Multidisciplinary Senior Design
Project Readiness Package

Project Title:	**Electronic Control System for Hydroponic Strawberry Project**
Project Number: (assigned by MSD)	P18419
Primary Customer: (provide name, phone number, and email)	**Durgin Family Farm**
Sponsor(s): (provide name, phone number, email, and amount of support)	Phil Durgin, durgin2000@yahoo.com, 585-359-0951
Preferred Start Term:	Fall 2017
Faculty Champion: (provide name and email)	Dr. Lynn Fuller, Professor Carlos Barrios
Other Support:	As applicable
Project Guide: (assigned by MSD)	

Nathan Tiberio

06/01/17

Prepared By Date

Received By Date

Project Information

*** Overview:**

The Durgin Family Farm is located at 1175 Martin Road, West Henrietta and this is the second year of its operation. The farm is relatively close to population centers and the Durgin family intends to take advantage of that through selling U-Pick berries. Also, it is less than 7 miles from RIT. Agriculture is the largest economic sector in New York state. As a result, Cornell University has been actively researching growing strawberries in NY -- but they consider hydroponic strawberries to be noncompetitive because it requires costly infrastructure.

The Farm has three primary long-term goals for the hydroponic system: (1) grow the highest quality strawberry, (2) make each plant as productive as is reasonable, and (3) optimize convenience to the customer. Underlying these goals will be to make the system cost effective. The goal of this RIT project is to design a hydroponic system that is cost effective using existing components and have it powered by a microelectronic control system.

The RIT project is intended to provide a modular design consisting of (1) a stand-alone unit consisting of pipes and support, (2) a modular design of how the units should be tied together with a reservoir, etc. and (3) a microelectronic control system. There would be a "proof of concept" unit built at the Farm. This modular design could then be replicated by the Durgin Family Farm to whatever size was needed (e.g. ¼ acre, ½ acre etc.)

*** Preliminary Customer Requirements (CR):**

There are three expected requirements for design of the control system. The first is to monitor the physical attributes of the water such as: temperature, conductivity and dissolved oxygen. The system should be able to trigger an alarm to notify if the reading is outside the limits. The second requirement is for the system to be able to control the water flow. The third requirement is for the monitoring and control system to be tied into the internet so that it can be accessed remotely.

There are no specific requirements for the units and how they should be tied together to form a module other than minimization of construction costs.

1. Electronic system to monitor physical properties of the hydroponics system, ideally temperature, conductivity, and dissolved oxygen
2. Create a prototype of the hydroponic system that can be used to model the electrical system that will monitor the plants, i.e. proof of concept to be created before the end of the second senior design class. Ideally a self contained unit of two rows by 20 feet.

3. The system will give feedback response if any of the above properties are not in desired state
4. Regulating the waterflow of the hydroponics systems with ability to change time interval and quality of flow
5. Ability to connect electronic system to the internet so make monitoring the system convenient and remotely accessible
6. Safe: System abides by all required safety standards (OSHA, UL, etc). System failure defaults to safe mode.
7. Easy to use: u-pick customers can easily and safely access strawberries

* **Preliminary Engineering Requirements (ER)**:

1. Sensor accuracy (Teamperature, dissolved O_2, conductivity: ± %)
2. Approximate module size (# rows x length, target range)
3. List of states that trigger notification (yes/no list)
4. Flow control (range of achievable, gpm; adjustment increment, gpm)
5. Ability to connect electronic system to the internet so make monitoring the system convenient and remote accessible
6. Maintenance or inspection interval (days)
7. Energy consumption (W)
8. Distance between rows (ft)
9. Plant height (ft)
10. Meets safety requirements (list of standards)

* **Constraints:**

The primary constraint is physical. It is the fact that a hydroponic system will be off campus. The weather (e.g. rain or freezing conditions) may not allow for building/testing of the unit(s) in a desired time frame.

Cost: <$3,000 for prototype module (includes preliminary prototyping costs that may not be required to replicate the unit)

Cost: amount to replicate module

Power: client will need to provide information

Water source: client will need to provide information

† **Budget Information:**

The cost estimate is in the range of $2,000 to $3,000. The major costs are off-the-shelf sensors for the control system.

* **Intellectual Property:**

None

Project Resources

[†] **Required Resources (besides student staffing):**

Describe the resources necessary for successful project completion. When the resource is secured, the responsible person should initial and date to acknowledge that they have agreed to provide this support. We assume that all teams with ME/ISE students will have access to the ME Machine Shop and all teams with EE students will have access to the EE Senior Design Lab, so it is not necessary to list these. Limit this list to specialized expertise, space, equipment, and materials.

Faculty list individuals and their area of expertise (people who can provide specialized knowledge unique to your project, e.g., faculty you will need to consult for more than a basic technical question during office hours)	**Initial/date**
Carlos Barrios, Embedded Systems Professor	NT, 08/21/2017
Environment (e.g., a specific lab with specialized equipment/facilities, space for very large or oily/greasy projects, space for projects that generate airborne debris or hazardous gases, specific electrical requirements such as 3-phase power)	**Initial/date**
None	
Equipment (specific computing, test, measurement, or construction equipment that the team will need to borrow, e.g., CMM, SEM,)	**Initial/date**
None	
Materials (materials that will be consumed during the course of the project, e.g., test samples from customer, specialized raw material for construction, chemicals that must be purchased and stored)	**Initial/date**
Other	**Initial/date**

[†] **Anticipated Staffing By Discipline:**

Indicate the requested staffing for each discipline, along with a brief explanation of the associated activities. "Other" includes students from any department on campus besides those explicitly listed. For example, we have done projects with students from Industrial Design, Business, Software Engineering, Civil Engineering Technology, and Information Technology. **If you have recruited students to work on this project (including student-initiated projects), include their names here.**

Dept.	**# Req.**	**Expected Activities**
BME		
CE	1	Programming (Assembly, C, Python), Networking
EE	3	Embedded Systems Design, Soldering, Circuit Functionality Testing,Network **Nathan Tiberio, Thierno Diallo, Raymond Zhang**
ISE	0	Project Management, Rapid Prototyping
ME	3	Design and construction of growing units and water circulation system.
Other		