5.0Research design and methodology*(Provide clear descriptions of software development model adopted, system design and modules and methodology)*

5.1 Objective 1: To develop a web-based application for the automatic download of Landsat 8/9, Sentinel-2A/2B, and Sentinel-1A/1B images of Mwea-west from their respective hubs/ portals

A web-based application employing an integration of user-friendly client GUI and server applications will be designed, developed and implemented. The general architecture will consist of three (3) main modules that work seamlessly to address near-real time functionalities: -

- **Frontend:** This will include the client user interface that will enable the end consumer(Farmer, technical, political, economic or any other interested parties) to input/query their service of choice via HTTPs get requests.This will run on the browser and naative Mobile application to enable users to intercat with the web app and or portal by cinsumonig functionalities like read and write as they wish. For example.
    - Which areas best support which crop type for maximum yield?
    - Which areas are currenlty covered by which crop (Classification logic)?
    - What is the general crop health at agiven phenological stage of growth?-Crop yield forecast.
    - How has environmental factors e.g rain been feeding the small scale crops in the recent past?
    - Which region(s) were highly affected by the previous crop pest and diseases(If any)-Crop health diagnosis
    - Which regions are nutritionally succeptilbe to poor yield?-Predictive insights.

- **Backend :** This is where the web services and APIs used by front-end architecture and mobile app resides. This will enable server-side web application logic to integrate with the client-side. This will be through, the maintenance of the crop mapping central database, making sure that it has high performance and agile responsiveness to requests from the client/user side. Most of the spatial backend logic will be handled by the Google Earth Engine Cloud platform especially now that it hosts a vast variety of spatial datasets in cloud repository that gets updated on a near daily basis.

Full-Time hosting services: This will make the applications and websites accessible to any user who has access to cloud resources like internet. Will constitute a network of connected virtual and physical cloud servers to host the application and website, ensuring greater flexibility and scalability specially to run the complex machine learning and IA enabled algorithms.

Key Functional features of the proposed hosting services:

- Web and Mobile Applications and solutions are deployed on a cloud network like Google Cloud Platform (GCPs) for easy sink with the GEE backend logic.
- Resources are scaled to user needs as indicated in the front-end logic.
- Querying support using SQL (including PostgreSQL) or NoSQL databases like spatial GeoJSONs.

Enables the Small-Scale Crop Mapping Solutions are to run autonomously and controlled using APIs, web portals, and the mobile apps.

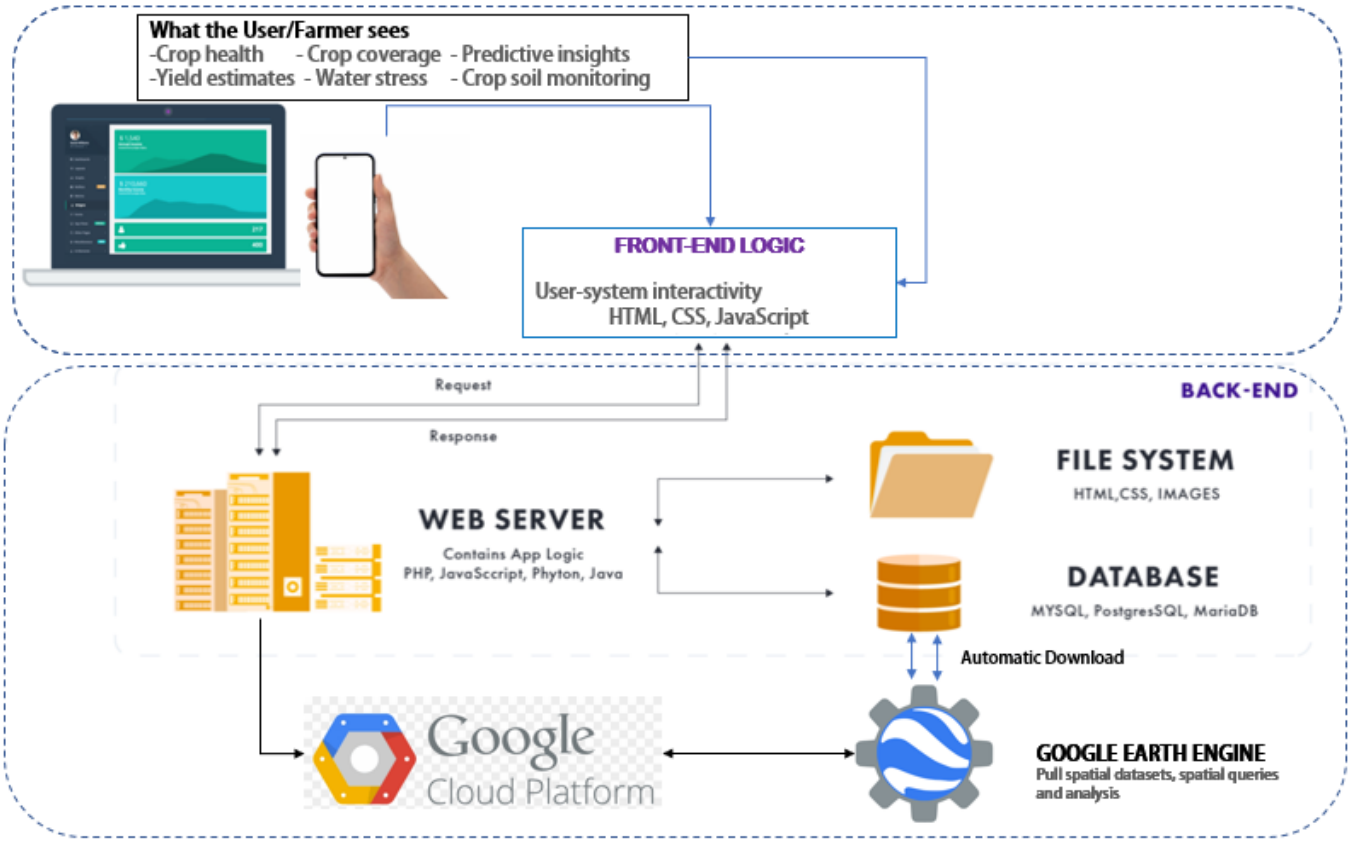

Fig: Web and Mobile based Client-server architecture, to automatically download from GEE query and display results