Irrigation Monitoring App Project Plan

Team 17:

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1 Introduction

1.1 Project Statement

This senior design project is focused on the improvement of crop irrigation monitoring. Existing products on the market are overpriced systems that utilize wired technology that is inconvenient for a farmer to use. Because of this, many farmers are resistant to the idea of computerized monitoring systems; instead, they simply probe the soil with their fingers and guess when the next watering time should be. Our efforts for this project are centered around a development of a low cost, easy to use, wireless monitoring system that guarantees soil moisture accuracy. This way a farmer is equipped with the best knowledge of when to water his or her crops.

1.2 Purpose

The client, Dr. Ajay Nair, a professor in the department of horticulture at ISU, has been working with farmers and researchers for several years. He has noticed a need for farmers to accurately monitor their crops, but many are resistant to it because of the high prices and difficulty using the technology. Our project is intended to alleviate both of these concerns so that farmers will save on irrigation costs. This helps the environment by reducing water consumption as well as reducing the grower’s water bill. It also ensures healthier crop, since the crop will be properly hydrated at all times. Healthier crop also allows the grower to receive higher profit margins.

1.3 Goals

The goal for our project is to deliver a fully-functional product that has been demonstrated to work in fields. This task is not accomplished without several smaller goals which include but are not limited to: designing a successful prototype, developing a fully featured application, sustaining battery life to last an entire season, and writing useful documentation on how to use the product. Those are our goals for the product, and we also have several goals for ourselves. By the end of senior design, we hope to have obtained valuable experience in the design process of a marketable product, increased communication skills between group members and the client, and learned new technology that is being used in industry today.

2 Deliverables

Number	Deliverable	Date
D1	Sensor Prototype	3-30-2017
D2	Application Prototype	4-28-2017
D3	Fully Functioning Sensor and Application	11-10-2017
D4	Comprehensive Documentation	12-1-2017

3 Design

3.1 Market Survey

Based on research there are a few options for iOS/Android soil moisture devices that seemed to be marketed toward home garden application and less large scale farm setups. These devices run the gamut in terms of price with higher end models being the the $400-$500 range. As far as our research has determined, there is not much in the way of these devices for large farms and none of the current devices on the market have the scalability we intend to build into our system.

The current system in place, which is not as scalable and does not operate with a mobile application is priced below:

Item	**Unit Price**	**Quantity**	**Sub-Total**
Watchdog Soil Moisture Sensor	$36	8	$288.00
FieldScout Soil Sensor Reader	$279	1	$567.00

3.2 Proposed System

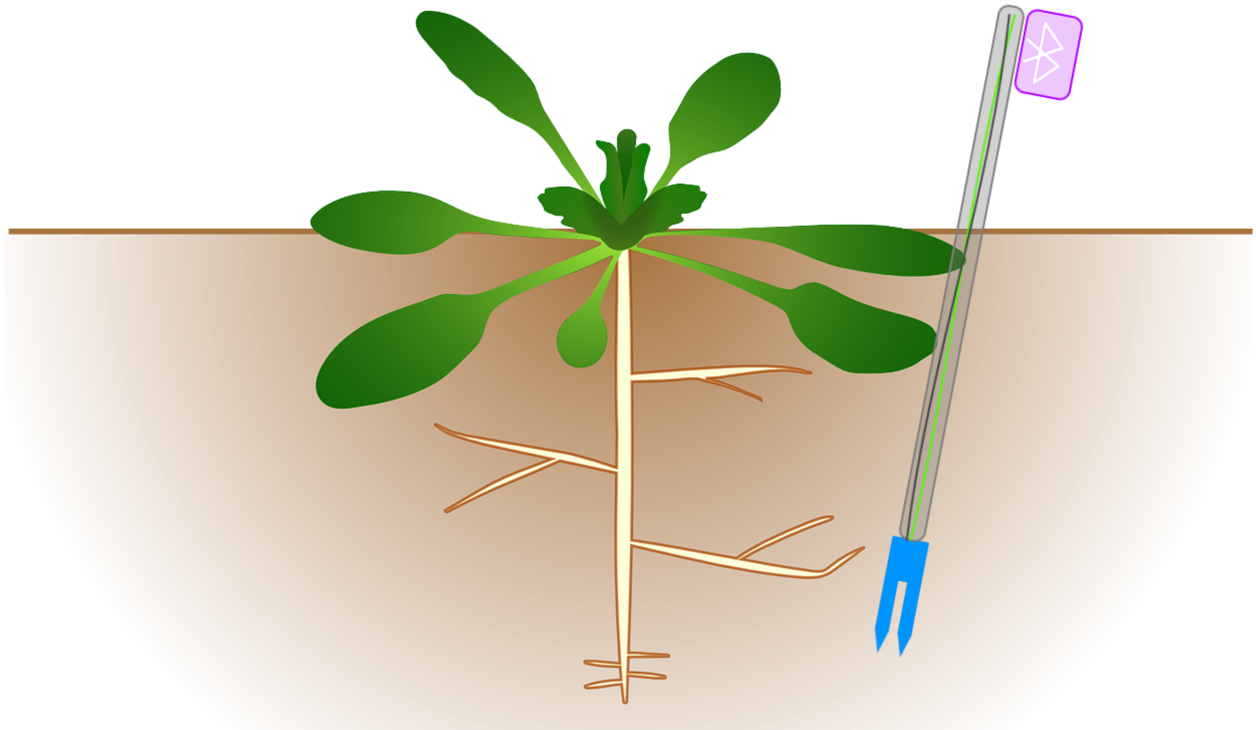


Figure 1: A mock sketch of our prototype

As shown above, the design is intended to work so that the soil moisture sensor is buried into the dirt. It will then relay the information to a bluetooth microcontroller above soil. When the farmer inspects the plant, the microcontroller will wirelessly relay its information to the application.

3.3 Cost Estimate

*Early estimation using commercially available parts.

Item	Unit Price	Quantity	Sub-Total
Soil Moisture Sensor	$4.70	10	$47.00
BLE Transceiver	$1.50	10	$15.60
CH340G NANO	$1.589	10	$15.89
Battery	$4.80	10	$48.00
Enclosure	$.87	10	$8.70
		10 System Total:	$135.20
		Price Per System:	$13.52

3.4 Use Cases

3.4.1 Use Case 1

Farmers use soil monitors when irrigating their crops. Currently they have to either use their touch or use soil monitors with wired connections. Our task is to implement a system where the soil can be monitored remotely. We envision the farmer walking down his row of tomatoes, inspecting the plants for pests, and having the soil monitors send their data to the phone as he walks down the row. To achieve this, we are planning on using Bluetooth low-powered systems that will automatically connect to the phone when in range.

3.4.2 Use Case 2

Use case 1 is the base project and is all our client really wants. However, he has talked about implementing a fully automated irrigation system if we have extra time. This means the soil monitors relay their information to an irrigation controller which will automatically turn on the system if the sensor indicates an area is dry. This would help eliminate water waste and would alleviate the Farmer’s irrigation concerns.

3.5 Validation

In order to confirm our solution works, we will perform field testing on the finished project. We will bury the sensor in the field, and monitor them with our mobile application. Based on the results of this test, we will validate our solution.

4 Product Requirements

4.1 Functional Requirements

- Sensors will be buried in 18-24 inches of soil
- Sensors must relay information back to a mobile application
- Sensors must be able to operate in wet soil conditions
- Sensor battery will last the growing season
- Application links sensor’s MAC address to application record
- Application allows for easy sensor pairing

4.2 Non-Functional Requirements

- Application must be easy to use and understand
- Application must have adequate response time
- Sensor will report battery level, will notify if below N%

4.3 Constraints & Standards

- Team members have limited time, knowledge, and resources
- Implementation of effective device communication while buried
- Implementation must conform to Bluetooth 5 standards

5 Challenges

5.1 Knowledge Risks

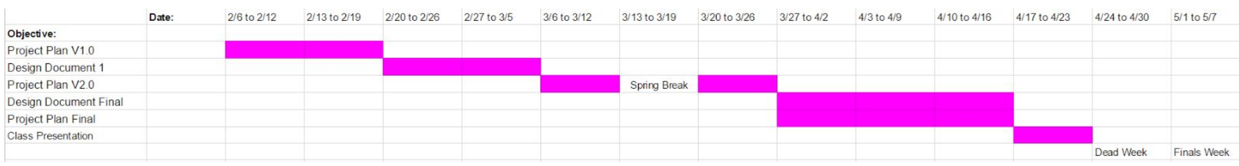
- Team members have limited knowledge about mobile development
  Mitigation: Extensive research will be done into mobile development, and the team will begin early as to create a flexible schedule
- Team members have limited knowledge about irrigation and plant life
  Mitigation: Extensive research will be done into irrigation, and all questions and issues will be promptly communicated with the client

6 Timeline

6.1 Spring Semester

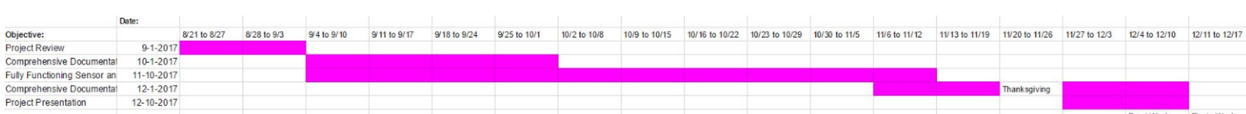
Objective	**Date**

Project Assignment	1-20-2017
Project Plan V1.0	2-21-2017
Design Document 1	3-7-2017
Project Plan V2.0	3-28-2017
Design Document Final	4-18-2017
Project Plan Final	4-18-2017



6.2 Fall Semester

Objective	Date
Project Review	9-1-2017
Comprehensive Documentation V1.0	10-1-2017
Fully Functioning Sensor and Application	11-10-2017
Comprehensive Documentation Final	12-1-2017
Project Presentation	12-10-2017



7 Conclusion

The goal for our project is to deliver a fully-functional irrigation monitoring application that has been demonstrated to work in fields. In order to accomplish this goal, we will be: designing a successful prototype, developing a fully featured application, sustaining battery life to last an entire season, and writing useful documentation on how to use the product. By using our resources and following our scheduled plan, we will be able to produce a fully functioning irrigation monitoring application by the end of Fall semester.

8 References

http://www.specmeters.com/soil-and-water/soil-moisture/soil-moisture-sensors/fieldscout-soil-sensor-reader/?F_All=Y

http://www.specmeters.com/assets/1/22/6450WD.pdf

https://pixabay.com/p-160035/?no_redirect

System Components:

BLE Transc.

CH340G NANO

Battery

Moisture Sensor

Enclosure