IoT based Hydroponic System

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Introduction

- Hydroponics is a technique of growing plants without soil and without the limitations of space and climate.

- In the traditional farming system, plants depend on soil to obtain all nutrients needed for their growth.

- In contrast, a hydroponic garden provides all of these nutrients without involving sunlight, soil, extra labour, allowing farmers to benefit from efficiencies and to reap large produce yields.

- Photosynthesis process :

    Carbon Dioxide + Water -> Glucose + Oxygen

    $6CO_2 + 6H_2O$ -> $C_6H_{12}O_6 + 6O_2$

    There is no mention of "soil" anywhere in there and that's all the proof you need that plants can grow without it.

- Plants require 17 essential elements to grow and reproduce
- The first three are Hydrogen, oxygen and carbon
- Other 14 are:

    Macro-Elements: Nitrogen, Phosphorous, Potassium, Calcium, Magnesium, Sulphur

    Microelements: Iron, Manganese, Copper, Zinc, Boron , Chlorine, Molybdenum, Nickel

Nutrient Solutions

▶ In Hydroponics, Nutrient control is easy

▶ It consists of a nitrogen rich grow formula

▶ A phosphorous and potassium rich bloom formula

And the results ?

Bumper crops of delicious fruits and vegetables every time.

Motivation

▶ Have a Mobile & Dynamic setup

▶ To design efficient systems in terms of water usage, and a higher crop yield.

▶ Reduce inefficient and Destructive farming

▶ To increase awareness relating to the benefits of Hydroponics.

Problem Definition

▶ **Every plant grown using open agriculture farming, ties up a certain amount of land for a long duration (usually through the growing season).**

▶ **Agriculture uses lots of water.**

▶ **Agriculture farming takes lot of time to produce outputs.**

Literature Survey

Sr. No	Topic	Author	Year	Major Findings
1	iPONICS: IoT Monitoring and Control for Hydroponics IEEE Conference	K. Tatas, A. Al-Zoubi Antoniou D. Zolotareva	2021	The system is composed of a specialized Wireless Sensor Network for monitoring the essential parameters for Hydroponics and control for the pump. It provides the user with a user friendly web-based tool to monitor his crops as well as being appraised by appropriate alarms and warnings. This greatly facilitates the observation of multiple hydroponics greenhouses with minimal effort and need for intervention.

Literature Survey

Sr. No	Topic	Author	Year	Major Findings
2	Hydroponics System for Soilless Farming Integrated with Android Application by Internet of Things and MQTT Broker – IEEE Conference	Navneet K. Bharti Mohit D. Dongargaonkar Isha B. Kudkar Siuli Das Malay Kenia	2019	In this work monitoring several parameters is involved, which is achieved with basic sensors and one single micro-controller. Monitoring these parameters not only helps to keep a watch on the system but also data is used for further evaluation of the quality of the harvest for future scientific data analysis. Internet of Things is used to accumulate the data and store it on servers. An Android application can fetch this data, creating a more personalized setup and data. Many people are not aware of this kind of farming; Android application is a better platform to spread the knowledge than any other media

Literature Survey

Sr. No	Topic	Author	Year	Major Findings
3	Automated Irrigation System Using a Wireless Sensor Network and GPRS Module - IEEE Transaction	Joaquín Gutiérrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel Ángel Porta-Gándara	2014	The automated irrigation system hereby reported, consisted of two components wireless sensor units (WSUs) and a wireless information unit (WIU), linked by radio transceivers that allowed the transfer of soil moisture and temperature data, implementing a WSN that uses ZigBee technology. The WIU has also a GPRS module to transmit the data to a web Configuration of the automated irrigation system. WSUs and a WIU, based on microcontroller, ZigBee, and GPRS technologies.. The information can be remotely monitored online through a graphical application through Internet access devices

Literature Survey

Sr. No	Topic	Author	Year	Major Findings
4	IoT Based Automated Hydroponic Cultivation System – IJAER Journal	Dr. Ponmurugan Sudharsan, Vargunan, Vignesh Raj , Selvanayagan	2019	In this study, the crops are grown without the use of soil, instead the nutrients from the soil are directly given to the crops by water reservoir. The adequate nutrients that are required by the plants are measured and added to the water reservoir so that the crops get enough nutrients from the water as equal as from the soil. By the intervention of IoT this whole hydroponic system can be automated. All the data from the hydroponic system are sent to the cloud data for the automation purpose. The health condition of the crops is continuously monitored with the help of data that are collected by the sensors and actuators.

Software Requirements Specification

- Open Source Languages & Libraries
- Arduino
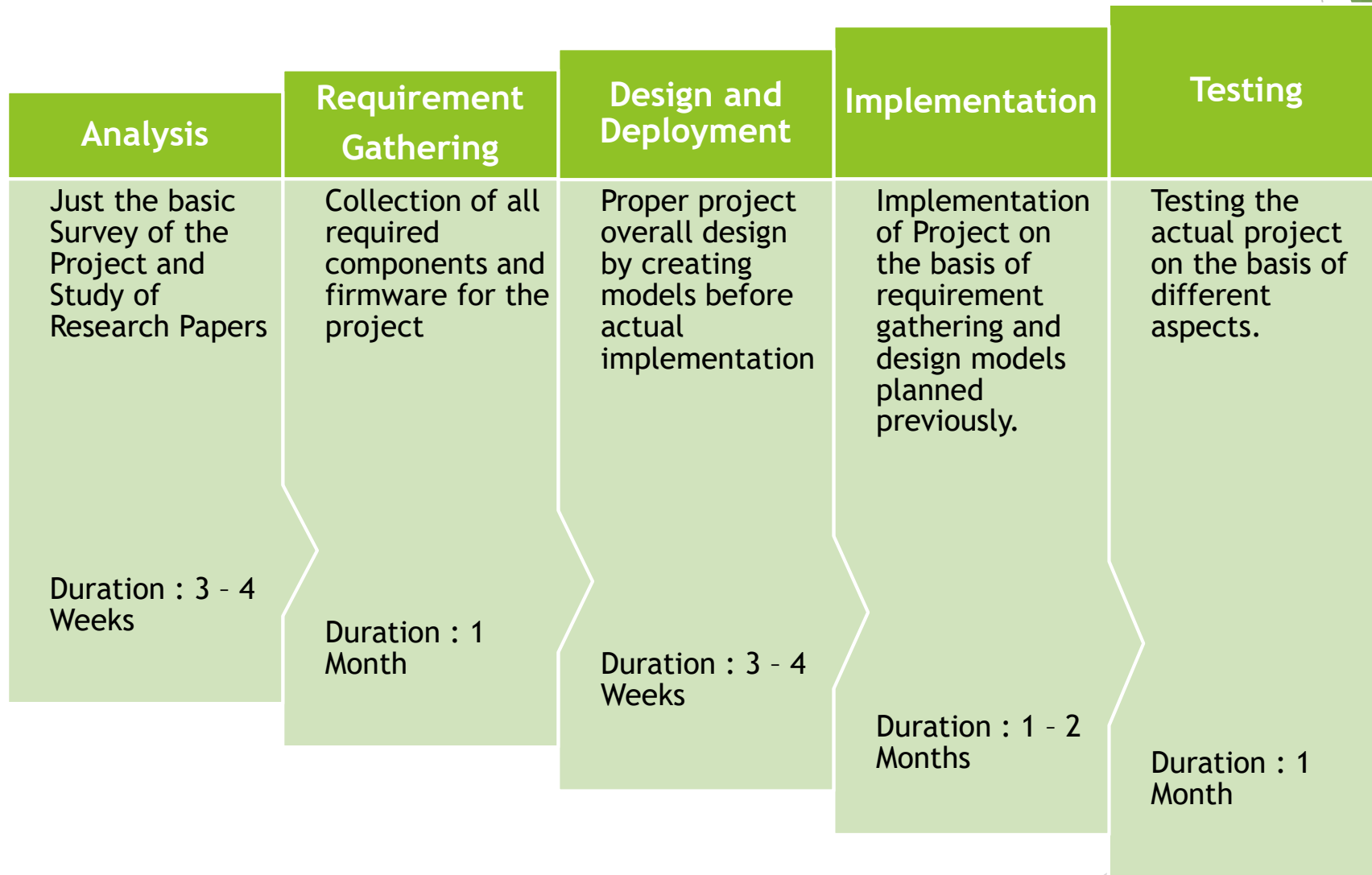- AutoDesk for Creating model

Hardware Requirements Specification

- pH Control
- Horticulture Lighting(Grow Lights)
- Pipes to transfer fluids
- A Controller to control the System (Arduino)

Project Scope

- 100% Automation

- PCB design and layout with sensor interfacing

- Web integration

- Mobile application design

Besides project scope, there are intangible skills we look to gain as well.

Project Timeline Chart

Analysis	Requirement Gathering	Design and Deployment	Implementation	Testing
Just the basic Survey of the Project and Study of Research Papers	Collection of all required components and firmware for the project	Proper project overall design by creating models before actual implementation	Implementation of Project on the basis of requirement gathering and design models planned previously.	Testing the actual project on the basis of different aspects.
Duration : 3 – 4 Weeks	Duration : 1 Month	Duration : 3 – 4 Weeks	Duration : 1 – 2 Months	Duration : 1 Month

Assumptions and Dependencies

- You'll have access to all the resources you need to complete the project, both human and material.

- Project team members will have the resources they need to complete their individual tasks on time, from specialized equipment and software down to electricity during working hours.

- Personnel costs will not change during the project cycle.

- Other material and resource costs will remain consistent throughout the project.

- The overall cost of day-to-day operations will not increase.

- All equipment will be in working condition through the project cycle.

- Most important Dependency is the location where the system is built. It should be spacious enough.

Conclusion

- Hydroponics is the effective technology for the places of the world having scarcity of infertile and arable land for cultivation of crops. Fresh products can also be harvested through hydroponics throughout the year as it is not like traditional cultivation practices.

- Additionally technologies like Machine Learning, Artificial Intelligence, Deep Learning, etc. can help to boost this sector and help deploy it for millennials. As observed, we can conclude that using such technologies can help us increase crop yield over 70% and reduce the cost significantly 'over-time' as well.

Thank you !