Design Doc Template

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# Introduction

## Summary

We are developing a product which can give a fair idea for a crop that when it should be irrigated , this information will be displayed on a website/mobile application so one can access this from anywhere in field.

## Background

Irrigating fields plays a vital role in crop yield. However, how much and when to irrigate is still moderated by the traditional knowledge for the farmers. Knowing how much water is actually required for a given crop for a particular soil type depends majorly on soil’s capacity to hold moisture. We developed an IOT based solution which can auto irrigate the fields for a given crop based on the soil moisture content

Currently many others also approached this problem but they only display the real time data and farmer have to analysis this data on his experience then have to decide that when the crop to be irrigated.

Whether we give a complete solution by giving a fair prediction about when the crop should be irrigated so no further calculations or analysis are required .

Irrigation pays a vital role in the crop yield as under irrigation leads to loss in yield whether over irrigation leads to wastage of water and sometimes it ruins the crops also. So a fair irrigation predictor will let the farmer to proper irrigate the crop and it will lead the higher gain in yield of crop. More yield leads to more profit by using limited source for farmer and it will also make irrigation management easier because it gives a fair prediction about how much and when the irrigation is required.

Definition of terms that will help readers understand the documents, or acronyms common in your project area

DEFINATIONS

**Field Capacity-**

It is the amount of soil moisture or water content held in the soil after excess water has drained away and the rate of downward movement has decreased. This usually takes place 2–3 days after rain or irrigation in pervious soils of uniform structure and texture.

**OPTIMUM MOISTURE CONTENT**

It is the moisture content should be maintained in the soil for optimum growth and development of plants

**DEPTH OF ROOT ZONE**

**Root zone depth** is the **depth** within the soil profile that commodity crop (cc) **roots**can effectively extract water and nutrients for growth. **Root zone depth** influences soil productivity significantly.

# Design Overview

## Requirements

For proper commencement of this system/device we need a good internet connection at the field and topographical data of the field and user have to sign up and login to a webpage portal giving the knowledge about type of crop and type of soil.

### Documentation

We will need a webpage and webhosting.

## Minimum Viable Product

The irrigation predictor will predict that how many days are left for next irrigation for a particular type of soil and crop on webpage. The prediction will be done on the basis of real time value collected by sensors at the field. The sensors will be placed so that they will give desired values; for this purpose the location are marked at field where sensors to be placed.

## Stretch goals

We will focus on making whole irrigation system automate by commanding the motor pump to on/off base on the analysis done by webpage i.e. the irrigation should start automatically when needed and should stop when the irrigation is completed.

## Future work

Notifications through sms/alert call will be delivered to farmer when less days are left, it will easier to use for farmer than. We will also collect all the data that of field wise requirement of irrigation for different fields so it will assist the irrigation management for water supply schedule and quantity of water required for irrigation.

# Architectural Diagrams

# 

# System Diagrams

This section, sometimes referred to as a ‘System Context Diagram’, would typically consist of a UML diagram which illustrates the boundary and interaction with external systems. For a this may show which backend systems provide the data, for services it may indicate dependencies such as databases, Kafka, or downstream services.

# Application Programming Interface CLI

For services, libraries, and command line interfaces that present an interface which can be wrapped

## Recommendations

Using a versioned endpoint simplifies the process of making future backwards incompatible API changes;

/api/v0

# User Interface

Firstly the device will be installed successfully, then the user can fetch desired prediction through website. The link of website is given below.

<https://iotsmpandey.000webhostapp.com/irrigation/indexi.php>

# Data Models and Storage

For projects requiring messages queue such as Arduino, MySQL, etc.

Arduino

* ESP8266 board is used for data collection and sending it to web server
* Arduino IDE is used to program this board
* It will send data to webserver after a certain time. In the prototype we are sending data after 5 minutes

MySQL

* There are 3 tables in MySQL database
* 1. Weather – in this table Data received from field is stored in terms of moisture, temperature, humidity and rain.
* 2. Crop- in this table predefined data for crop and soil type is stored. In terms of optimum moisture content, depth of root zone, per day evaporation, crop factor etc.
* 3. User- this table have login details of the user
* All this data is fetched in formulas to calculate the irrigation frequency.

# Service Operability

## Key Performance Indicators

As we mentioned earlier we will predict the irrigation time on webpage and the performance of this device depends on how accurate the moisture content measured. We can check the performance of the device by comparing growth of the crop irrigated based on device prediction with respect to the crop irrigated according to traditional method under same conditions.

## Service Level Objectives

We will compare the growth of crop with respect to traditionally irrigated crop under same conditions. We will compare the yield of crop and will analysis the effect of irrigation on it seasonally. The yield of crop should be increased under the ideal condition and resources, and also we will compare the yield with water used for irrigation. We may use graphs and data interpolation for this purpose.

# Project Overview

## Communication and Tracking

This product is very much applicable in big farms mainly governed by GOVERNMENT authorities as one have to do some pre installation surveys; these surveys are complicated procedure.

## Risks

Here are the list of risks-

1. Variance of moisture content in a field due topography under same condition.
2. Wired connections
3. Internet dependency
4. Sensor may be defected

## Milestones

We will conduct all the field surveys and demo within one week and try to make a deliverable product within 4 weeks and then will check its performance in field.

## Project Phases

We categorized whole process in under mentioned steps-

1. Field work and achieving efficiency at field to collect data
2. Data interpolation
3. Prediction of irrigation
4. Making user interface and user experience better
5. Cost efficient

## Cost

Cost is unpredictable at current phase because we may have to change the sensors and many other used accessories on the basis of their performance efficiency in field. We will try to achieve greater efficiency in minimum cost by trying different combinations.

# Frequently Asked Question

# References

1. Google
2. Google scholar
3. A text book by K.R. ARORA

PRINCIPLE OF IRRIGATION-

Roots of plants absorb water from the soil. Main source of water for plants is moisture content store in pores of soil known as capillary water in soil. If the depth of the root of plant is D then the pattern for the water Yield of crops depend on water available for root plants in soil through the growth of crop plant. For maximum yield the moisture content in soil should not be less than a threshold value of moisture content known as OMC (optimum moisture content). Soil can hold a maximum value of moisture content; this maximum value is known as FC (field capacity).

Purpose of the irrigation should be keeping moisture content more than OMC and moisture content should not exceed FC for prevention of wastage of water during irrigation for maximum yield of crop.

Values of FC for different type of soil is as given below-PWP (permanent wilting point) is the minimum moisture content required to at least survival of the crop plant. If the moisture of soil falls down then PWP the crop will ruined permanently.