

GLUCare

An Advanced Non-Invasive
Glucose Monitoring System
using NIR Spectroscopy

PRESENTED BY:

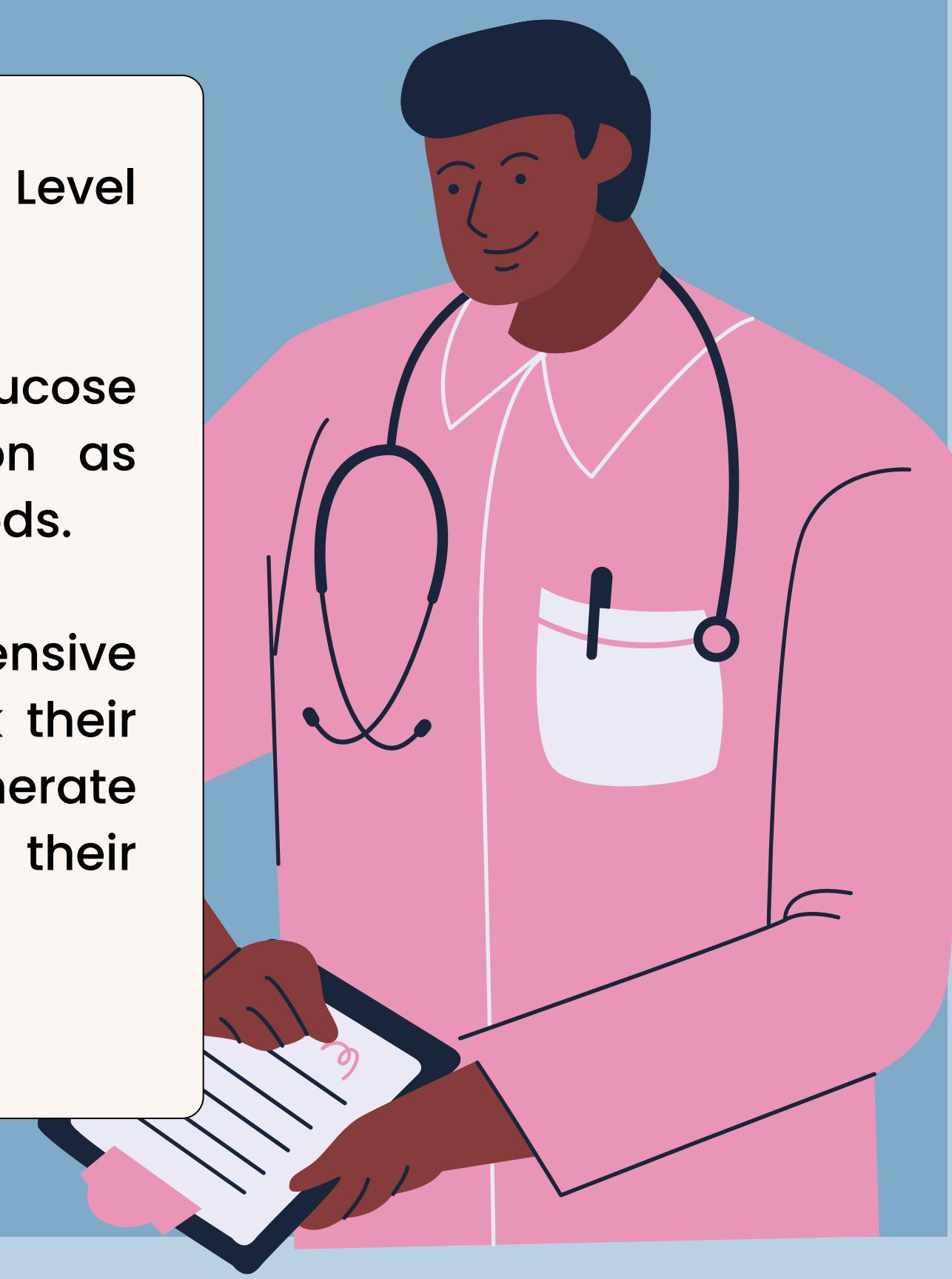
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Project Overview



Non-invasive way of Blood Glucose Level Measuring system.

Use of NIR Spectroscopy for glucose measuring to achieve more precision as compared to other spectroscopic methods.

Developing a website as a comprehensive solution for the patients to easily track their glucose level in real time and also generate reports containing detailed analysis of their data that is reliable.

Need Analysis

The International Diabetes Federation (IDF) reports that about 537 million people worldwide have diabetes. The number of cases has been increasing over the past few decades.

Need for our project can be clearly seen from the number of people it can provide relief from the pain using non-invasive technique with the following benefits compared to invasive methods.

- Reduced pain and discomfort
- Increased convenience
- More frequent testing
- Reduced risk of infection
- User friendly application to help in maintaining records and analysis of data readings.



Literature Survey

Methods

Raman Spectroscopy

Challenges

Proof of functionality in humans is not present and sample collection time is reduced through lasers which is harmful

Bioimpedance spectroscopy

Prone to changes by the interference of different phenomena such as sweat and temperature[.]

Thermal emission spectroscopy

Intensity of radiation through eardrum affected by thickness which may vary in humans

Sonophoresis

Experimental error changes are unacceptably high

Fluorescence

Not tested on humans but only on in-vitro cell culture models

Existing Devices

Glucowatch

GlucoTrack

Optical Coherence Tomography (OCT)

Challenges

components needed to be replaced frequently

reverse iontophoresis

inaccurate; sensitive to the eyes of diabetic patients



Problem Statement

The existing challenge in non-invasive glucose detection lies in the limited commercialization of NIR devices due to issues related to accuracy. Current research suggests that NIR spectroscopy is a promising method for glucose monitoring, but its widespread adoption is hindered by a lack of precision.

Our project addresses this gap by enhancing accuracy and reliability through the incorporation of clinical parameters. By considering individual variations in physiology, our goal is to make NIR-based glucose detection more robust, thereby paving the way for the successful commercialization of non-invasive glucose monitoring solutions.



Project Objectives

- 1.** To analyze and compare existing state of the art technologies for glucose monitoring.

- 2.** To design and implement a non-invasive device to monitor Blood Glucose level using Machine Learning.

- 3.** To create the test data and validate the performance of the device by comparing with clinical invasive techniques.

- 4.** To design and develop a web application/app to display the results.



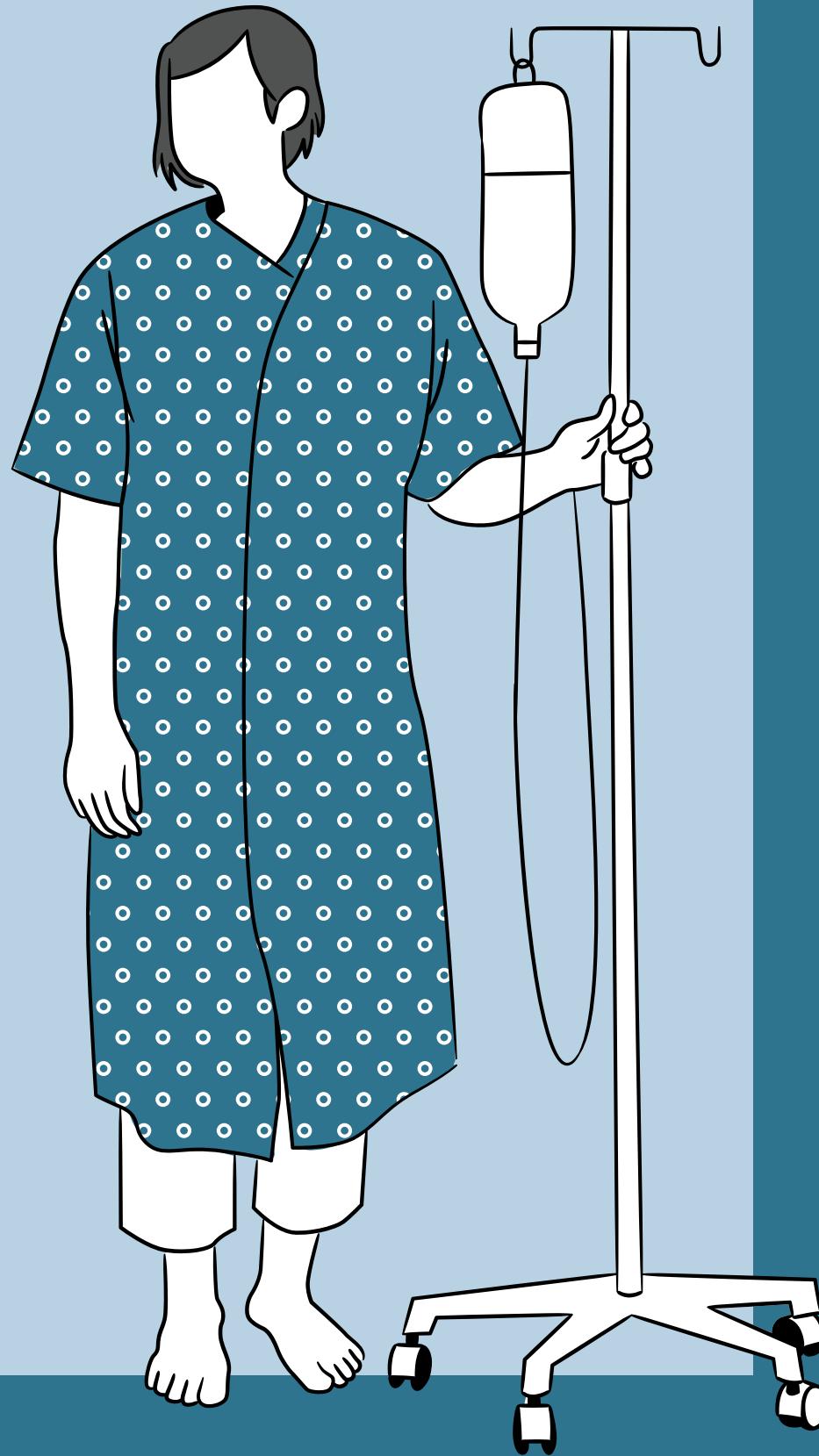
Assumptions And Constraints

Assumptions

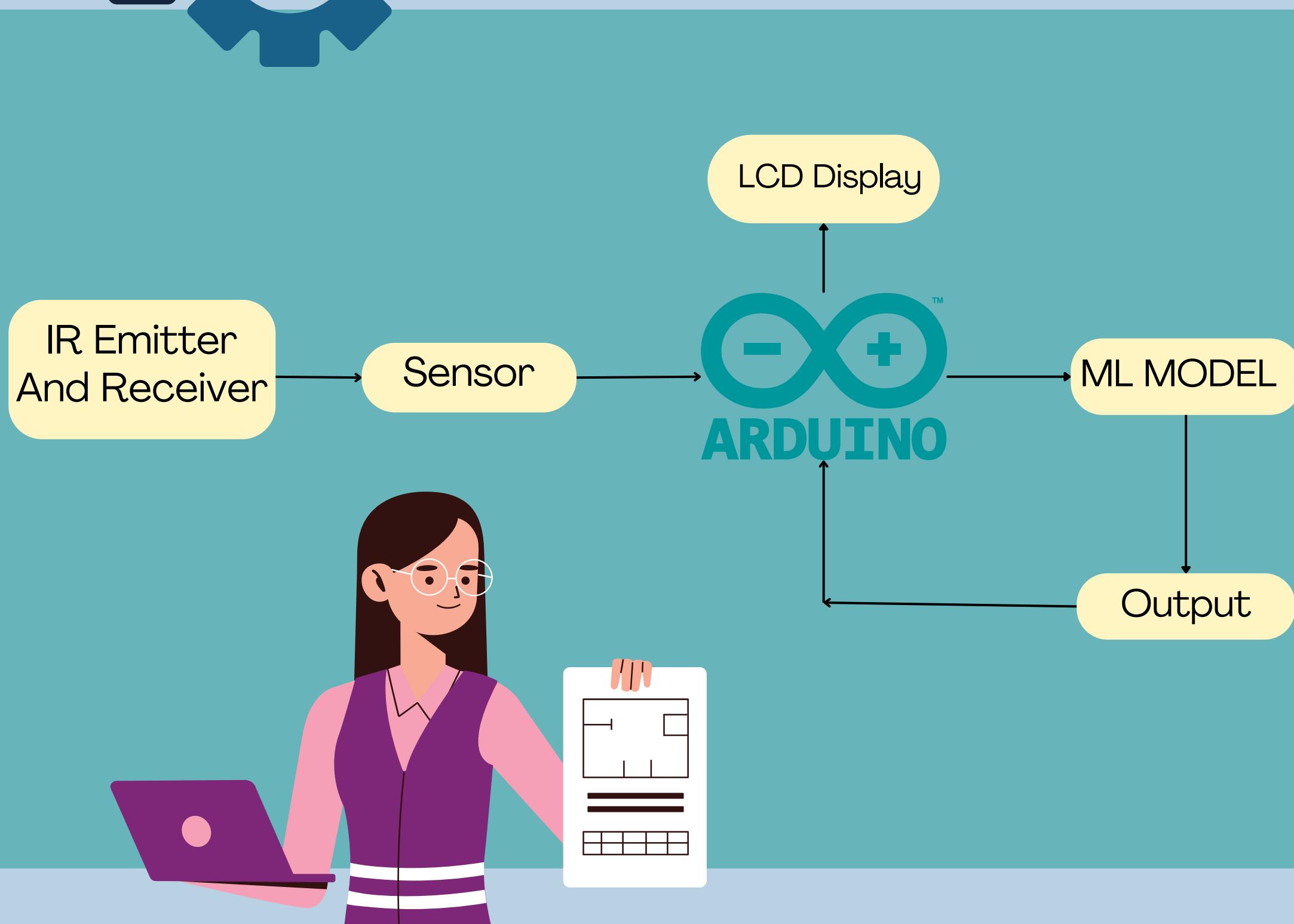
- The sensors integrated are accurate and reliable
- Data collected from device is stored securely and confidentially to protect user privacy.

Constraints

- To make it affordable
- Finding appropriate wavelength of the NIR
- Dependence on investigated tissue type



Project Execution Plan



Project Requirements

PLATFORMS

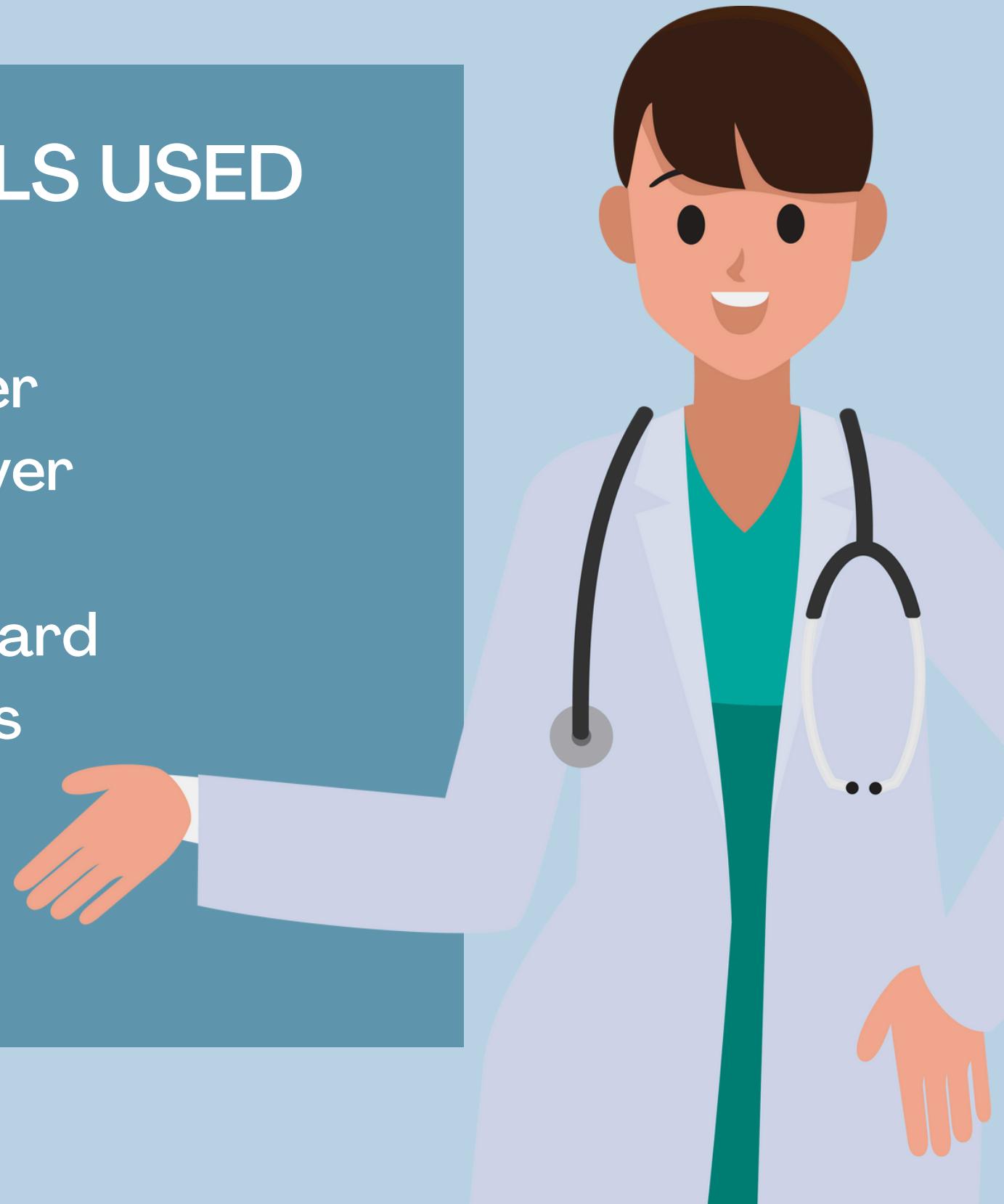
- Autocad EAGLE
- Tinkercad

TECH-STACK

- React.js
- Firebase (backend)

TOOLS USED

- Arduino
- IR Emitter
- IR Receiver
- LCD
- Breadboard
- Resistors
- Wires



Project Outcomes

01.

To develop an accurate and reliable non-invasive blood sugar level monitoring device.

02.

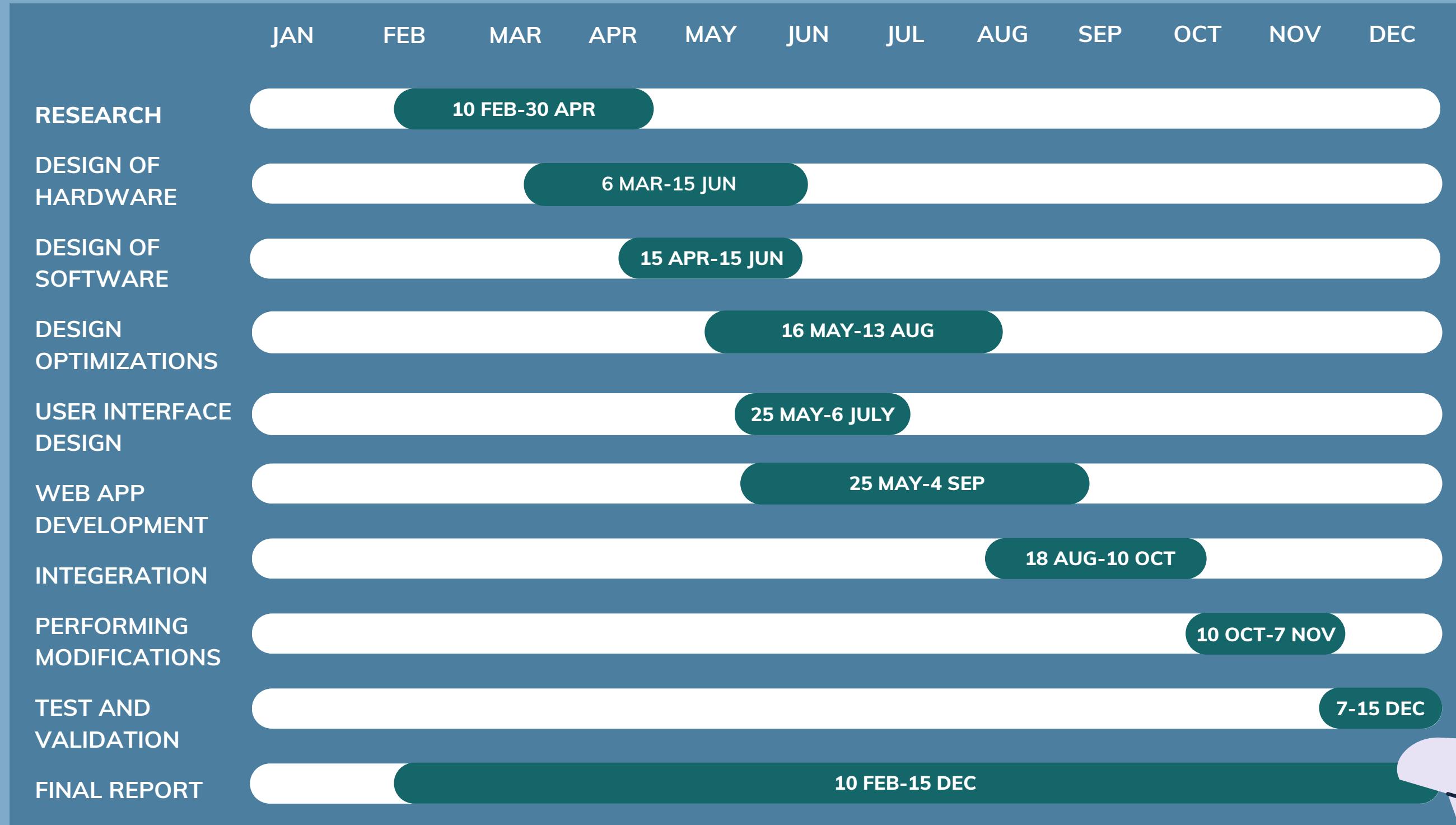
Validate the proposed system using current testing methods across different demographics.

03.

Develop a user friendly web application which will track user's blood sugar level.



Work Plan



Contributions of Individual Team Members

Research Work

Pia Anupriya Nitleen

Stuti

Design and study of hardware

Nitleen Pia Stuti

Model Training

Stuti **Riddhi**
Nitleen
Pia

Web application development

Anupriya Pia
Nitleen
Riddhi

Integration of hardware & software

Nitleen Riddhi
Pia Stuti
Anupriya

Testing

Pia
Anupriya
Nitleen

References

IDF Diabetes Atlas 10th edition

https://diabetesatlas.org/idfawp/resource-files/2021/07/IDF_Atlas_10th_Edition_2021.pdf

On the use of fiber lasers in non-invasive blood glucose monitoring

<https://www.sciencedirect.com/science/article/pii/S1068520022000050>

Non-Invasive Methods of Glucose Measurement: Current Status and Future Perspectives

https://www.researchgate.net/publication/221892032_Non-Invasive_Methods_of_Glucose_Measurement_Current_Status_and_Future_Perspectives

Wearable-band type visible-near infrared optical biosensor for non-invasive blood glucose monitoring

<https://www.semanticscholar.org/paper/Wearable-band-type-visible-near-infrared-optical-Rachim-Chung/eebf89973bc64fcfcdb3dab1220864f918e0810f>



Thank
you very
much!

