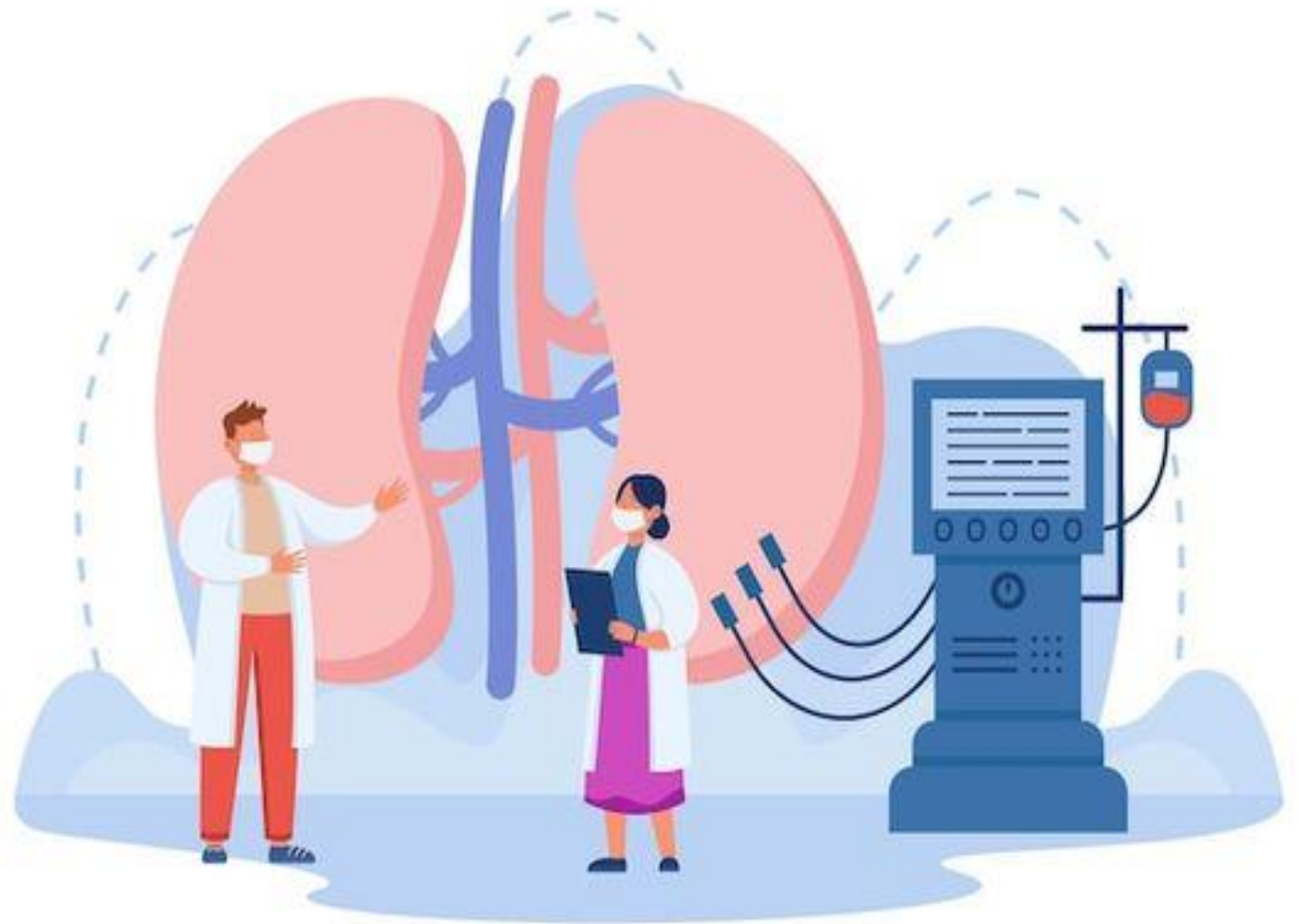# KidniFy

Your Kidney Care Companion
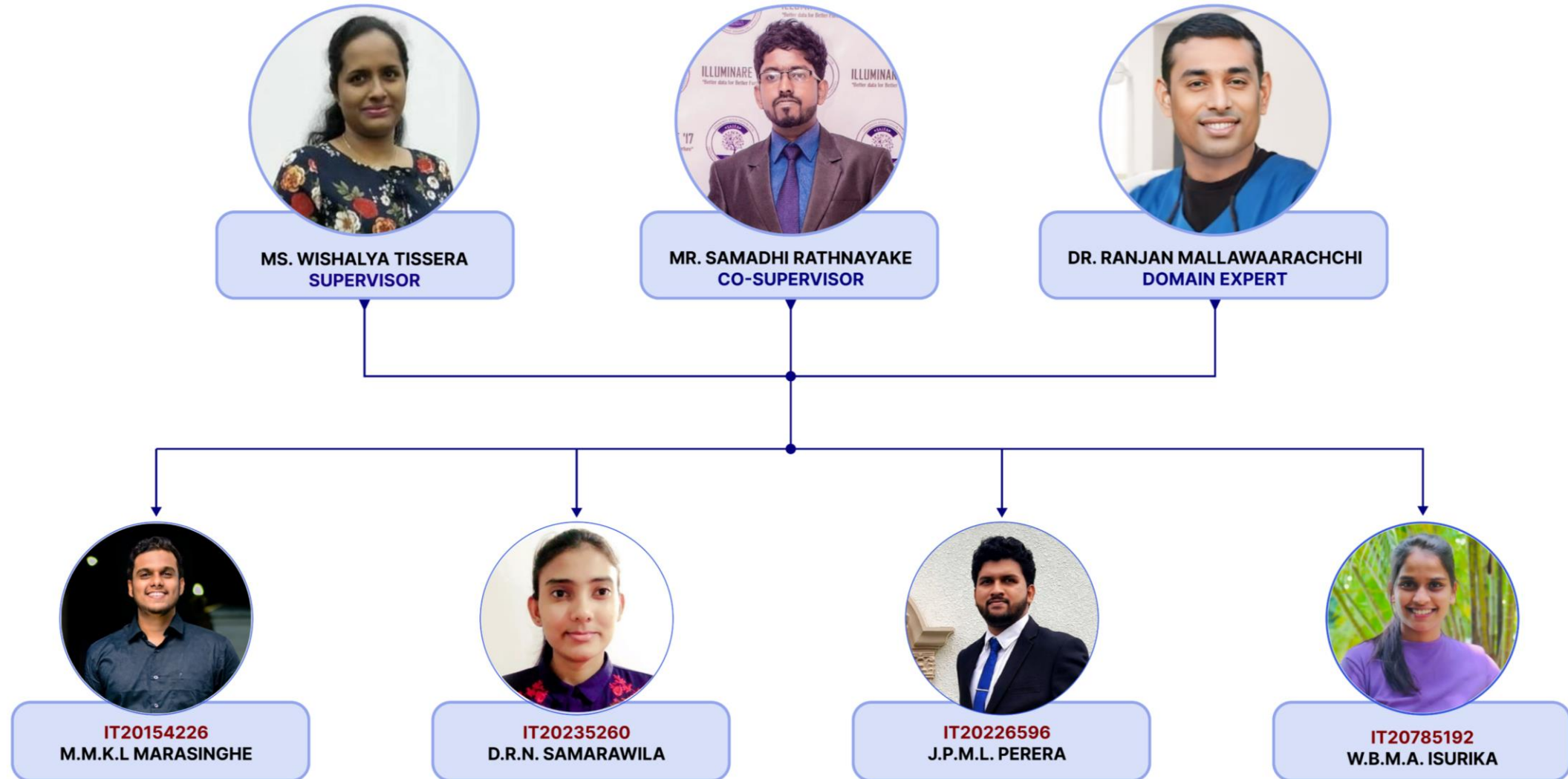
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Outline

❑ **Our Team**

❑ **Introduction**

- Background

- Research Problem

- Overall Problem

- System Overview

- Gantt Chart

- Commercialization

❑ **Individual Components**

- Background

- Research Problem

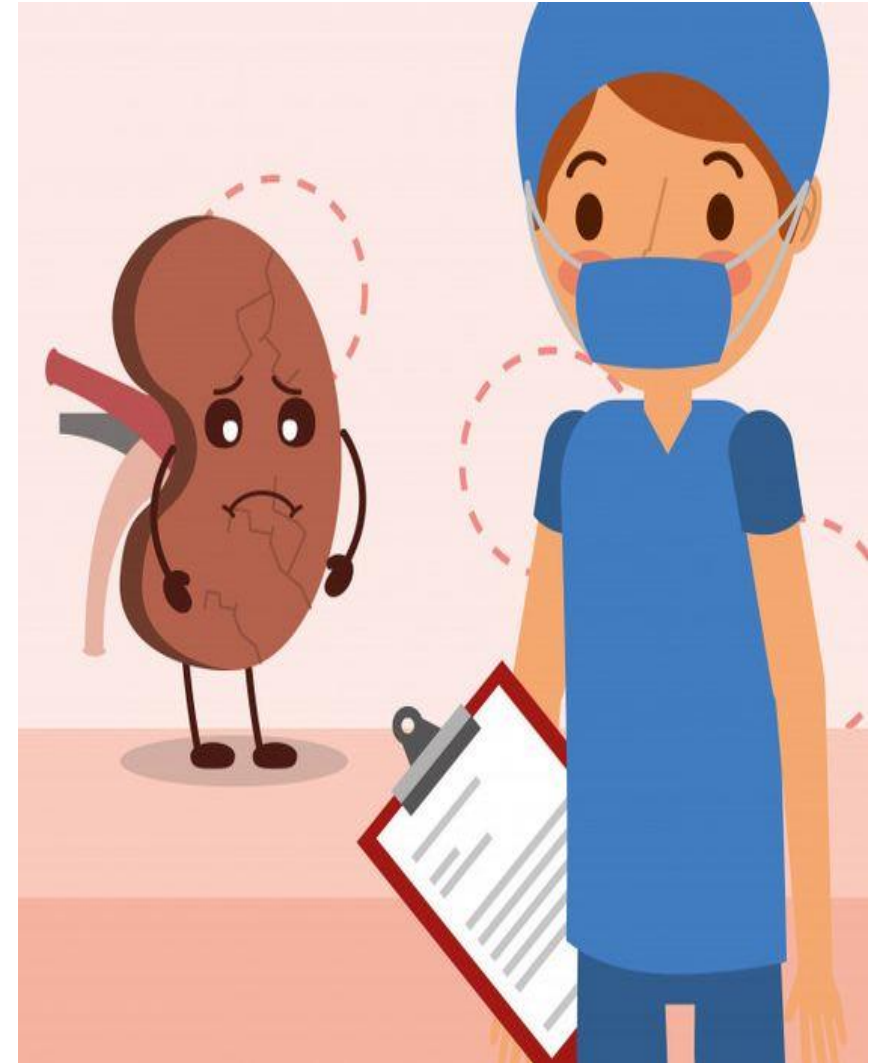- Research Gap

- Objectives

- Methodology

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Our Team

MS. WISHALYA TISSERA
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Introduction

Background

- The importance of the kidneys

- What is CKD

- Reasons for those disease types

Research Problem

Lack of public awareness

- Late presentation of kidney diseases

- Having less awareness about medical imaging and the importance of it

- Consumption of contaminated water

- Neglecting healthy lifestyle choices

Objectives

To develop a mobile app that is easy to use yet effective to
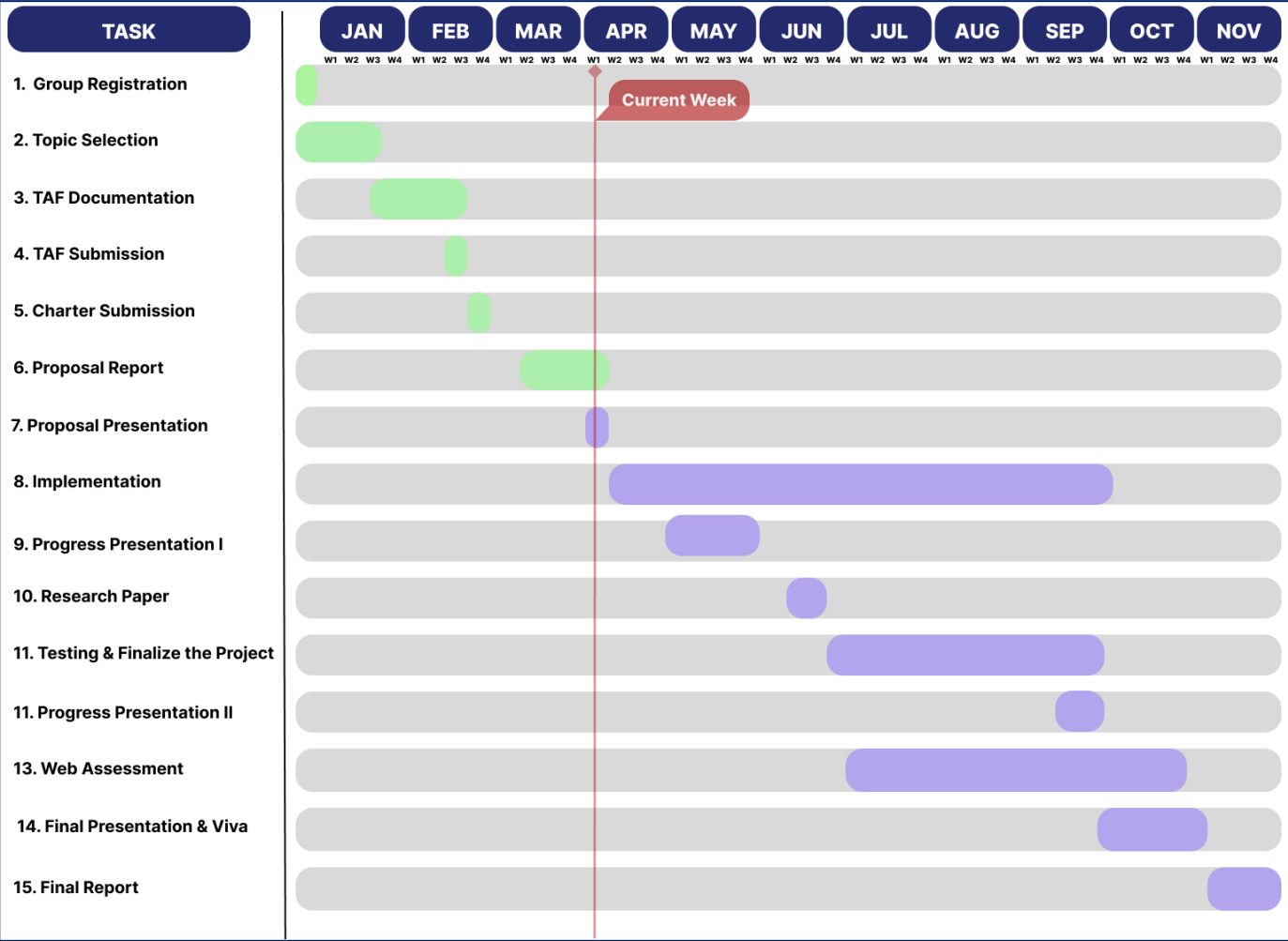
- Accurately predict about kidney health based on real time data.

- Get timely diagnosis of kidney disease using image processing

- Measure the quality of water with the use of an IOT device

- Analyse patient data and provide personalized diet plans

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System Overview
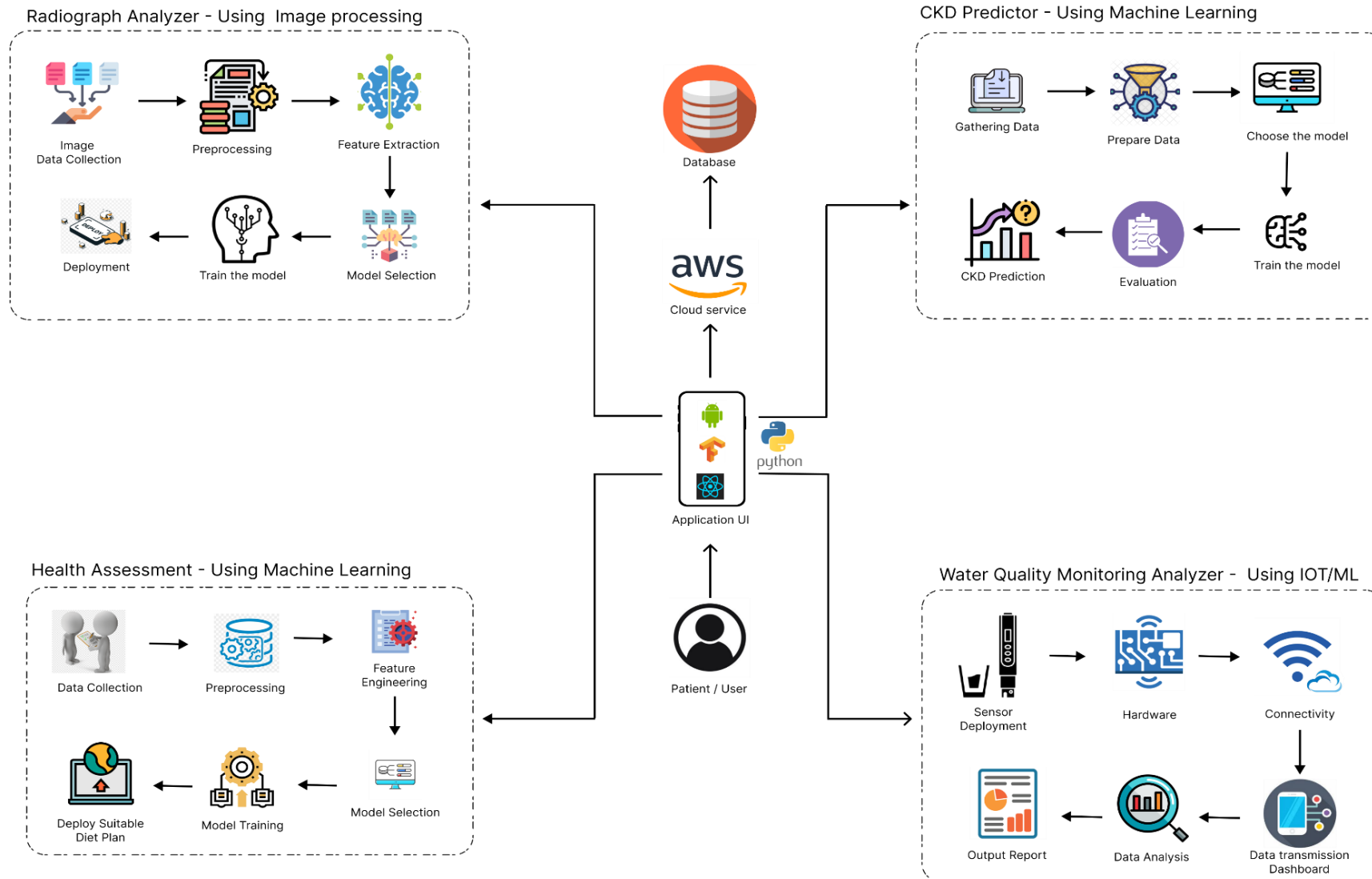
Gantt Chart

Commercialization

- Partner with healthcare providers to offer our app as a resource for their patients.

- Collect data from app users to identify patterns and trends in kidney disease prevalence and risk factors. Use this data to improve the app's features and functionality and to develop targeted marketing campaigns.

Individual Components

IT2O235260 | D.R.N. Samarawila

Specializing in Information Technology

Predictive analysis for risks of having a Kidney Disease

Background

- Types of the CKD and main reasons for them.

    1. Diabetic nephropathy

    2. Hypertensive nephropathy

    3. Glomerulonephritis

    4. Polycystic kidney disease

    5. Interstitial nephritis

    6. Congenital kidney disease

- In addition to these main types of CKD, there are also other less common causes of kidney disease, such as kidney stones, tumors, and structural abnormalities.

- Identify a CKD in early stages and the importance of that.

- Use the modern technology to aware and to prevent from the CKD.

Research Problem

- Limited resources and lack of awareness

- What are the symptoms and risk factors of CKD

- How to predict whether the user is affected or not from CKD

-

Research Gap

- Developing an exhaustive, technology-based approach to Predict the risks of having a kidney disease
- Targeting Sri Lankan prevalence of kidney patients
- Increase the accuracy of the prediction considering more parameters
  - Symptoms
  - Medical Conditions
  - Lifestyle Choices
  - Genetics

  and by using more than one model.

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Features	Research A [1]	Research B [2]	Research C [3]	KidniFy
1.Predicting whether the specific user is contract with CKD or not.	✓	✓	✓	✓
2.Predicting the stage of the disease with high accuracy.	✓	✗	✗	✓
3.Recommending the treatments and directing the patient for that	✗	✗	✗	✓
4.Giving the details of the locations of the treatment units or nephrology hospital.	✗	✗	✗	✓

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Objectives

Main Objective

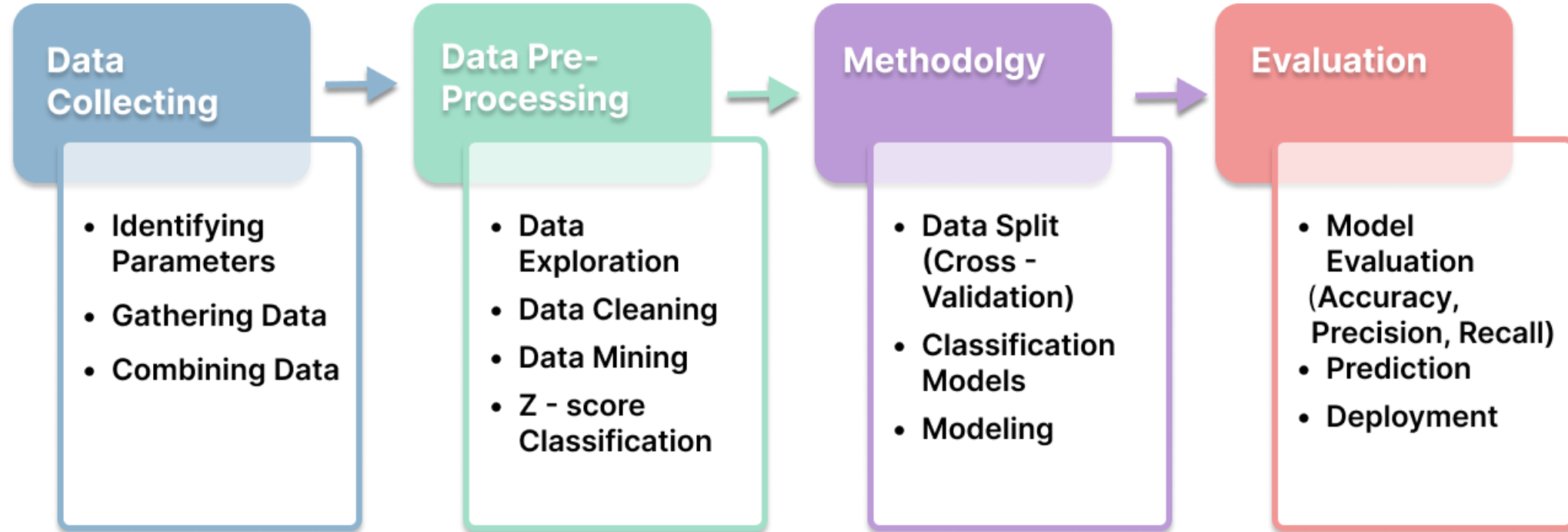- Develop an effective solution for predicting a user's kidney health condition with high accuracy.

Sub Objectives

- Gathering the data and preprocessed that data.
- Train highly accurate ML model with collected data.
- Giving the prediction according to the real time test data.
- Giving the instructions and the recommend treatments
- Based on patient's health condition and the current location, display a list of the nearest medical facilities where they can go through the necessary tests.

Methodology

- Component overview
- Tools and Technologies
- Requirement Analysis

Component Overview

Data Collecting

- Identifying Parameters
- Gathering Data
- Combining Data

Data Pre-Processing

- Data Exploration
- Data Cleaning
- Data Mining
- Z - score Classification

Methodolgy

- Data Split (Cross - Validation)
- Classification Models
- Modeling

Evaluation

- Model Evaluation (Accuracy, Precision, Recall)
- Prediction
- Deployment

Tools and Technologies

Software technologies

- Python
- TensorFlow
- AWS / Azure
- React Native
- MongoDB
- Node JS

Requirement Analysis

Functional requirements

- Gathering the data and preprocessed that data.

- Train highly accurate ML model with collected data.

- Giving the prediction according to the real time test data.

- Giving recommendations for the treatments.

Non-functional requirements

- Accuracy

- Availability

- Performance

- Speed

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References

[1] Gazi Mohammed Ifraz, "Comparative Analysis for Prediction of Kidney Disease Using Intelligent Machine Learning Methods,"National Library of Medicine, 2021.

[2] H. B. A. S. B. Abhijit V. Kshirsagar, "A Simple Algorithm to Predict Incident Kidney Disease," JAMA Network, 2008.

[3] A. Vijayalakshmi, "Survey on Diagnosis of Chronic Kidney Disease UsingMachine Learning Algorithms,"IEEE, 2020.

IT20154226 | M.M.K.L. Marasinghe

Specializing in Information Technology

Kidney Disease Diagnosis
using
Image Processing

Background

- Types of image modalities

- Importance of medical imaging when diagnosing CKD patients

- Advancement of medical imaging

Research Problem

- Complexity of medical terminology

- False positives and false negatives

- Different interpretations by different healthcare providers

- Inconsistency in reporting

Research Gap

- Developing a comprehensive, technology-driven approach to accurately diagnose kidney diseases using more advanced technologies.

Features	Research A [4]	Research B [5]	Research C [6]	KidniFy
Automatic abnormality detection of kidney using CNN	✗	✗	✗	✓
Multimodal Image Fusion to get more accurate predictions	✗	✗	✓	✓
Using standardization to keep track of the medical images uploaded by the user.	✓	✗	✗	✓

Objectives

Main Objective

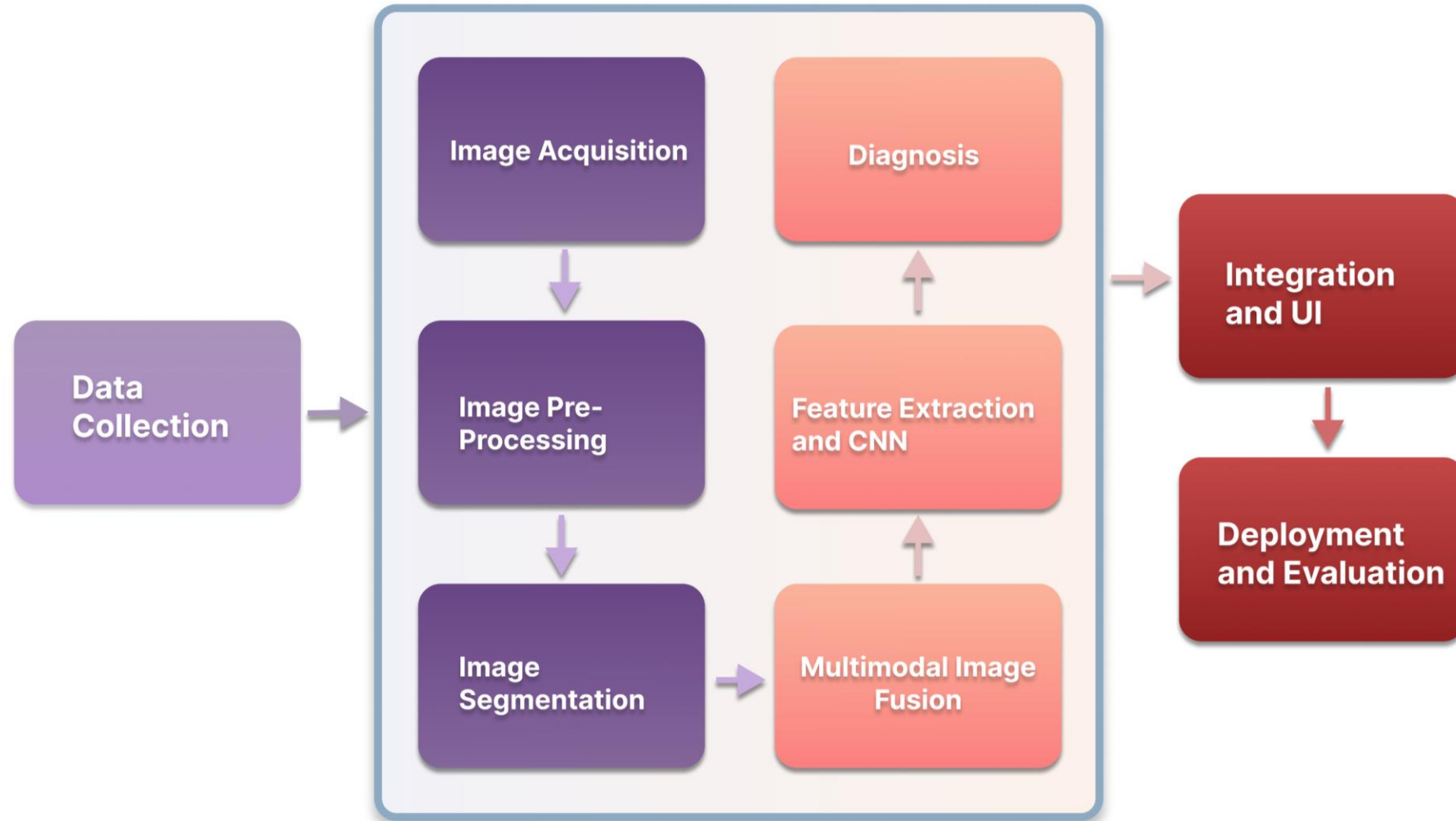- Analyse medical images to diagnose the patient more accurately using image processing.

Sub Objectives

- Using standardization, create a visual representation of the progression of the kidneys over time.

- Image Enhancement

Methodology

- Component overview
- Tools and Technologies
- Requirement Analysis

Component Overview

Requirement Analysis

Functional requirements

- Analyse medical images to diagnose the patient more accurately

- Create a visual representation of the progression of the kidneys over time.

Non-functional requirements

- Accuracy

- Availability

- Performance

- Speed

Tools and Technologies

- **Python**

- **TensorFlow**

- **AWS / Azure**

- **React Native**

- **MongoDB**

- **Node JS**

- **OpenCV**

References

[1] Siddharth Rajput, "Automated Kidney Stone Detection Using Image Processing Techniques,"

   IEEE, 2021 .

[2] Ahmed Soliman, "Kidney segmentation from CT images using a 3D NMF-guided active

    contour model, " IEEE, 2021 .

[3] D. P. K. K. M.P.N.M. Wickramasinghe, "Dietary prediction for patients with Chronic Kidney

   Disease (CKD) by considering blood potassium level using machine learning algorithms,"

   Research Gate, 2017.

IT20226596 | J.P.M.L. Perera

Specializing in Data Science

IoT & Machine Learning based Water quality Monitoring System for kidney patients

Background

- In Sri Lanka, prevalence of Kidney diseases (CKDu) have increased rapidly in recent decades.
- Most affected people are living in rural areas, and they have limited access to modern health care.
- Poor water quality has been identified as a possible contributor to kidney diseases.
- It is important to being aware of whether the daily used drinking water is harmful to kidneys or not.

Research Problem

- What are the constituents of pure drinking water and the levels as well as the ranges ?

- How to check the quality of drinking water ?

- How to know that the tested water sample is at a suitable level for the health of kidneys ?

Research Gap

Novelty

- Quality testing of drinking water based on the well-being of the kidneys.

- Showing the status of tested drinking water sample to reduce the harm caused by lack of awareness to the general public in Sri Lanka.

Features	Research A [7]	Research B [8]	Research C [9]	KidniFy
Drinking Water quality testing using IOT based on kidney health.	✗	✗	✗	✓
Analyze parameters on pre-tested water sample data using machine Learning.	✓	✓	✗	✓
Determining the effect on the kidneys is relation to the analysis	✗	✗	✗	✓
Displaying in detailed result that the tested water sample is suitable for drinking or not.	✓	✓	✗	✓

Objectives

Main Objective

- Test the quality of drinking water and identify any constituents that may be dangerous for condition of kidney.

Sub Objective

- Test the water quality using sensors and get the pH value, TDS value, dissolved oxygen value & Turbidity value in real-time.
- Train a highly accurate ML model with a collection of pre-tested water sample data.
- Analyze the effect of the tested water sample on kidney health and display the result in the dashboard.

Methodology

- Component overview
- Tools and Technologies
- Requirement Analysis

Component Overview
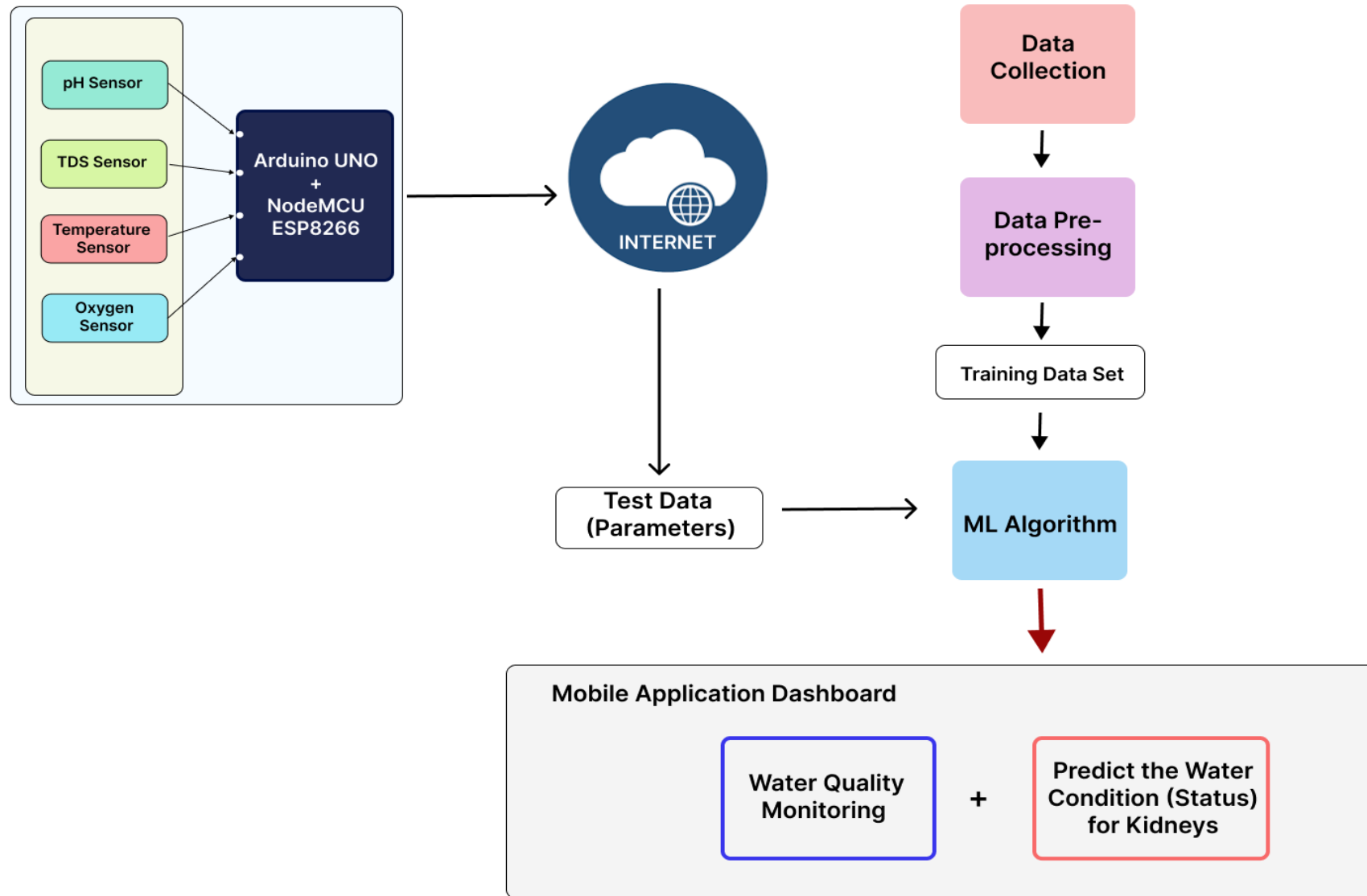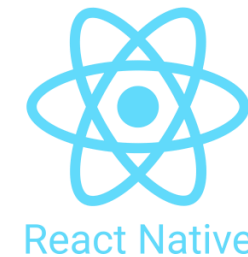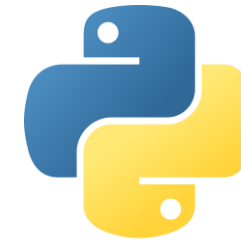
Tools and Technologies

Hardware tools

- Arduino UNO
- NodeMCU

- pH Sensor
- Turbidity Sensor
- TDS Sensor
- Oxygen Sensor
- Chlorine Sensor
- Temperature Sensor

Software technologies

- Python
- TensorFlow
- MQTT Broker
- AWS / Azure
- React Native
- MongoDB
- Node JS

Requirement Analysis

Functional requirements

- Test the quality of the water using IoT

- Analyze the effect of the tested water sample

- Display the effect on kidney health with parameters

Non-functional requirements

- Accuracy

- Availability

- Performance

- Speed

References

[1] D. P. K. K. M.P.N.M. Wickramasinghe, "Dietary prediction for patients with Chronic Kidney Disease (CKD) by considering blood potassium level using machine learning algorithms," Research Gate, 2017.

[2] N. K. K. S. Moldobaeva Munara, "Recommending IoT based Real-time Water Quality Monitoring System in Malaysia," IEEE, 2022.

[3] A. J. N. B. J. D. P. K. Shashika Lokuliyana, "A Survey: IoT Enable Framework for Water Quality Measurement and Distribution," IEEE, 2018.

IT20785192 | W.B.M.A. Isurika

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Personalized
Health Assessment and Management

Background

WHAT IS PROPER DIET MANAGMENT?

❑ Limit Sodium Intake   -   no more than 2-3 grams per day

❑ Control Protein Intake - limit their protein intake to 0.8 grams per kilogram of body weight per day

❑ Monitor Potassium Intake - too much potassium can be harmful to CKD patients. should avoid high potassium foods

Research Problem

❑ Not be aware of the importance of proper diet planning

❑ Lack of education from healthcare providers, limited access to dietitians

❑ Financial constraints – income is low

Research Gap

❑ Recent research has focused on Potassium level of blood to help manage the diet plans for CKD patients.

❑ Increase the accuracy of model and give proper diet plan

❑ Most studies have focused on short-term outcomes, such as changes in blood pressure or kidney function, rather than long-term outcomes such as financial side of patients.

Comparison

Features	Research A [10]	Research B [11]	Research C [12]	KidniFy
ZONE attribute helps in recommending diet	✓	✓	✓	✓
Consider any current diseases of the patient may have before making predictions to get high accuracy	✗	✗	✗	✓
Check the given food plan and if the patient chooses certain foods because he has allergies with those foods, recommend another food.	✗	✗	✗	✓

What is Zone Attribute ?

❑ Existing dietary managements needs will be determined based on the ZONE Attribute

   ✓ **Safe** - blood potassium level 3.5 - 5.0
   ✓ **Caution** - blood potassium level 5.1 - 6.0
   ✓ **Danger** - blood potassium level higher than 6.1
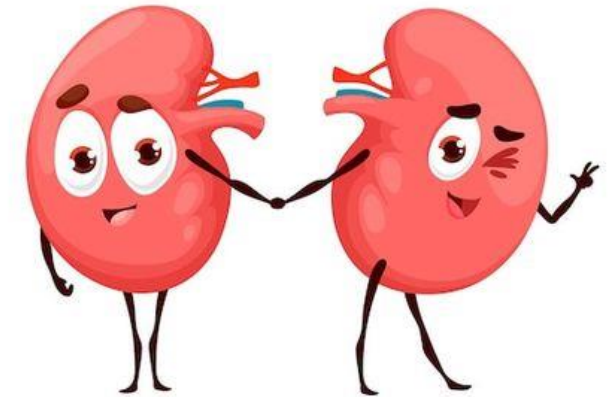
What tests they do ?

❑ "Serum Potassium Test" or "Potassium Blood Test"

Objectives

Main Objective : provide personalized recommendations to kidney patients regarding the most appropriate diet, exercise, and lifestyle changes based on their health condition.
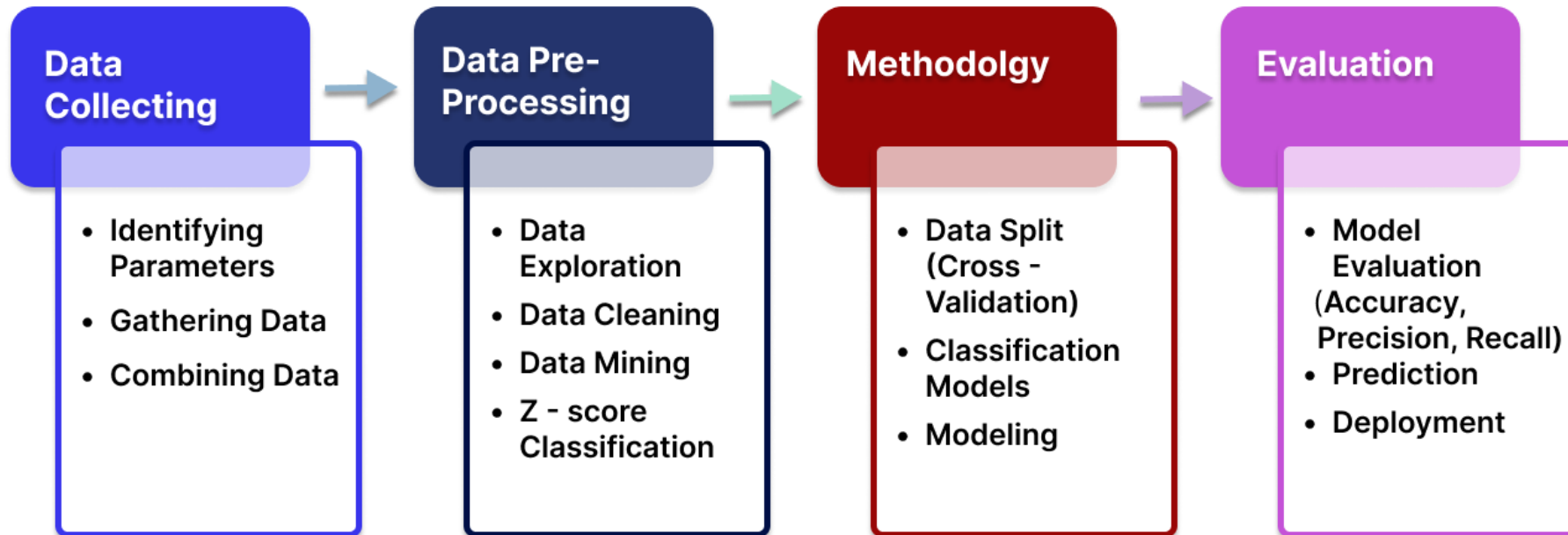
Sub Objectives :

- ❑ Based on the Potassium level of the blood, categorize the patient into three zones.
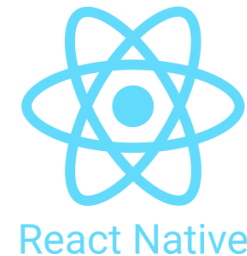- ❑ Categorize and prepare proper diet plan

Methodology

- Component overview
- Tools and Technologies
- Requirement Analysis

Component Overview

Data Collecting	Data Pre-Processing	Methodolgy	Evaluation
• Identifying Parameters • Gathering Data • Combining Data	• Data Exploration • Data Cleaning • Data Mining • Z - score Classification	• Data Split (Cross - Validation) • Classification Models • Modeling	• Model Evaluation (Accuracy, Precision, Recall) • Prediction • Deployment

Tools and Technologies

- Python
- Pandas , NumPy
- TensorFlow
- MongoDB
- AWS
- NodeJS
- React Native

Requirement Analysis

Functional

requirements

- ❑ Predict the proper

  diet plan using ML

- ❑ Remind patients to

  get their meal

  through

  notification.

Non-functional

requirements

- ❑ Accuracy

- ❑ Availability

- ❑ Performance

- ❑ Speed

References

[10] N. Y. N. ,. R. R. S. S. P. K. Annapoorna B. A, "Prediction of chronic kidney disease and diet recommendation," IJARIIT, 2021.

[11] D. P. K. M.P.N.M. Wickramasinghe, "Dietary prediction for patients with Chronic Kidney Disease (CKD) by considering blood potassium level using machine learning algorithms," Research Gate, 2017.

[12] National Kidney Foundation," [Online]. Available: https://www.kidney.org/kidneydisease/howkidneyswrk.

Q & A

Thank You!