access or modify settings.



Figure 2.4.1 Purpose

We are going to implement our system for different user of different age groups.

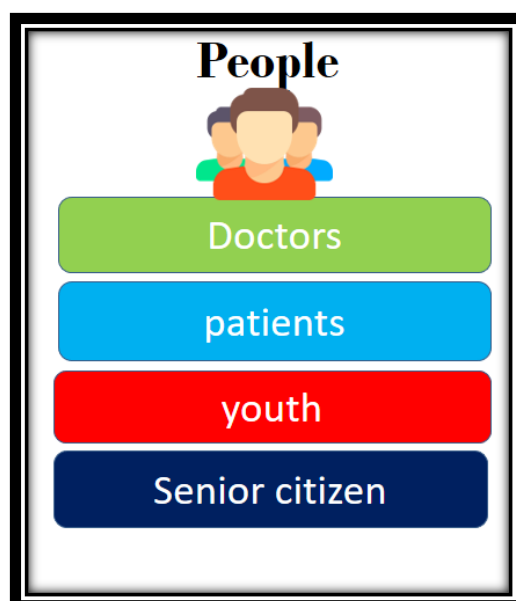


Figure 2.4.2 People

There are so many functions which we include in our System. First we identify the main function.

Quick overview of system function:-

- Suggest precautions
- Medical reminder
- Diagnosis diseases

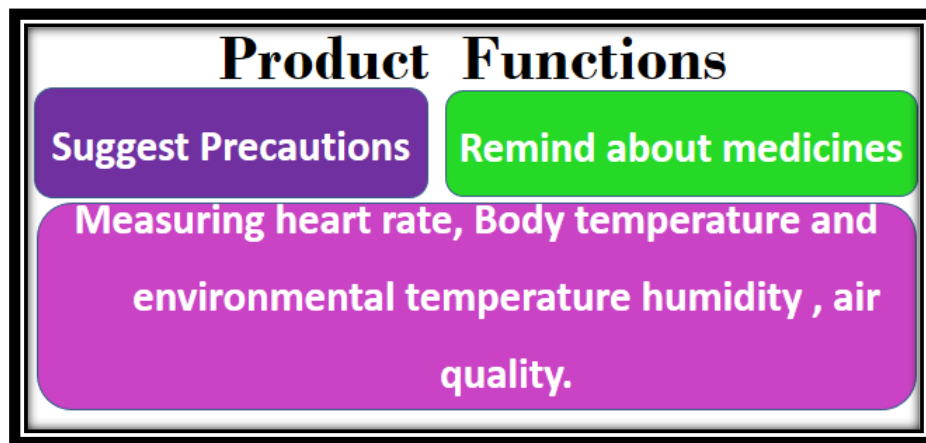


Figure 2.4.3 Product Functions

Quick overview of system feature:-

- Medical reminder
- Response gathering
- Provide precautions as per user

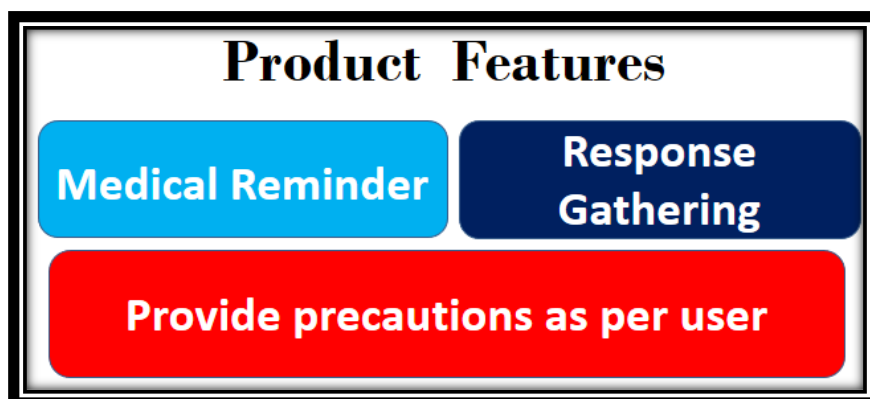


Figure 2.4.4 Product Features

Components as below:

- Android phones
- Web services
- Android watch
- Sensors

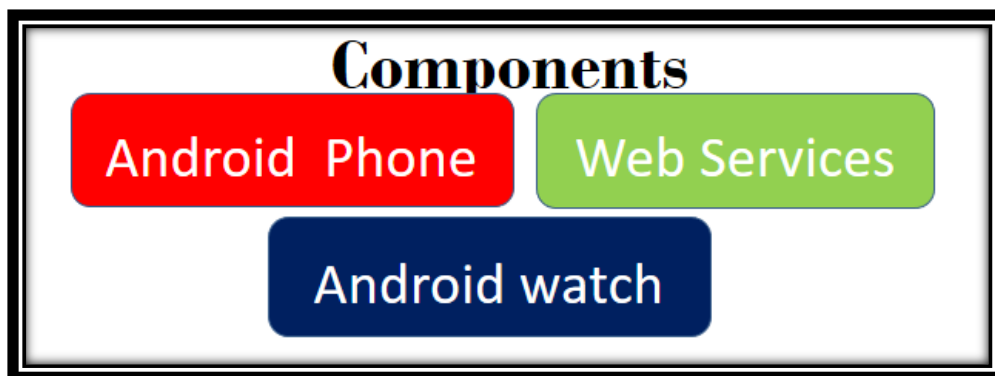


Figure 2.4.5 Components

Product Experience:-

- User Friendly
- Easy To Use
- Accurate Suggestion



Figure 2.4.6 Product Experience

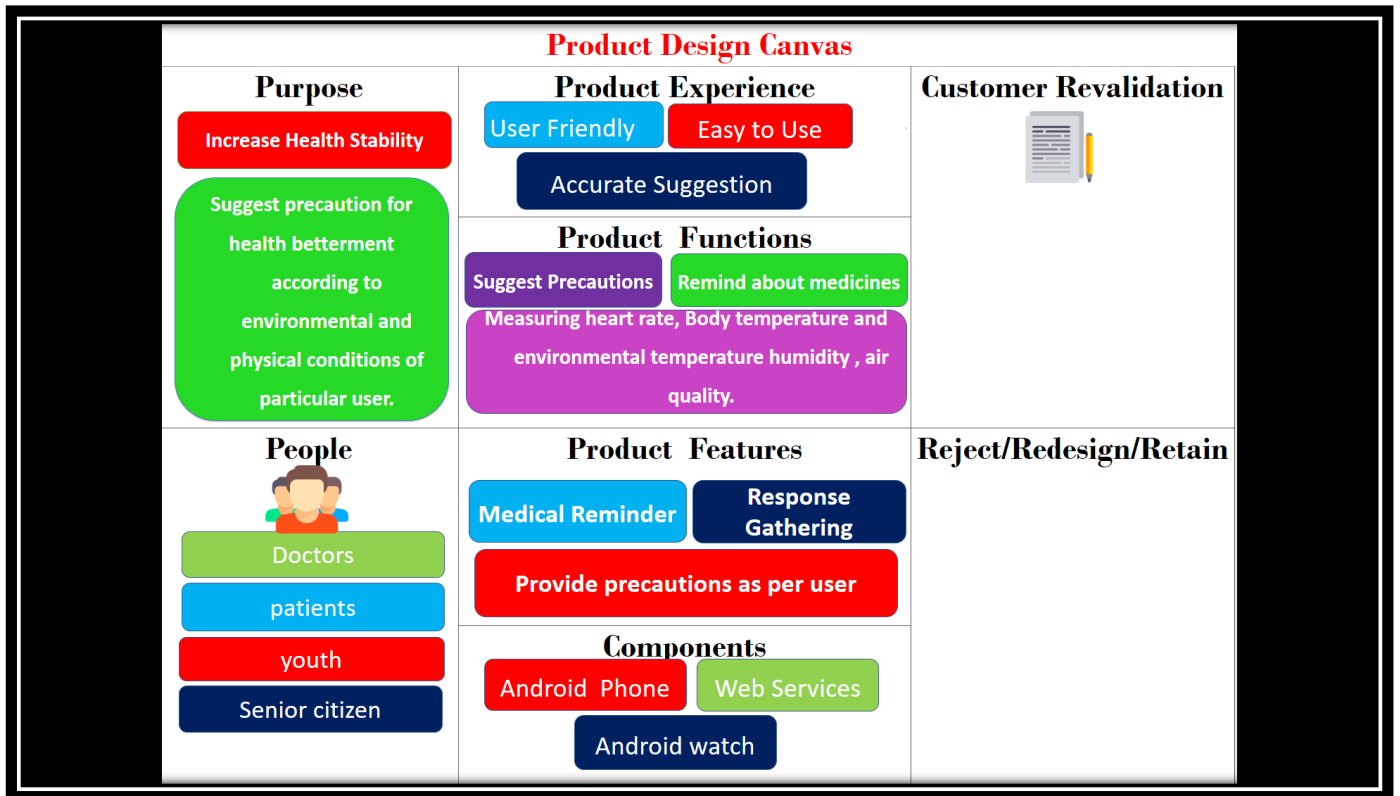


Figure 2.4.7 Product Design Canvas

3. Implementation

In this section we include the implementation part of the project. In the web model, first student need to log in into his account.

3.1 Android Application

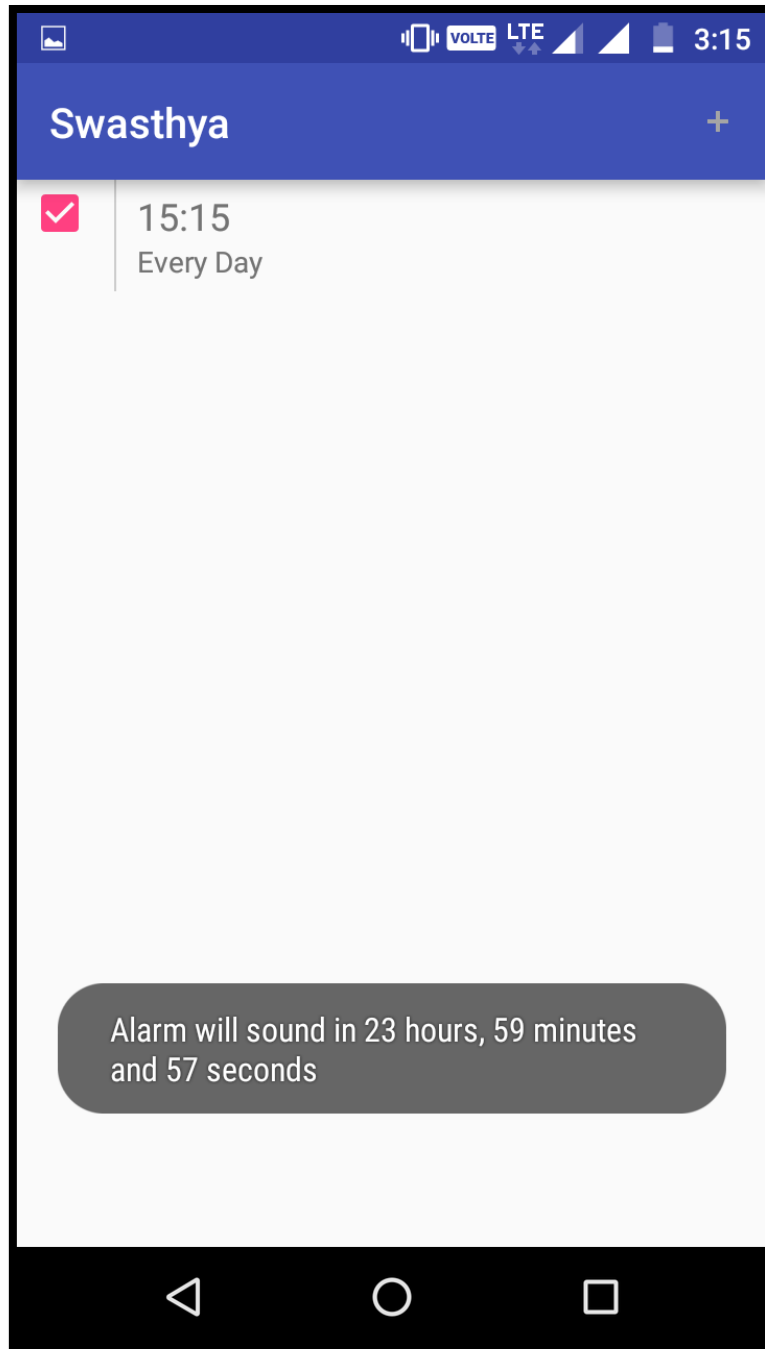


Figure 3.1.1 Login Page

Swasthya

Enter Symptoms

Enter Symptoms

Enter Symptoms

Enter Symptoms

Enter Symptoms

Enter Symptoms

SEARCH

Figure 3.1.2 Symptoms Checker

3.2 Database Design

Table Names:-

1. UserInfo
2. TimeReminder
3. MeasuredData
4. PrecautionTable
5. DoctorGaurdianTable
6. symptomsTable
7. PastHistoryTable

1. UserInfo:-

- Gmail account
- Sex
- Height
- Weight
- B'date
- Contact_No
- Gender

2. TimeReminder:-

- Gmail account
- Name_Of_Medicine
- Time_for_Medicine

3. MeasuredData:-

- Gmail account
- Pulse (heart rate)
- Humidity
- Surrounding Temperature

- Skin Temperature
- Air Quality (level of CO2 , O2 , NO2 etc)

4. PrecautionTable:-

- D_id
- S_id
- Type of diseases
- Precaution Statements
- Name of diseases expected

5. DoctorGaurdianTable:-

- Gmail account
- P_id
- Name of Person
- Relation guardian/doctor
- Contact_No

6. SymptomsTable:-

- S_id
- Name of Diseases
- Type of Diseases
- Symptoms Details

7. PastHistoryTable:-

- Gmail account
- D_id
- S_id

3.3 Website Design



Figure 3.3.1 Website Login Screen

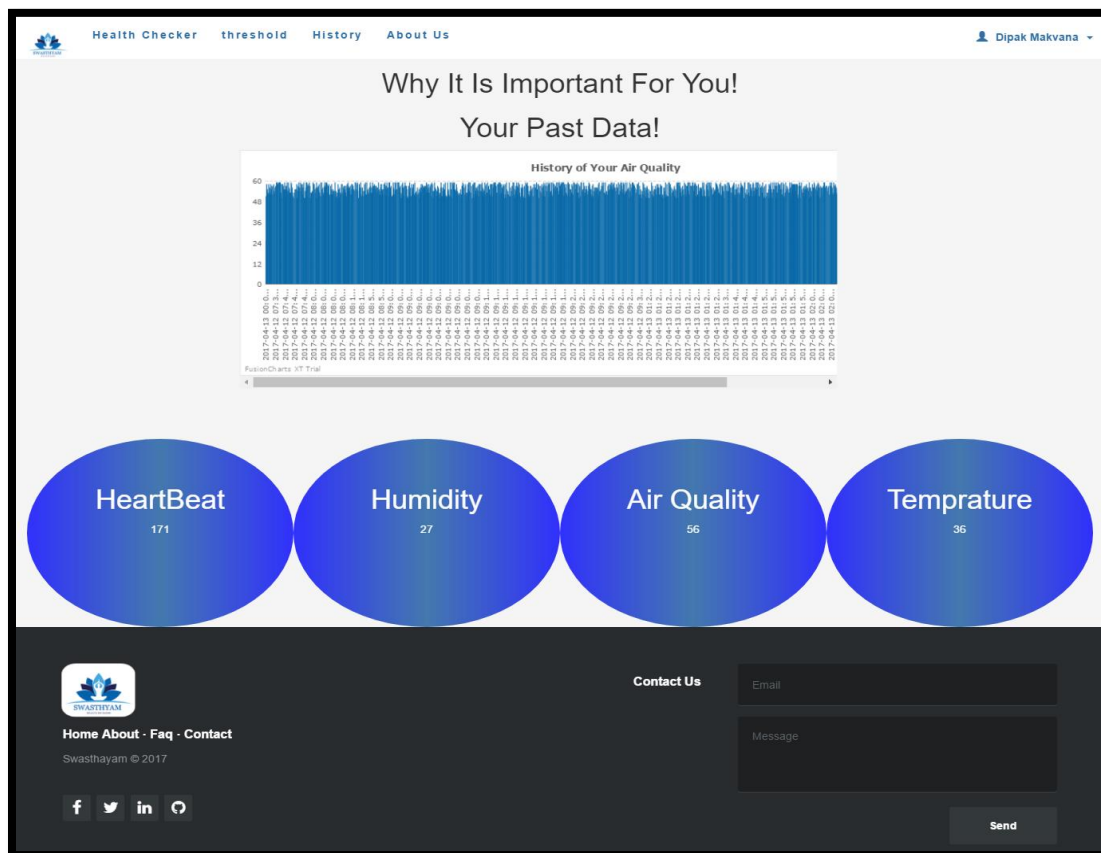


Figure 3.3.2 Viewing patient's past readings

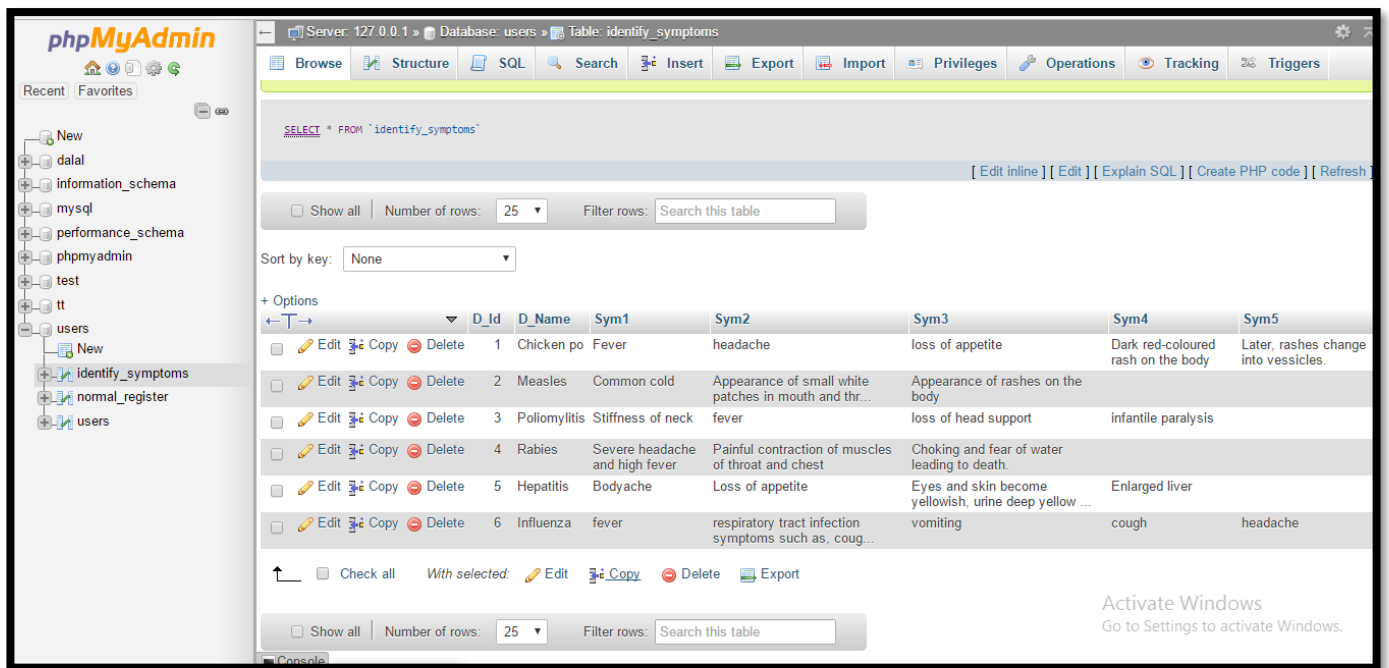


Figure 3.3.3 Database

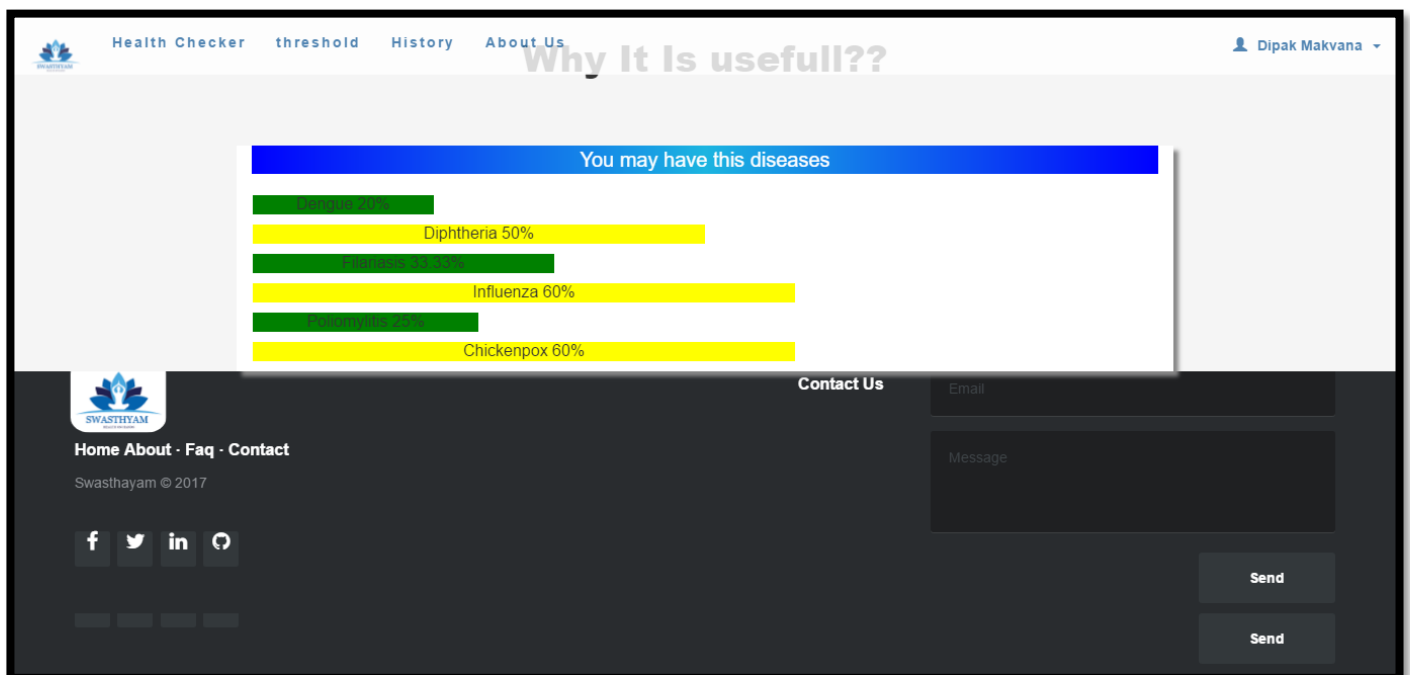



Figure 3.3.4 Possible Diseases based on readings and symptoms



Health CheckerthresholdHistoryAbout Us

How It Is Useful?

Dipak Makvana

Insert Value

body_temperature

44

C

submit

Home About · Faq · Contact

Swasthayam © 2017

f

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in

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Message

Send

Send

Figure 3.3.5 Checking effect of different parameters on patient's health

4. Summary of the Results

4.1 Advantages

Our product will prove to be a very good solution in the field of health as all the other existing health monitoring devices either basically measures the readings of the sensors or alerts the user. But our device will not only measure the readings of the sensor but it will also provide valuable precautions to the user using this device. This device can prove to be very useful for preventing certain diseases and help in suppressing it before it results into something bigger and harmful. The alert button feature of this device can be very much useful. Sometimes it happens that a person starts feeling uncomfortable and get unconscious. So in such conditions, the person can press the alert button which will send SMS to his guardian/doctor along with the readings of the sensors attached to the wearable device.

As per our research currently there are no such similar solutions like ours. All the existing solutions work on either monitoring the person's health or alerting the doctor or requesting an emergency. But we rather work on giving precise precautions. Our precautions are not suggested based on static thresholds of diseases but it is made to vary according to the physical structure of the person. As not all the person gets affected at same reading of body temperature, air temperature, air quality, and humidity and heart rate sensors. It is different for different body structures. Hence, our product is different from other in the above mentioned aspects.

4.2 Features of the project

- Interactive GUI
- Medicine Reminder
- Giving precise precautions based on environmental conditions and readings of sensors.
- Using smart wearable device
- Easy monitoring of readings of the sensor by the user.
- Have in-depth look of users' past readings of the sensor.
- Portable device
- Alert guardian/doctor on detecting extreme readings
- Vary thresholds of diseases based on the body structure of the user.

References

- <https://patents.google.com/patent/US6168563B1/en?q=health>
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