CS-308-2016 Final Report

Smart Irrigation (SIRI)

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1. Introduction

Our project is Smart Irrigation (Siri for short). In India, water scarcity is widespread. Being a country which relies heavily on agriculture, water consumption is an essential problem. There are several existing devices which give a message to out mobile or some other device to water the plants. However, one still has to manually water the plants. We want to tackle two problems. The first one is to detect when plants need water. The other is to actually water the plants.Since our product base is the farmers of India we would like to make thex` cost as small as possible

2. Problem Statement

For the first problem we have figured out that we are going to consider three major factors that are useful for deciding a model. They are temperature, soil moisture and water level already in the trough. The problem statement is given the above conditions for a plant we need to decide if the plant can thrive in those conditions. If yes we avoid sending the water. If the plant cannot survive then we need to send in water to plants. Thus we will allow water only when necessary to optimize on water supply

3. Requirements

3.1 Functional Requirements

Water Level sensor :

Needs to be suspended in water. There is a cork at the bottom which floats in water and sits down in the absence of it. It gives different set of values on the Analog pins which differ for both cases.

Plant Moisture sensor :

This has two components one component is suspended in soil and the other end of it is connectedd to an LM293 which inturn is connected to TIVA. This gives different values based on moisture level in soil based on the conductivity.

Wireless booster kit:

Wireless booster kit goes on TIVA. This should be connected to a wifi router(AP mode Infrastructure mode doesn't work). This will then send the data on port 80

Temperature sensor - In built on TIVA needs ADC conversion.

3.2 Non-Functional Requirements

1. Water Level sensor - < 1200 is low ,1300 is high

2. Plant Moisture sensor - < 3200 low moisture, > 4000 high moisture

3. Wireless booster kit – Needs AP mode

4 Temperature sensor – Works as far as TIVA works

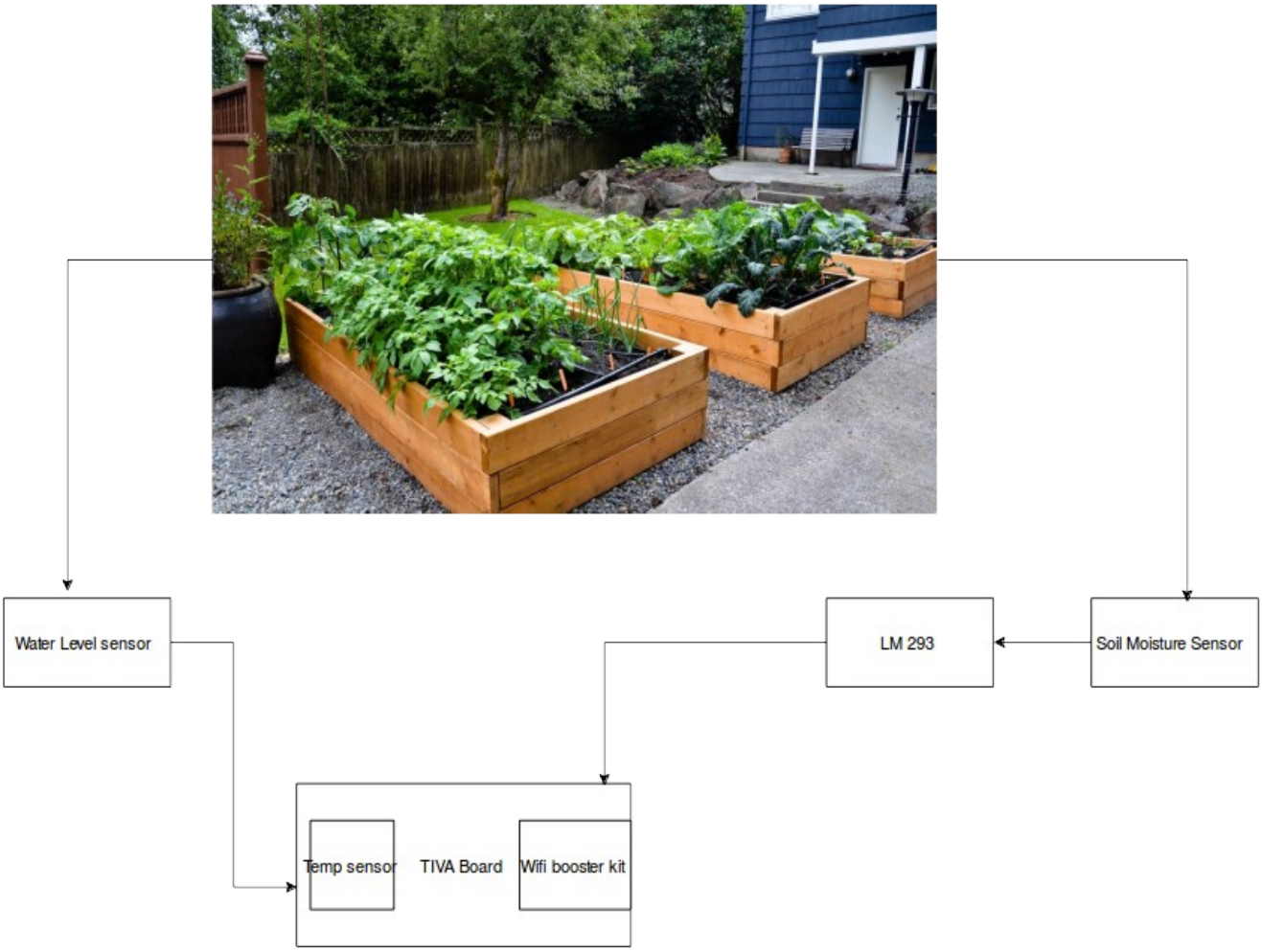
3.3 Harwdare Requirements

1. Water Level sensor (Which tells if the trough is filled or not)
2. Plant moisture sensor + LM293
3. TIVA Microcontroller
4. Wireless booster kit
5. Water pots to test

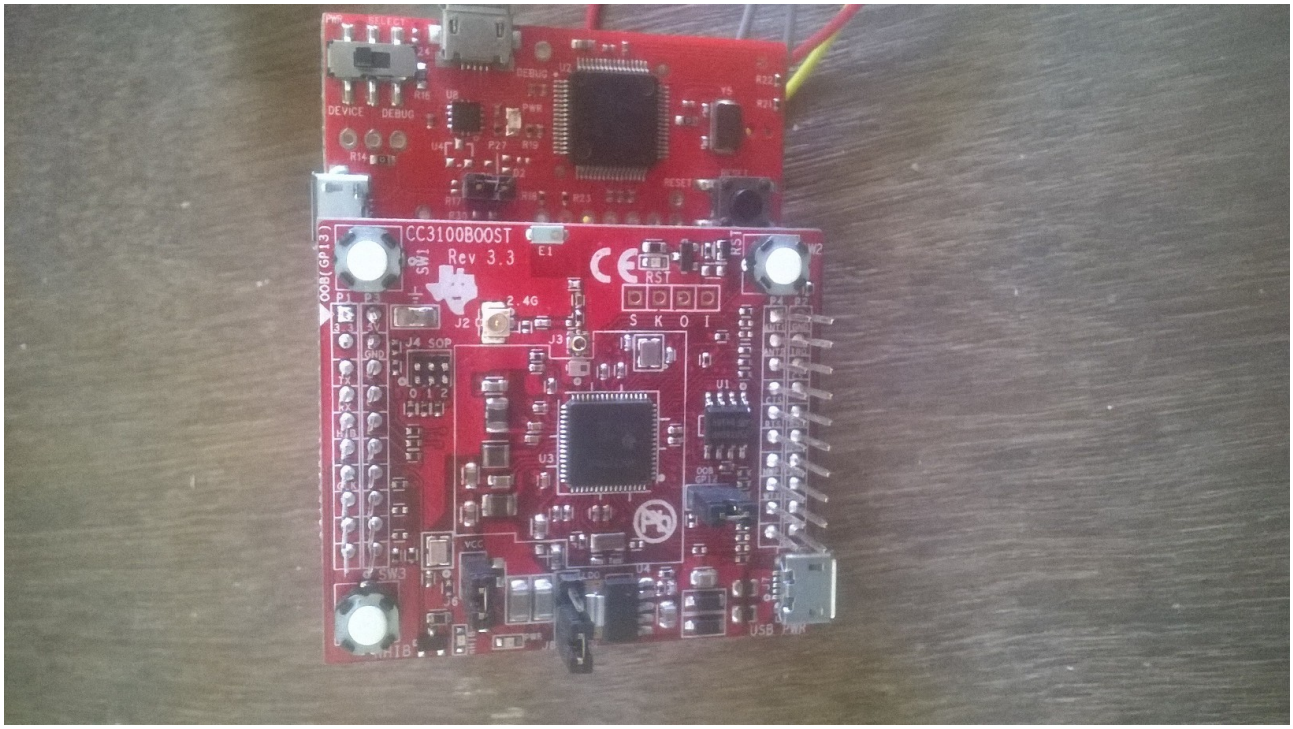
3.4 Software Requirements

1. Energia: Basic IDE for configuring TIVA
2. Browser: To see the log files and server/client action
3. Bash: For updating the log from server

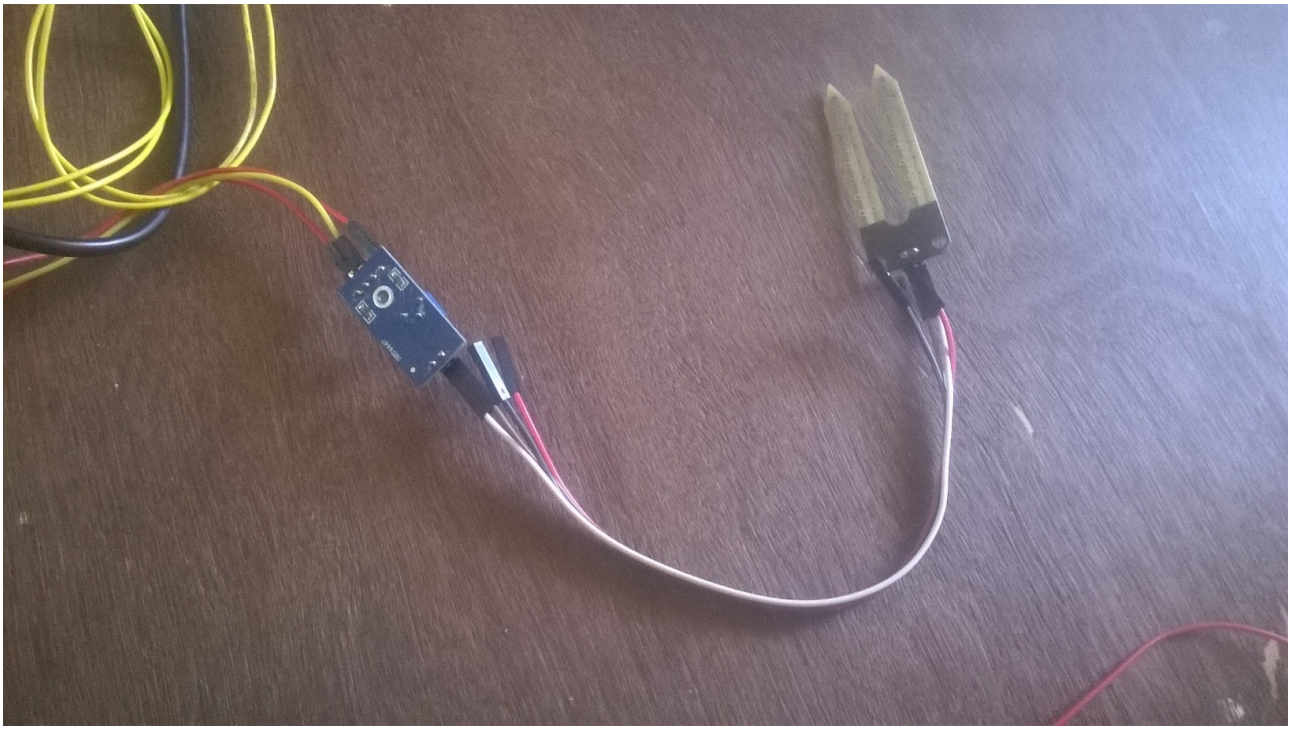
4. System Design


Water Level sensor
LM 293
Soil Moisture Sensor
Temp sensor
TIVA Board
Wifi booster kit

1. Water Level Sensor



2. Wifi booster pack



3. Water moisture sensor

5. Working of the System and Test results

Firstly we have collected data of abou 45 points of data for various alues of sensor data using visual inspection. Now we trained this data to frm wo clusters one which requires water and one which doesn't. Whenever we get a new point we check if it requires water or not using a neares neighbour algorithm using votes from 9 nearest neighbours. We also maintain a log or prediction which can be useful for data for further analysis.internationals. We give a green led output if we need not send water in. We send a red led if we need water.

For water level sensor the threshold for sending water is - 1200

We tested by varying temperature,moisture level and water level and used the train data to test using 9- Nearest Neighbour algorithm. We had the booster module soo we had to carefullly check for the unused pins to make sure we got correct results. Each sensor was individually tested in extreme conditions like fully moist soil and dry soil etc.

6. Discussion of System

a) What all components of your project worked as per plan?
Soil Moisture sensor and temperature sensors worked as per planned. Water level sensor didnot work because of the specifics of the trough which we planned to implement the device on. Wifi Module initially was difficult to configure hence we switched to booster module but it only works for wifi in AP mode.

b) What we added more than discussed in SRS?
Breadboard and a resisitor for some sensors.

c) Changes made in plan from SRS:
Initially our water level sensor used to give a range of values for water level hence we thought of using a regression model for predicting water level. But the sensor is inaccurate at low distances hence we had to switch to another sensor which only tells if water level is full or not. This led to change in machine learning model from regression to cluster prediction. We changed the wireless module as it was very difficult to configure and it was expensive which defeated the aim we started with (i.e to reduce the cost).

7. Future Work

Currently the device is configurable for a small area (1 or 2 plants). To make it extend to large farms we propose a mechanism to feed the TIVA board all the data through wireless modules from many different parts of the farm and then using a queue make decision accordingly to each of the area. Also one can work with weather prediction data as well to optimize in rainy conditions. In case of network problems we would like to store the values of log in buffer for reliability.

8. Conclusions

We have succesfully made a crude model which predicts water consumption. Also we have learned how we can apply machine learning models, collecting data etc using practical equipment. We have seen different sensor work using simple electric currents and some physical stress..

9. References

1. Energia
http://energia.nu/

2. Wifi booster

http://www.ti.com/tool/cc3100boost

3. TIVA reference for configuring circuit

http://energia.nu/wordpress/wp-content/uploads/2014/01/LaunchPads-LM4F-TM4C-%E2%80%94-Pins-Maps-11-32.jpeg