Final Year Project Proposal

Project Title	Intelligent IoT Based Hydro-Aeroponics based Agriculture System		
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Course	B Tech	Year of Study	IV
Start Date	Jan 2018	Completion Date	May 2018
Guide Name:	Dr. S Suresh		

Aim and Objectives:

Agriculture has a major impact on economy of the country. Lot of Research been carried out in automating the irrigation system by employing wireless sensor and mobile computing. Also research been done in applying machine learning in agricultural system too. Recently Machine to machine (M2M) communication is an emerging technological framework where devices can communicate with each other and send data to the M2M central server or cloud through M2M area networks and core networks. So accordingly an IoT based Automated irrigation system been developed where sensor data pertaining to soil moisture captured and K-NN Supervised machine learning algorithm developed for analyzing the sensor data for prediction towards irrigating the soil with water

Now currently agricultural innovation is more towards hydroponics and aeroponics which allow plants to grow anywhere as hanging or so without the need of soil. That means plants are given enough nutrients to grow taking into account environmental factors into consideration without the need of soil. The challenge in such a system is that there is need for manual monitoring of plants for spraying the appropriate nutrients to grow effectively.

So now with the upcoming of IoT technologies where M2M communication possible, we here propose to develop an Intelligent IoT based Hydro-Aeroponics based agricultural system which allows the environmental data to be captured and intelligently spray the appropriate nutrients for plant growth. These would be developed as prototype with intelligence.

Summary of Previous Work/Research in Area:

In many of the research reported pertaining to Aeroponics and Hydroponics, time clocks to put the nutrient solution on the plant roots. Most of the plants grown using Hydroponic or Aeroponics are done in Malaysian Climate which are different from different seasonal changes we have in India for different places. Plants grown using Aeroponics and hydroponics are:- 1) Lettuce 2) Tomatoes 3) Radishes 4) Celery 5) Cucumbers 6) watermelon 7) grapes**.** Goa is the first place in India to have hydroponics farm. Ajay Naik is a software Engineer who started the automated hydroponics in India.

No research reported pertaining to applying intelligence in IoT towards automating the aero-hydroponics based agricultural system for spraying the appropriate nutrients based on environmental conditions and so forth.

Methodology:

Phase 1

1. Identify aeroponics and hydroponic friendly plants and specifically study their required nutrients.

2. Procure specific nutrients required by the hydroponic system. Identify suitable supervised learning algorithm for the data set available.

3. IoT based Prototype system development for Aero-hydroponics based Agriculture involving appropriate sensors, Microcontroller and Processor board for analysis

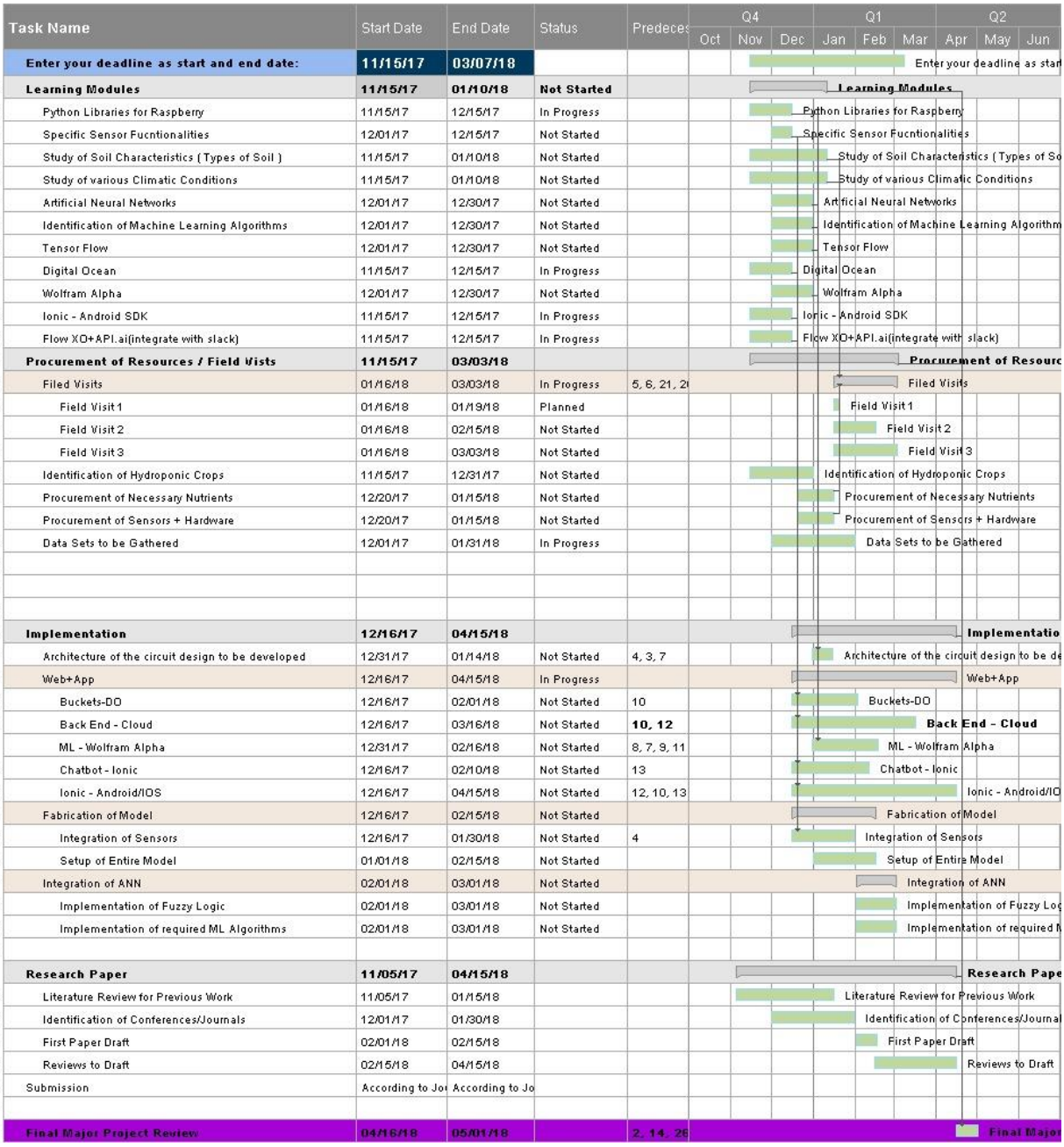
4. Procure the data sets for a particular type of plant and accordingly apply the appropriate machine learning algorithm in training the data set towards prediction for regulate the nutrients and oxygen required by the plant based on Ph, Temperature, lighting, humidity and so automatically without the need of human.

5. Cloud server on Digital Ocean for enabling the users to access the system from any part of the world.

6. Development of a user friendly mobile application across android and iOS with an added functionality of a chatbot which can send out timely notifications and can be a mediator between the system and the user.

7. Integrate the entire system with all the modules to develop a smart solution of aeroponics and hydroponic systems for harsh climatic conditions.

Timing Plan:



	Task Name	Start Date	End Date	Status	Predeces
1	**Enter your deadline as start and end date:**	**11/15/17**	**03/07/18**		
2	**Learning Modules**	**11/15/17**	**01/10/18**	**Not Started**	
3	Python Libraries for Raspberry	11/15/17	12/15/17	In Progress	
4	Specific Sensor Fucntionalities	12/01/17	12/15/17	Not Started	
5	Study of Soil Characteristics (Types of Soil)	11/15/17	01/10/18	Not Started	
6	Study of various Climatic Conditions	11/15/17	01/10/18	Not Started	
7	Artificial Neural Networks	12/01/17	12/30/17	Not Started	
8	Identification of Machine Learning Algorithms	12/01/17	12/30/17	Not Started	
9	Tensor Flow	12/01/17	12/30/17	Not Started	
10	Digital Ocean	11/15/17	12/15/17	In Progress	
11	Wolfram Alpha	12/01/17	12/30/17	Not Started	
12	Ionic - Android SDK	11/15/17	12/15/17	In Progress	
13	Flow XO+API.ai(integrate with slack)	11/15/17	12/15/17	In Progress	
14	**Procurement of Resources / Field Vists**	**11/15/17**	**03/03/18**		
15	Filed Visits	01/16/18	03/03/18	In Progress	5, 6, 21, 2
16	Field Visit 1	01/16/18	01/19/18	Planned	
17	Field Visit 2	01/16/18	02/15/18	Not Started	
18	Field Visit 3	01/16/18	03/03/18	Not Started	
19	Identification of Hydroponic Crops	11/15/17	12/31/17	Not Started	
20	Procurement of Necessary Nutrients	12/20/17	01/15/18	Not Started	
21	Procurement of Sensors + Hardware	12/20/17	01/15/18	Not Started	
22	Data Sets to be Gathered	12/01/17	01/31/18	In Progress	
23					
24					
25					
26	**Implementation**	**12/16/17**	**04/15/18**		
27	Architecture of the circuit design to be developed	12/31/17	01/14/18	Not Started	4, 3, 7
28	Web+App	12/16/17	04/15/18	In Progress	
29	Buckets-DO	12/16/17	02/01/18	Not Started	10
30	Back End - Cloud	12/16/17	03/16/18	Not Started	**10, 12**
31	ML - Wolfram Alpha	12/31/17	02/16/18	Not Started	8, 7, 9, 11
32	Chatbot - Ionic	12/16/17	02/10/18	Not Started	13
33	Ionic - Android/IOS	12/16/17	04/15/18	Not Started	12, 10, 13
34	Fabrication of Model	12/16/17	02/15/18	Not Started	
35	Integration of Sensors	12/16/17	01/30/18	Not Started	4
36	Setup of Entire Model	01/01/18	02/15/18	Not Started	
37	Integration of ANN	02/01/18	03/01/18	Not Started	
38	Implementation of Fuzzy Logic	02/01/18	03/01/18	Not Started	
39	Implementation of required ML Algorithms	02/01/18	03/01/18	Not Started	
40					
41	**Research Paper**	**11/05/17**	**04/15/18**		
42	Literature Review for Previous Work	11/05/17	01/15/18		
43	Identification of Conferences/Journals	12/01/17	01/30/18		
44	First Paper Draft	02/01/18	02/15/18		
45	Reviews to Draft	02/15/18	04/15/18		
46	Submission	According to Jo	According to Jo		
47					
48	**Final Major Project Review**	**04/16/18**	**05/01/18**		**2, 14, 2**

Resources needed (Software/Hardware)

Hardware:
Raspberry Pi 3
Arduino Mega
Humidity Sensor
DHT 11 Temperature Sensor
PH Sensor
Light Intensity Sensor
Relay Modules
PVC Pipes
Jumper wires
External Batteries
Holding Pots for Plants
Necessary Nutrients

Software:
Blynk
Python 3.6
Raspbian Jessie
Arduino IDE
Digital ocean
Github
Trello
Wolfram Alpha
Ionic Framework
Php
HTML 5.0
CSS3
JavaScript

Illustrate the connection between theory and practice:

The system here would result in development of an intelligent and smart aero-hydroponics based automated agricultural system. In terms of theory, courses learnt pertaining to IoT, Mobile application, Networking, Machine Learning are been applied to practise in developing the IoT system where IoT and Networking concept included in developing prototype. Machine learning intelligence applied in analysing the data towards automating it. Also Cloud computing and mobile application learnt applied in developing cloud and mobile app for our project.

Project Highlights:

1) IoT based Automated Aero-hydroponics agricultural system been developed with machine learning intelligence
2) Machine learning for analysing the data captured for predicting the needed nutrients and oxygen for plant growth spraying it accordingly
3) Timely notification to user's mobile about the status of plant.
4) We are making a system through which a plant can grow in harsh areas like desert where growing of plant is really difficult.
5) This technology can be used to grow crops in Smart Cities.
6) The key feature is that changing seasons, changing climate or the area of growing will not affect the growth of plant

Contributions:

Major contribution would be development of an IoT based automated aero-hydroponics based agricultural system where machine learning intelligence deployed for predicting the needed nutrients and oxygen for plants based on environmental conditions like PH, Humidity, Lighting, and Temperature. The prediction would result in sending feedback to plant through the IoT system in spraying the appropriate nutrients. The complete prototype system is automated with cloud and mobile application support for sending notification to user too.

Real life Need:

Aeroponics and Hydroponics is an exploding industry that has yet to reach its full potential. The use of hydroponics broadens the ability to garden in small spaces where adequate land is scarce and in arid or barren conditions not conducive to propagation. With the increase in the population leading scarcity for land resources, hydroponics is an excellent solution for cultivation of crops. Smart Cities can exploit the potential of hydroponics and automating the system would further help in reducing human efforts.

Abstract (Maximum 350 Words)

Hydroponic systems have been utilized as one of the standard methods for plant biology research and are also used in commercial production for several crops, including lettuce and tomato. Within the plant research community, numerous hydroponic systems have been designed to study plant responses to biotic and abiotic stresses. We present a solution for intelligent hydroponic system that can be easily implemented in laboratories, households, etc.
In hydroponic gardening systems, plants are placed in a growing medium and nutrients are provided directly to the roots.
So we here would be developing an IoT based system using Machine Learning for the Aero-hydroponic agricultural system focusing more on harsh climatic conditions. The system would be trained to identify the crops and regulate the nutrients for its cultivation. The user would be

Reference (Minimum 6)

[1] J. Pitakphongmetha, N. Boonnam, S. Wongkoon, T. Horanont, D. Somkiadcharoen, and J. Prapakornpilai, "Internet of things for planting in smart farm hydroponics style," *20th Int. Comput. Sci. Eng. Conf. Smart Ubiquitos Comput. Knowledge, ICSEC 2016*, 2017.

[2] P. P. Ray, "Internet of things for smart agriculture: Technologies, practices and future direction," *J. Ambient Intell. Smart Environ.*, vol. 9, no. 4, pp. 395–420, 2017.

[3] N. Suma, S. R. Samson, S. Saranya, G. Shanmugapriya, and R. Subhashri, "IOT Based Smart Agriculture Monitoring System," *Int. J. Recent Innov. Trends Comput. Commun.*, vol. 2, no. February, pp. 177–181, 2017.

[4] Ms.S.Charumathi, Ms.R.M.Kaviya, and Ms.J.Kumariyarasi, "Optimization and Control of Hydroponics Agriculture Using IoT," *Int. J. Adv. Sci. Eng. Res.*, vol. 2, no. April, pp. 28–34, 2017.

[5] N. K. Goyal, "Hydrobase : An IoT Gardening Application," 2016.

[6] M. F. Saaid, A. Sanuddin, M. Ali, and M. S. A. I. M. Yassin, "Automated pH controller system for hydroponic cultivation," *ISCAIE 2015 - 2015 IEEE Symp. Comput. Appl. Ind. Electron.*, pp. 186–190, 2015.

[7] T. H. Wu, C. H. Chang, Y. W. Lin, L. Da Van, and Y. B. Lin, "Intelligent Plant Care Hydroponic Box Using IoTtalk," *Proc. - 2016 IEEE Int. Conf. Internet Things; IEEE Green Comput. Commun. IEEE Cyber, Phys. Soc. Comput. IEEE Smart Data, iThings-GreenCom-CPSCom-Smart Data 2016*, pp. 398–401, 2017.

Student Signature **Guide Signature with date**