MEDISAFE - STAY AWAY AND DEFEAT DISEASE

2022 - 143

Project Proposal Report

Perera B.A.A.W.S

B.Sc. (Hons) Degree in Information Technology

Specializing in Information Technology

Department of Information Technology

Sri Lanka Institute of Information Technology

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Declaration

I declare that this is my own work and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The supervisor/s should certify the proposal report with the following declaration.

The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

....

Signature of the Supervisor Date

Abstract

In oriental medicine and Ayurveda medicine, pulse diagnosis is crucial. Asians frequently believe that pulse testing may diagnose and heal human diseases. Prior to the invention of Western medicine, humans sought treatment from Ayurveda or homemade medicines. The reason behind this is for Ayurveda's appeal are that it is based solely on herbs, which people are aware are not chemically compounded and are freely available. As Sri Lankans, "pulse diagnosing" is also called as "Nadi Parikshawa." This method of detecting illness by measuring the pulse has been around for thousands of years. The wrist of the patient is frequently used to do the pulse check. The pulse test is done in four ways by Hela Wedakama, the Sinhala neurologist who diagnoses the condition. There are also distinctions in how fingers are used to diagnose the condition. Although different traditional Sinhala physicians utilize different methodologies, pulse tests are generally grouped into four categories.

1. Dosha Naadi Saasthra
2. Anguli Naadi Saasthra
3. Hastha Naadi Saasthra
4. Bootha Naadi Saasthra

Ayurveda doctors measure the pulse using three fingers to detect its activity. With the advancement of modern technology, many people have moved away from Ayurveda medicine to Western medicine. The purpose of this study is explaining the analysing of pulse then identifying hidden disorders in human body and provide necessary treatments. What is expected to be done here is to give a new opportunity to the Ayurveda medicine methods and to carry out the project by providing solutions to the existing Western medical methods through the traditional medicine methods.

Keywords: Artificial neural network, Pulse detection, Prescription (Ayurveda and Western)

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List of abbreviations

Abbreviation	Description
NCD	Non-communicable diseases
ANN	Artificial neural network

1. Introduction

1.1 Background & Literature survey

Non-communicable diseases such as high blood pressure, kidney failure, and heart disease contribute significantly to the number of untimely deaths that are reported annually. Meanwhile, 41 million people die every year as a result of the food they eat, accounting for 71% of all deaths worldwide. This occurred during a global investigation on the causes of early death. Tobacco use, inactivity, alcohol consumption, and poor dietary habits all raise the chance of dying from NCD [10]. According to studies, one out of every five persons dies prematurely as a result of this.

Ayurveda is a form of primary medicine that is based on India's traditional medical system. It aims to cure and merge the body, mind, and spirit through a holistic model that emphasizes food, herbal treatments, exercise, relaxation, and exercise [11]. Based on organized, scientific investigations, Western physicians make conclusions regarding which medication will be most beneficial to their patients. Evidence-based medicine is the term for this approach. Prescribed medication, surgeries, infusion, and other traditional treatments and therapies are all examples of evidence-based treatment strategies.

As the COVID-19 spread, the whole country was locked down and hospitals were overflowing with patients. As a result, many were unable to receive the medical treatment they needed, and the mortality rate increased [9]. Then people tried to create their own drug pattern to prevent from their earlier diseases and current diseases. They followed wrong treatments without knowing the correct dosage of Ayurveda and Western medical treatments. It was also a cause for concern regarding the corona virus.

People's lifestyles have changed as a result of the advent of this covid-19 condition and the growing number of elderly people death around the world, resulting in the growth of chronic diseases. People should have the opportunity to have their health checked at home.

This study shows how to create a portable prototype to identify pulse activation. If people use modern health care technology to prevent diseases, their lives will be better. This gadget is most efficient when enabled wirelessly. It can be used by Ayurveda doctors to diagnose the disease by reading and analyzing the pulse and to provide solutions to current non-communicable diseases.

According to the survey following are the responses gathered from the people who had experiences with illnesses.

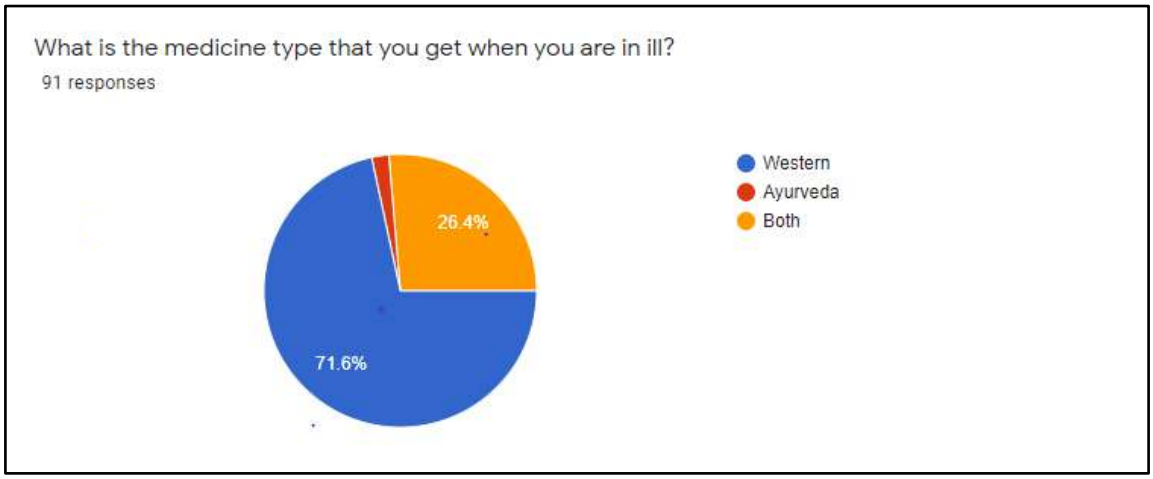


Figure 1.1: Medicine type that people get

According to the above data (Figure1.1), many people use western medicine. From this we can understand that people today have moved away from Ayurveda medicine and are increasingly inclined towards Western medicine. The reason for this is that it takes a long time for Ayurveda methods to give results and Western medical methods give quick results. But the medicines used in Ayurveda medicine are not harmful to the body and there can be side effects in Western medicine.

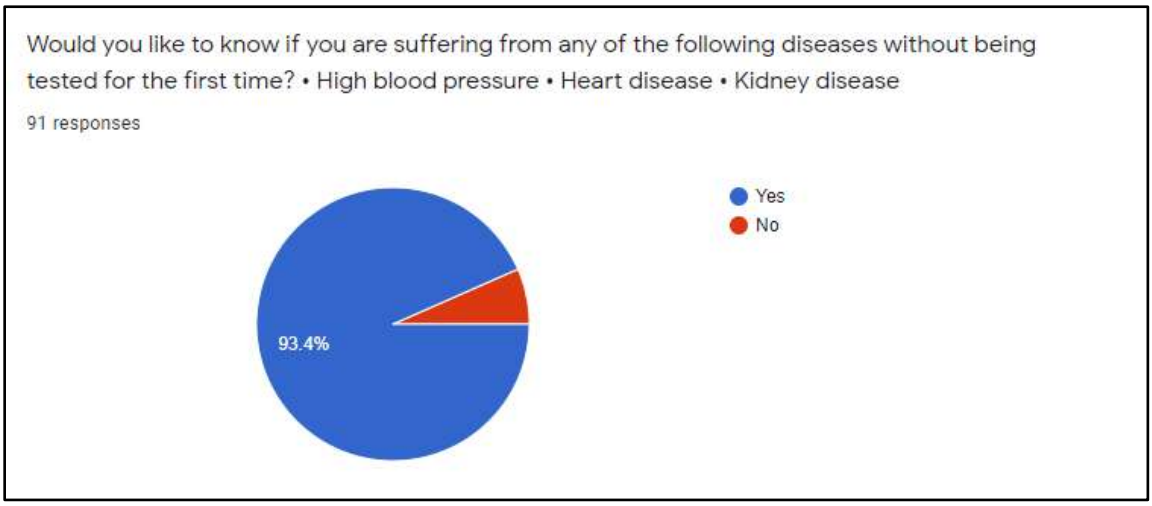


Figure 1.2: Willingness to know the diseases

Considering the above figure (Figure 1.2) shows that people would like to know their hidden conditions. As a result, we hope to use this system to identify which parts of the body are affected.

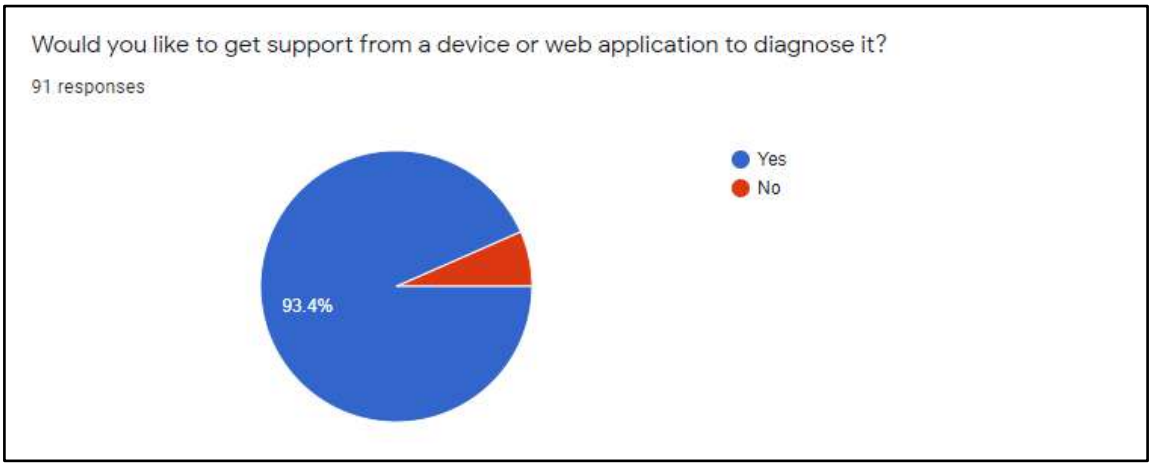


Figure 1.3: Willingness to use a device or web application

We've determined that a system is required based on the information provided (Figure 1.2). A hardware component for reading the pulse is also included in the disease detection system. This allows us to obtain correct patient data in order to treat them.

Once we have the read pulse data, we use API to grab the measured values to mobile phone and prescribe treatment.

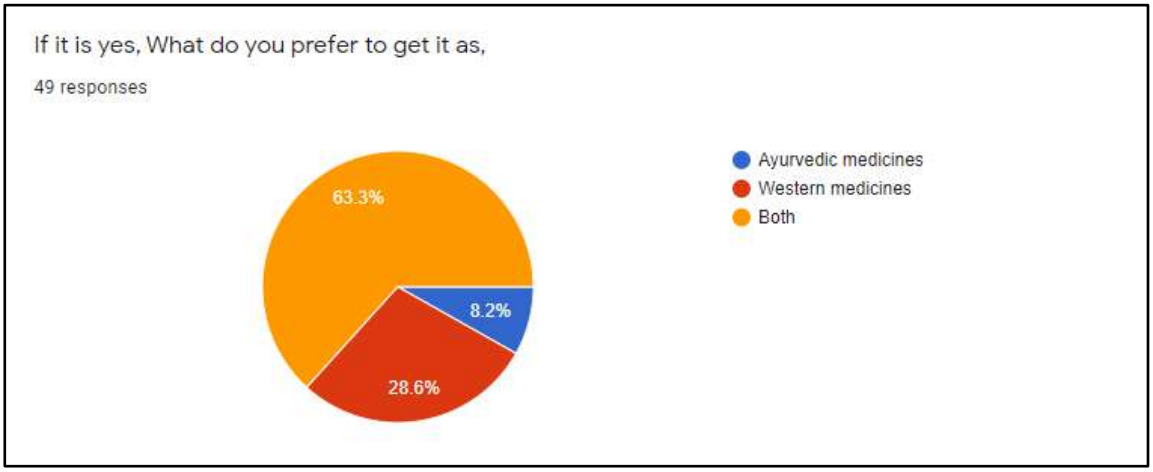


Figure 1.4: Willingness of chosen medicine type

Data collected (Figure 1.1) show that nearly 71% of people take Western method drugs. But by looking at the data above (Figure 1.4) we can see that the majority are interested in Western medicine as well as Ayurveda medicine. So, our response is to read the pulse like in Ayurveda methods and to educate the community and people about the need of Ayurveda remedies. However, using this approach, people can acquire the Ayurveda or Western medical prescription they want.

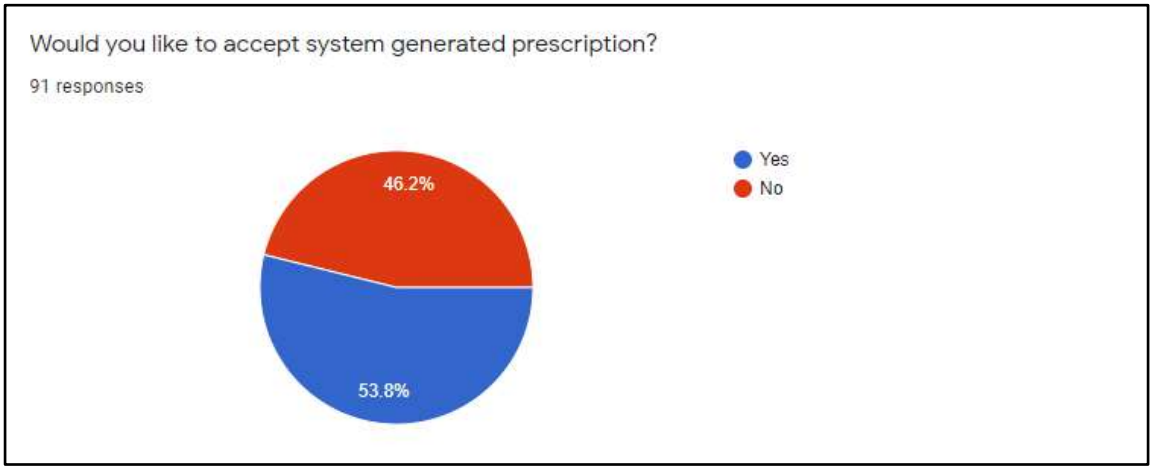


Figure 1.5: Acceptance of system generated prescription

However, the majority are still afraid to take prescription drugs online. There have been reports of patients who are misdiagnosed by hospitals and suffering from different disabilities. Above figure shows the percentage of preferences for a system generated prescription.

From the above survey we can see that in the beginning many people are used to take Western medicine and eventually they prefer to take medicine not only in Western medicine but also in Ayurveda medicine. In addition, they have expressed their willingness to diagnose chronic diseases in their body for the first time and to obtain prescriptions generated by the system for those identified diseases.

1.2 Research Gap

There are reports of people suffering from various ailments due to tobacco use, alcohol use and unhealthy diet. According to the information we can extract from persons with such diseases, the majority of study has studied the following metabolic factors.

- Heart rate
- Cholesterol level
- Blood sugar level

Several of the studies that have been undertaken include the,

- Identification of abnormal pulse rhythms
- Monitoring the gender and age
- Pulse rate analysis identifies some disorders

According to current research papers [1] - [8] and resources, several research papers on the concept of MediSafe (Proposed system) have been established to monitor body pulse rate. The majority of research is focused on pulse monitoring using pulse analyzing those three Ayurveda traditional methods (Vata, Pitta, Kapha) [1], [4], [7]. Research A [4] has focus about to identify the possibility of using the same features to diagnose age and gender, to be used in diagnosing diabetic. Research B [7] has consider about to construct a high-quality pulse acquisition system advance in instrumentation technology have been made. Research C [5] implementation is predicting the gathered pulse rate and identify gender and age. By considering that identify indicates whether there is a risk of heart disease.

Below table will describe the comparison of previous research and our proposed system.

Research products	Features			
	Identify gender & age	Development of advanced equipment	Identify chronic diseases	Provide prescription in western & Ayurveda methods
Research A	✓	×	✓	×
Research B	×	✓	×	×
Research C	✓	×	✓	×
Proposed system (MediSafe)	✓	✓	✓	✓

Table 1.1: Comparison of research

My proposed system is to identify pulses from home or any other place using data models to ensure a continuous connection between the device and the pulse monitor. It also monitors the patient's pulse patterns based on the patient's pulse data and tells their age, gender, which areas of the body the disease is present in and provide prescription for that matter. The purpose here is to develop an algorithm for diagnosing the disease.

1.3 Research Problem

An increasing number of people are today falling with stress and also many chronic diseases due to busy working, Tobacco usage, alcohol consumption, poor dietary habits and hectic work schedule or mismanaged lifestyle. Current lifestyle in young generation is a wake-up signal for major health-related difficulties. Because muscle movements are limited, the body becomes feeble, increasing the risk of obesity, cardiovascular disease, metabolic syndrome, and premature death, hypertension, kidney diseases, diabetic are disease which are the major concerns of society today. [6] This is quickly increasing among those aged 20 to 40.

The corona epidemic, which lasted for nearly two years, caused many problems for humans. The inability to see a doctor and get medicine for a disease, the development of hidden ailments with the spread of the virus, and the need to stay away from physical exercise due to having to stay at home were many problems. As a result, this has become a worldwide issue, and it is our responsibility as university students to offer new innovations. When a person is stressed, the body produces a hormone called adrenaline, which causes the pulse rate to rise rapidly [13]. There are currently methods that employ mobile applications, other digital equipment to assess the pulse rate [13] and those electronic devices are expensive. We must, however, hold the equipment in such a way that it can monitor the pulse rate in order to recover the pulse rate.

As a solution to the above problem, we proposed to implement solutions using appropriate technology to prevent such disorders. My component is to provide a solution by prescription using pulse analysis. Finally, this study suggests "MediSafe" as a tool and web application that can help people improve their quality of life by knowing hidden diseases.

2. Objectives

2.1 Main Objective

In this research main objective is providing necessary solutions and requirements for patients to their current diseases and identify chronic diseases in their body. One of the biggest problems in society today is the covid-19 virus. So far, the situation has been under control to some extent, but it is on the rise again. In such a situation, it is difficult for patients to know their current physical condition as well as to find solutions to it. The project aims to present the proposed device design and the result of a mobile application and web application required to operate the device.

The device is expected to be available in locations where most people are together. Suitable for a nursing home for example. That is, most of these adults have several ailments and some have difficulty walking. In such a situation, it is difficult to go to the hospital and have a medical examination. In such a situation there are advantages to getting their diagnosis easily. It is also suitable for an office. That is to say, with the busy schedule of the employees, they are left to maintain their proper physical condition as well as to undergo the necessary treatment. In this case, they have the opportunity to check their health status at any time by setting up this device.

Accurate analysis of the data obtained from the sensors this will give them an idea of their current situation, the procedures to be followed to get rid of them, the opportunity to respond appropriately to them through a dialogue (via chatbot) and their views on the current situation in Sri Lanka. It is hoped that this will provide an opportunity to provide proper information.

2.2 Specific Objectives

According to the above main objective explanation the specific objectives are as follow,

1) Expert device development to capture the sensor data and processing.
2) Frequency distribution of pulse rate variability data use to diagnose the disease.
3) Multi language chatbot personal assistant on treatments.
4) Provides the current situation diseases information in the country.

In this research project my implementation for the above 2nd step. The device connects to the wrist to retrieve data to identify a patient's pulse. After that this procedure entails taking into account the person's pulse rate data previous records gathered from several sources and utilized to identify the diseases using an algorithm. And the finally it will provide the necessary treatments to follow. As well as this will allow to know the chronic diseases (Kidney problem, Heart problem) to the people.

3. Methodology

The suggested "MediSafe" is a device implementation with a web application and mobile application that can do the following tasks:

- Measuring the current situation parameters of the patient via proposed device and analysing data. (Temperature, Exhale detector, Pulse detector, Blood pressure)
- Frequency distribution of pulse rate variability data use to diagnose the disease and provide necessary treatments.
- Multi language chatbot personal assistant on treatments based on user's symptoms or disorders.
- Identify the Sri Lankan current diseases information.

By considering the above steps I would be able to provide solution for the second step for the current problems and upcoming issues that people have to face in their life.
Here, the artificial neural network (ANN) architecture is used to detect the activation of the pulse. It uses back -propagation algorithms to minimize errors and ensure the accuracy of the results. It also uses the MATLAB neural network toolbox to categorize identifiable patterns. This data is then trained according to the neural network algorithm.
The reason we, as university students, chose to carry out this project is because of the information that we hear and see from our parents, neighbours, workplace employees and on social media networks about the rapidly disabling diseases that are frequently reported in society today.

To conduct this research the below technologies are using,

- Deep learning-based classifications
- Artificial neural network
- Artificial Intelligence
- React
- Cloud computing
- AWS
- Arduino
- Sinhala Unicode
- Google API
- MongoDB

3.1 System Architecture

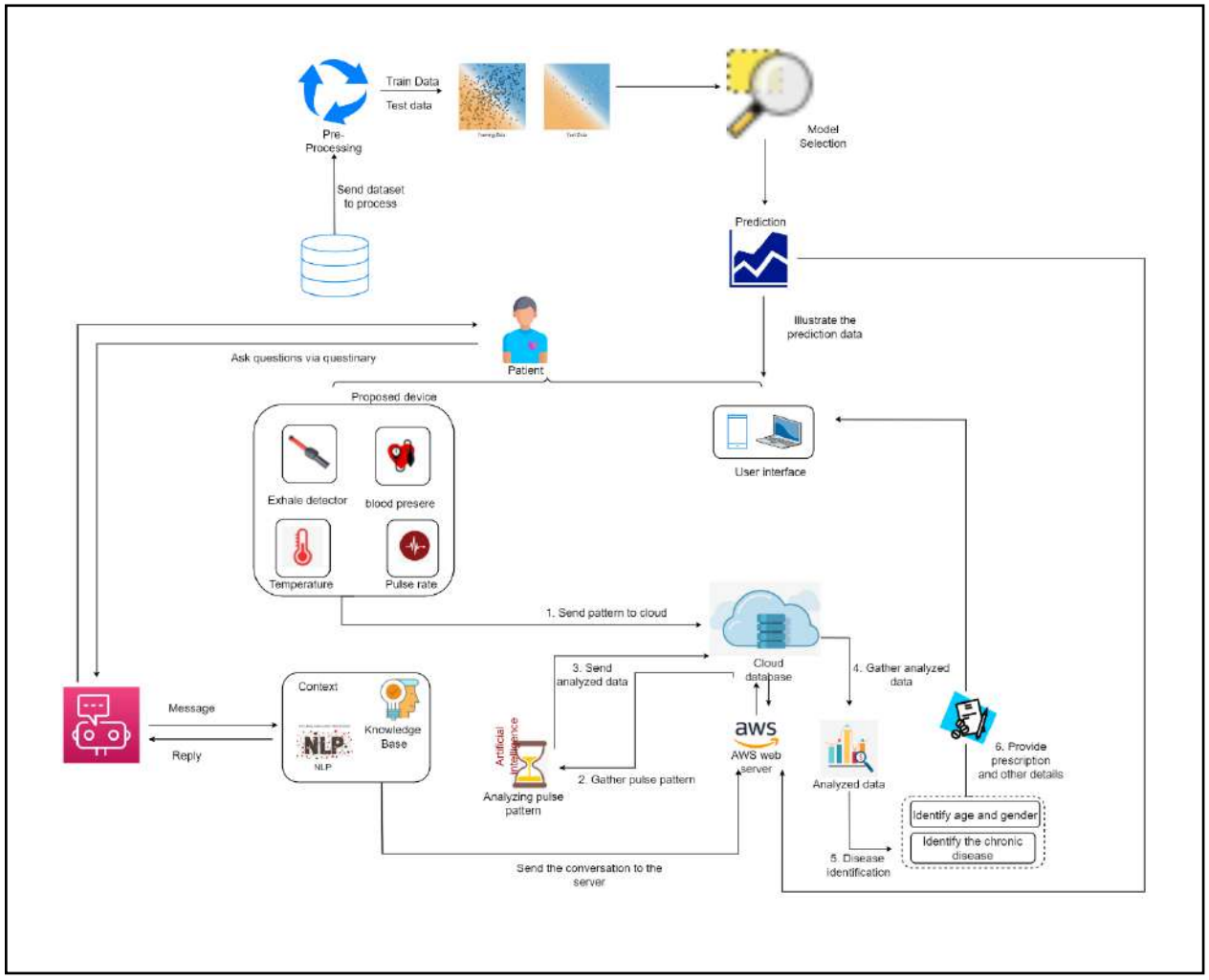


Figure 3.1: Overall system architecture

3.2 Software solution

Agile software development is a set of approaches focusing on iterative development, in which changes are implemented change via cooperation among self-organizing cross-functional teams.

Scrum is an agile development approach based on incremental and iterative procedures that is used in the creation of software. Scrum development's ultimate benefit is that it lets groups to provide product faster, with top standard and predictability, as well as a stronger capacity to adjust to change.

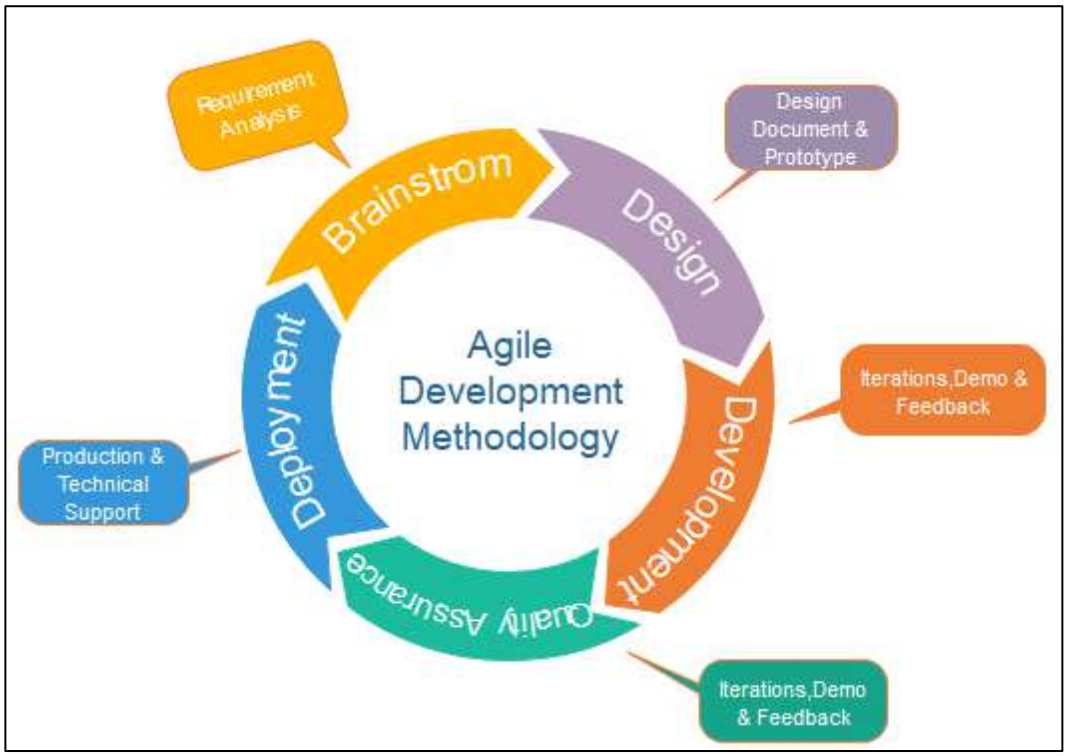


Figure 3.2: Agile methodology

- **Requirements gathering and analysis**

Considering the information and analysis required to carry out this project, we conducted several surveys to make our project a success based on the results obtained.

Here we have obtained the information we need by collecting the required information and distributing it among others through a google form. In addition, we considered the previous research papers made by researchers and gathered lot of ideas from those. We also had the opportunity to gather a lot of information through discussions with physicians who are knowledgeable about these diseases and this industry. We look forward to the support of our doctors to continue this project.

- **Feasibility study**

The result of this project is that our proposed tool will work with the web application and the mobile application to provide the correct solutions to the problems that are working perfectly, giving the correct results without any errors or omissions.

In addition, the cost of designing these accessories should be minimal. Also, the price of the components used should be low and the active outputs of those components should be reliable. Therefore, action must be taken to provide reasonable solutions to the cost of war forests.

A key element of this project is the creation of an instrument. Therefore, it is essential to have a good knowledge of the electronics used in the design, to get the correct output by connecting the devices to each other, and to have a thorough knowledge of the equations used in obtaining that output. We need to use certain sources to obtain this information.

- **Implementation**

The steps to take this project forward are as follows.

- ✓ Data to be captured by the sensors of the device and to process that data.
- ✓ Analysis and prediction of body conditions using signals obtained by pulse rate, body temperature, exhalation detector
- ✓ Predicting and providing solutions to the causes of such physical conditions through a chatbot development.

- ✓ In addition to the information provided, patients will be given the opportunity to provide further information.

This is done by providing the user with diagnoses for the final diagnosed disease through web applications and mobile applications.

- **Deployment**

Here the device uses Arduino technology to create and React will use to develop web application and android application. Amazon web server is also use here for the development.

3.3 Requirements

The following functional criteria are planned to be achieved in the proposed model.

1) Functional requirements

   - The pulse sensor data should be detected
   - Visualization of data
   - Provide prescription
   - Accuracy

2) Non – functional requirements
   - Performance
   - Reliability
   - Maintainability
   - Security

4. Description of Personal and Facilities

4.1 Expert device development to capture the sensor data and processing.

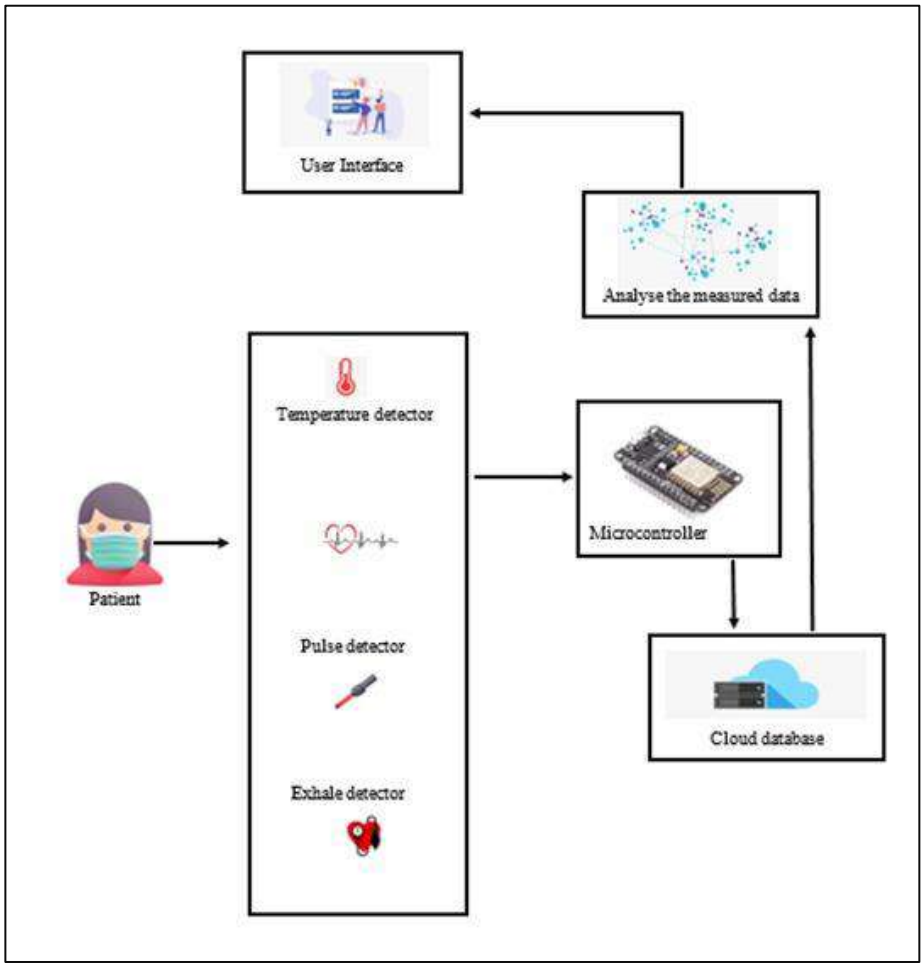


Figure 4.1: Proposed device implementation

The above diagram (Figure 4.1) will explain the member 1 component.

- The proposed device should be able to detect the data.
  - In here the proposed system have temperature detector, exhale detector, blood pressure detector sensors. From those sensers should have to get accurate value for the parameters.

- The grabbed data should send to the cloud database via Bluetooth or Wi-Fi.

- At the end it grabs the sent data from the cloud database and then it will display the relevant analysed data to user via web application and mobile application.

4.2 The frequency distribution of pulse rate variability data use to diagnose the disease.

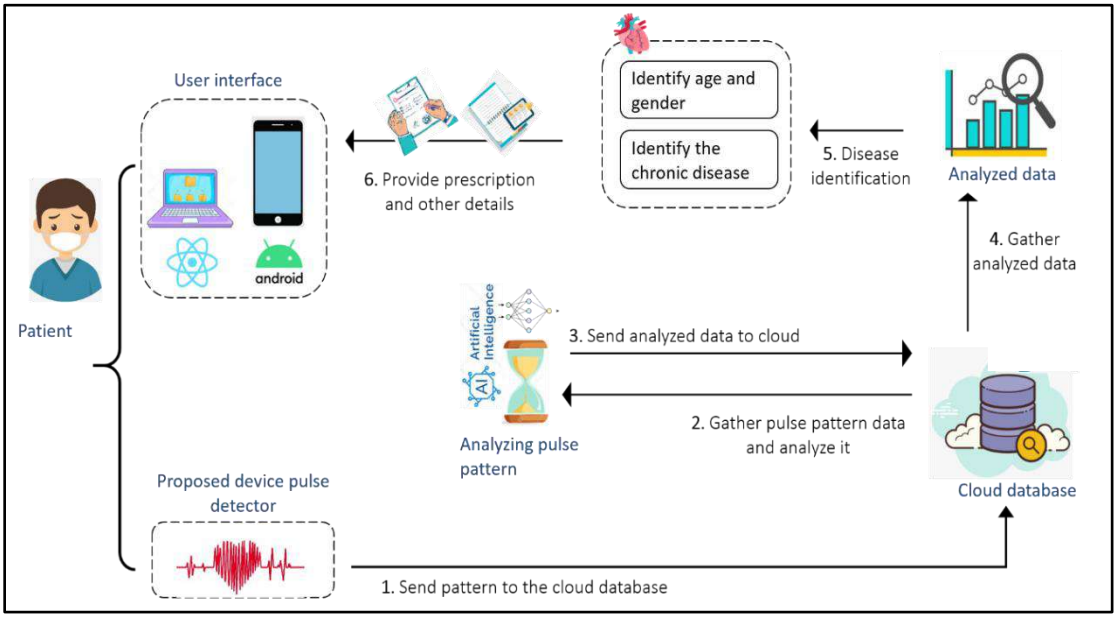


Figure 4.2: Pulse rate analysis and diagnose

The Pulse rate analysis diagram (Figure 4.2) depicts the process's flow.

- Gather the required sensor (Pulse detect sensor) information from the different data sources.
  - The proposed device (MediSafe) should gather data from the sensors and send it to a centralized server so that the following procedures may be carried out. All data should be forwarded to the cloud because the server is hosted remotely in the cloud. The captured data can be sent to the server using the user's current Wi-Fi network.

- Examine and detect gaps in the user's Pulse rate.

- The input obtained from data sources will be analysed to identify the patient pulse rate.

- Patients may check their pulse rate via their mobile app or desktop application.
  - Using the mobile app or desktop application they can see their current pulse rate as a graphical view because of the real time process.

- An algorithm will assess the user's pulse rate based on his or her present pulse data and previous data.
  - After completing the analysing the pulse rate that will provide the details about identified disease, current situation level and necessary treatments to follow. (Ayurveda or western)

One of the system's most significant duty is to detect the patient's disease and treat it appropriately. The above-mentioned approach is critical for identifying the ailment and curing the patient.

4.3 Multi language chatbot personal assistant on treatments.

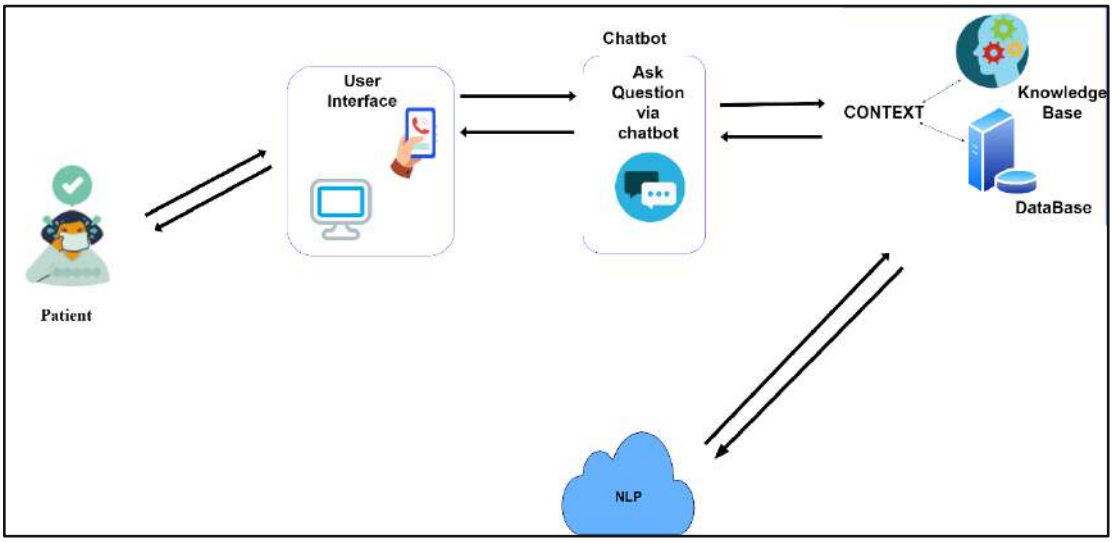


Figure 4.3: Chatbot implementation

The chatbot personal assistant diagram (Figure 4.3) depicts the process's flow,

- From this option will provide details regarding the diseases, treatments to follow and prevent from the diseases.
  - The details are provided by multiple languages: Sinhala and English languages. That is easy for someone who is fluent in their language.

- Long phrase conversations are allowed in this implementation.
  - Users can ask any kind of question without any limitation of the sentences. As a response it will provide some suggestions to users.

- This will manage previous and current chat conversations.
  - That will help to analyse necessary conditions by using previous records also.

4.4 Provides the current situation diseases information in the country.

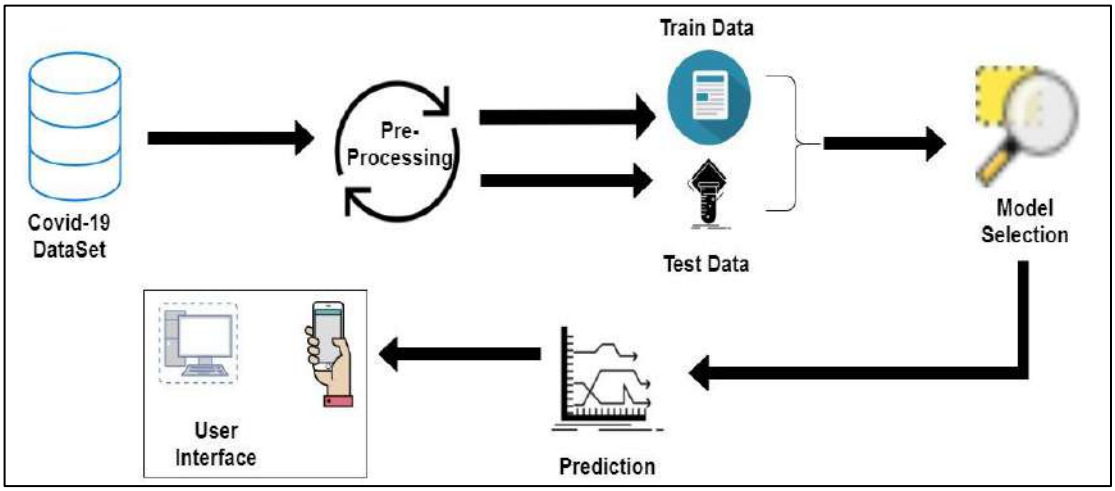


Figure 4.4: Disease information prediction

The disease information provider diagram (Figure 4.4) depicts the process's flow,

- The data must be collected from the different sources
  - To complete this prediction, have to collect data from the past 10 years or more to clarify it correctly. From that prediction help to get an idea about future.

- Develop a Machine Learning Model and use it to create illness predictions.
  - To process data, first make sure it's in the right format, then divide it into two factors and two parts. The first part is for testing, while the second is for training.

- Create dashboard to show details to users.
  - After the forecast is completed, the forecast information is displayed on the mobile app and web application dashboard. By referring to these details, people can identify future diseases. So, it will help them to avoid such situations and to prepare for such situations.

5. Gantt chart

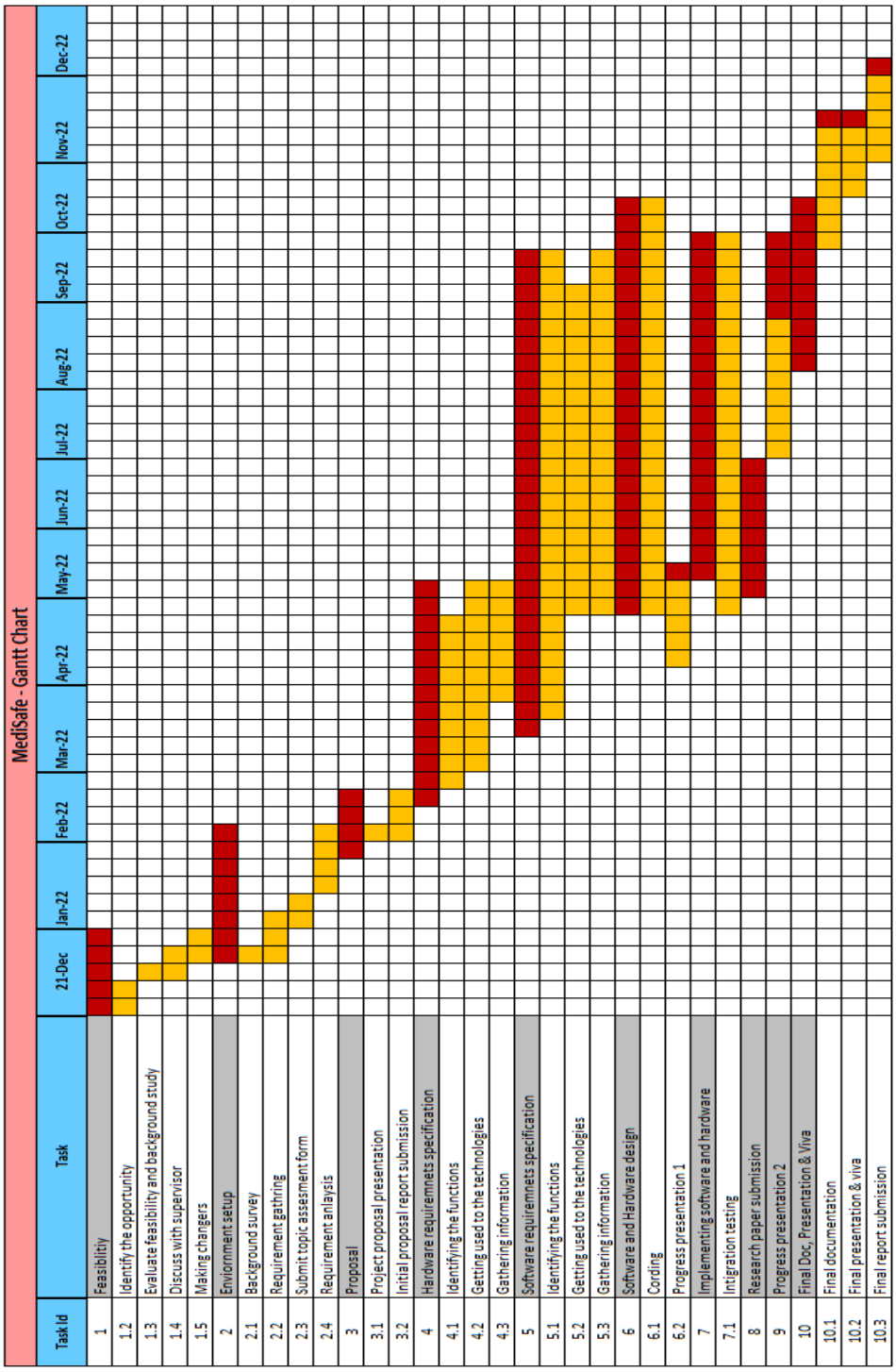


Figure 5.1: Gantt chart

6. Work Breakdown Structure

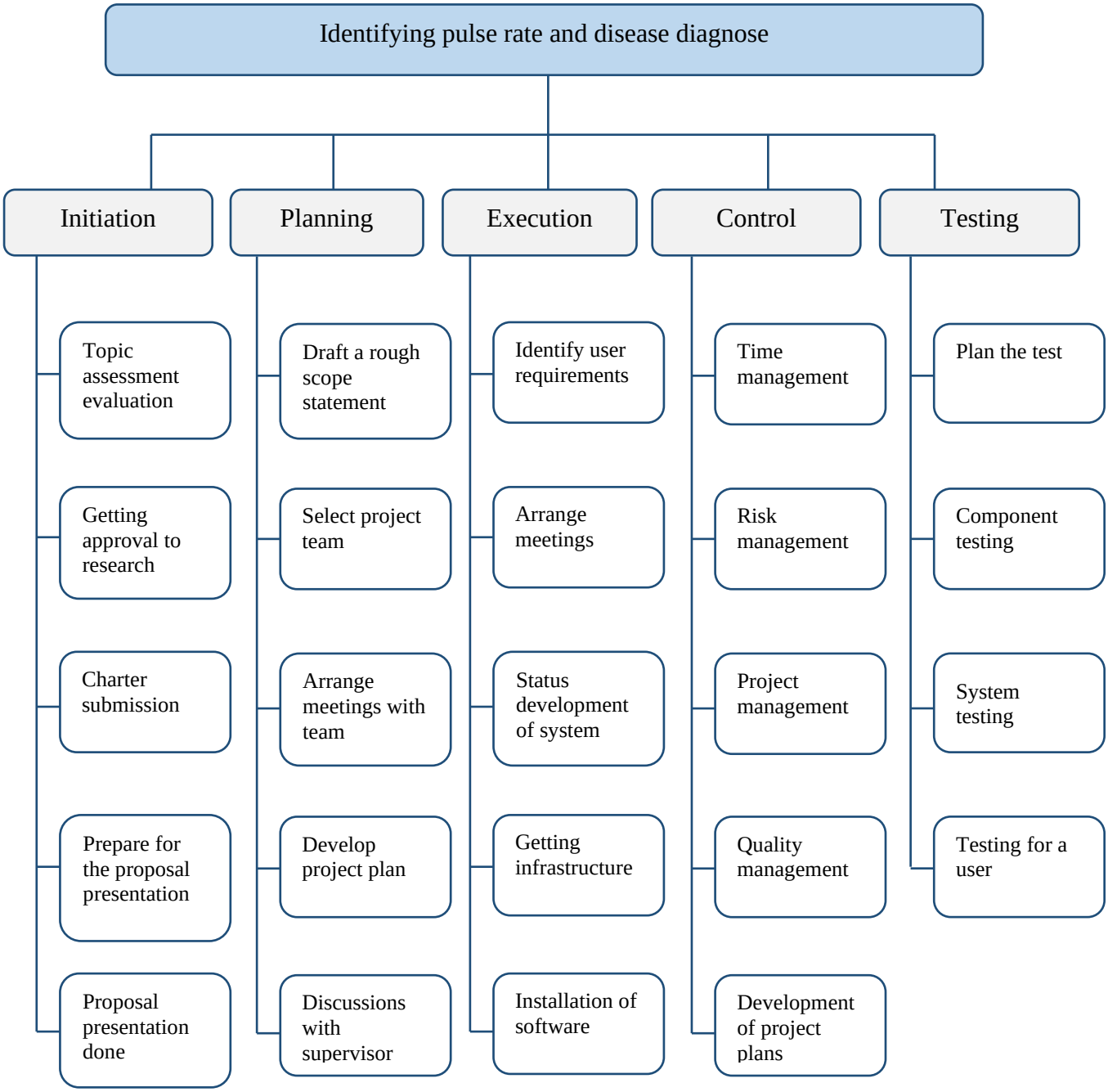


Figure 6.2: Work breakdown structure

7. Budget and Budget Justification

Component	Amount (USD)	Amount (LKR)
Device implementation cost		
Moga NodeMCU Wireless ESP8266	19.24	3900.00
DFRobet Gravity Heart rate monitor sensor	8.14	1650.00
DFRobet PT100 Temperature sensor probe	5.43	1100.00
Exhale detector ugm	4.20	850.00
Flexible cable	0.99	200.00
5V Power supply	0.84	170.00
Power battery	2.22	450.00
Reset button	0.22	45.00
Total	**41.32**	**8365.00**
Fixing cost		
Cloud service and servers	17.29	3500.00
Full Amount	**58.60**	**11865.00**

Table 7.1: Budget

Reference list

[1] M. S. Begum and R. Poonguzhali, "Noi Kanippaan: Nadi diagnosing system," 2011 International Conference on Recent Trends in Information Technology (ICRTIT), 2011, pp. 1049-1054, doi: 10.1109/ICRTIT.2011.5972318.

[2] Z. Jiang, D. Zhang and G. Lu, "A Robust Wrist Pulse Acquisition System Based on Multisensor Collaboration and Signal Quality Assessment," in IEEE Transactions on Instrumentation and Measurement, vol. 68, no. 12, pp. 4807-4816, Dec. 2019, doi: 10.1109/TIM.2019.2899514.

[3] N. Arunkumar and K. M. Mohamed Sirajudeen, "Approximate Entropy based ayurvedic pulse diagnosis for diabetics - a case study," 3rd International Conference on Trendz in Information Sciences & Computing (TISC2011), 2011, pp. 133-135, doi: 10.1109/TISC.2011.6169099.

[4] H. E. J. Umasha, H. D. F. R. Pulle, K. K. R. Nisansala, R. D. B. Ranaweera and J. V. Wijayakulasooriya, "Ayurvedic Naadi Measurement and Diagnostic System," 2019 14th Conference on Industrial and Information Systems (ICIIS), 2019, pp. 52-57, doi: 10.1109/ICIIS47346.2019.9063271.

[5] H. Pogadadanda, U. Shwetha Shankar and K. R. Jansi, "Disease Diagnosis Using Ayurvedic Pulse and Treatment Recommendation Engine," 2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS), 2021, pp. 1254-1258, doi: 10.1109/ICACCS51430.2021.9441843.

[6] Sukesh Rao M and R. Rao, "Investigation on pulse reading using flexible pressure sensor," 2015 International Conference on Industrial Instrumentation and Control (ICIC), 2015, pp. 213-216, doi: 10.1109/IIC.2015.7150740.

[7] A. Joshi, A. Kulkarni, S. Chandran, V. K. Jayaraman and B. D. Kulkarni, "Nadi Tarangini: A Pulse Based Diagnostic System," 2007 29th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, 2007, pp. 2207-2210, doi: 10.1109/IEMBS.2007.4352762.

[8] B. Thakker, A. L. Vyas and D. M. Tripathi, "Radial pulse analysis at deep pressure in abnormal health conditions," 2010 3rd International Conference on Biomedical Engineering and Informatics, 2010, pp. 1007-1010, doi: 10.1109/BMEI.2010.5639735.

[9] Epid.gov.lk. 2022. *COVID - 19 confirmed deaths - Weekly analysis*. [online] Available at: <https://www.epid.gov.lk/web/index.php?option=com_content&view=article&id=233&Itemid=489&lang=en> [Accessed 21 January 2022].

[10] “Noncommunicable diseases,” *Who.int*. [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases. [Accessed: 03-Feb-2022].

[11] R. M. Abeyrathne, “Current trends in the popular sector traditional medicine in Sri Lanka,” Pdn.ac.lk. [Online]. Available: https://arts.pdn.ac.lk/socio/staff/articles/abeyrathnayake%202019.pdf. [Accessed: 02-Feb-2022].

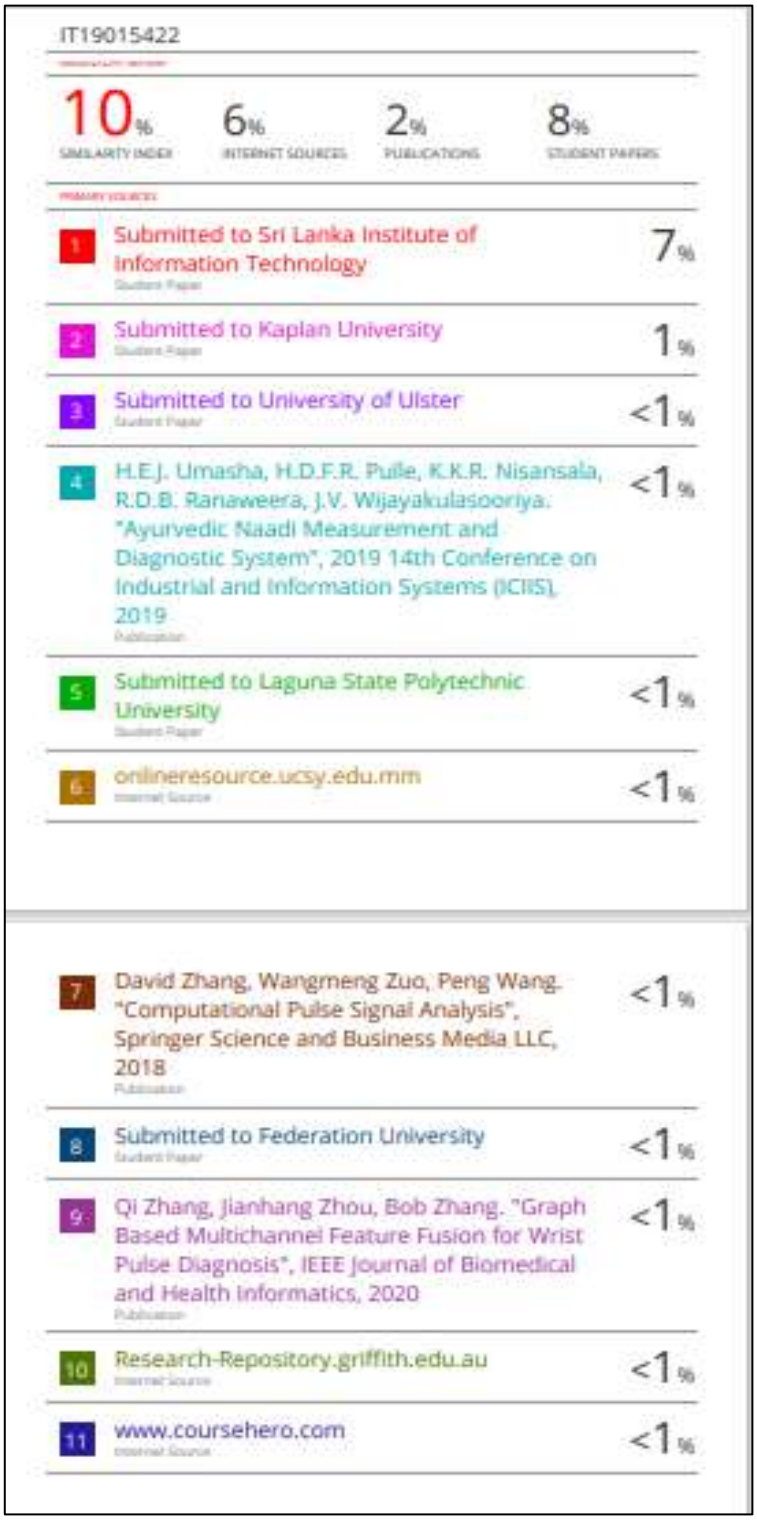
[12] F. S. Cattivelli and H. Garudadri, "Noninvasive Cuffless Estimation of Blood Pressure from Pulse Arrival Time and Heart Rate with Adaptive Calibration," 2009 Sixth International Workshop on Wearable and Implantable Body Sensor Networks, 2009, pp. 114-119, doi: 10.1109/BSN.2009.35.

[13] Yourhormones.info. (2018). Adrenaline | You and Your Hormones from the Society for Endocrinology. [online] Available at: http://www.yourhormones.info/Hormones/Adrenaline.aspx [Accessed 07 Feb. 2022].

[14] Researchgate.net. [Online]. Available: https://www.researchgate.net/publication/10711925_Attitudes_of_Hong_Kong_Chinese_to_traditional_Chinese_medicine_and_Western_medicine_Survey_and_cluster_analysis. [Accessed: 10-Feb-2022].

[15] “Tutorials - Javatpoint,” *www.javatpoint.com*. [Online]. Available: http://www.javatpoint.com. [Accessed: 09-Feb-2022].

Appendix



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