Portable Nutrient Data collection system

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Project plan

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0. List of Abbreviations

MEMS: Micro Electronic Mechanical System

1. Problem Statement

MEMS sensors, as a bio-compatible sensor, have been used widespread to measure data of pressure, humidity, etc. Smartphone is a very good interface to carry easy-access interface applications. Considering Managing nutrients in agriculture continues to be a major challenge in ecosystem science. In the project, the group will design a system that using integrated MEMS microplasma-based sensors and a spectrometer with microcontroller to collect and transmit data wirelessly to a smartphone app with an easy-access interface.

2. Deliverables

2.1 First Semester

- System diagram and requirement
    1. Separate the whole system to components
    2. List requirements
- Subsystem plan and research
    1. Parts comparison and selection
    2. Research the background
    3. Approaches to build the subsystem

- Subsystem design
    1. Construction circuits or structures
    2. Individual circuit and software testing
    3. Assembly of the whole system

4. Field test

3. System Requirement

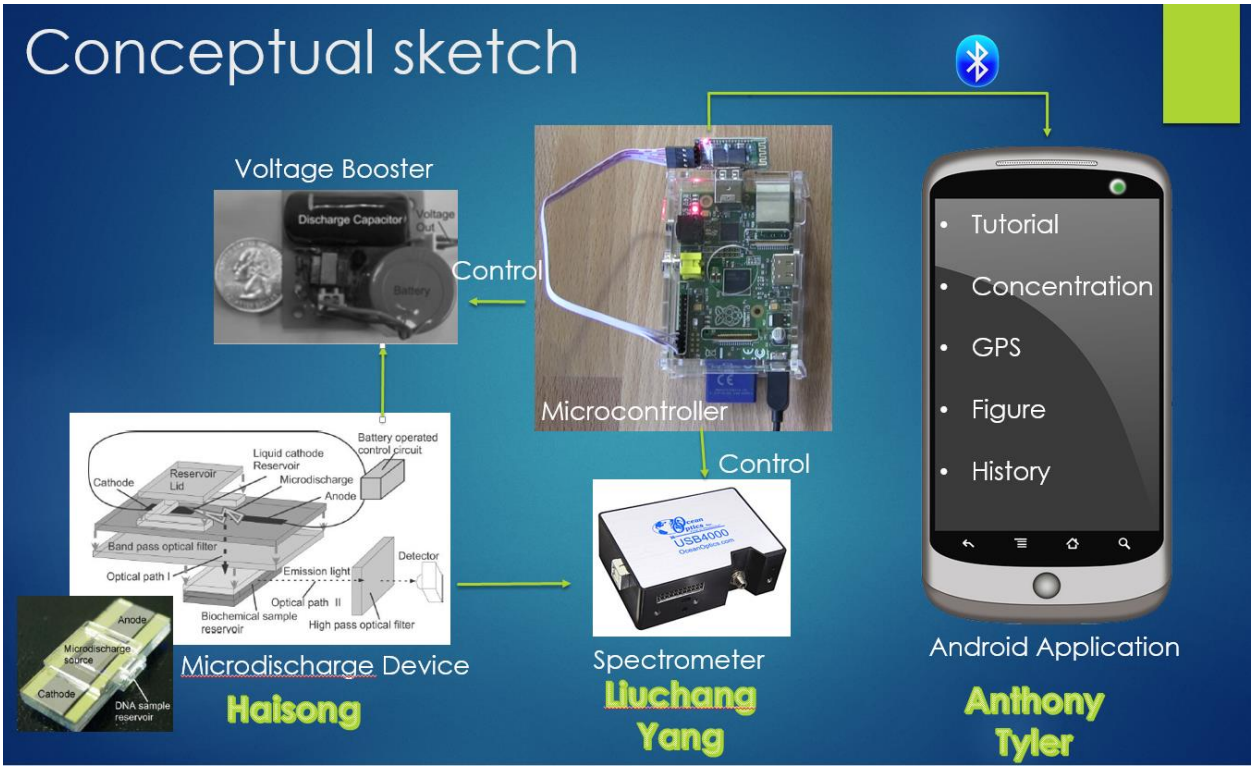
4.1 Functional Requirement

1. Display levels of different elements in water sample with **precision**
2. Application is based on Android
3. The whole process should take less than 30s
4. Have database for the history
5. Have GPS for location information
6. Accurately distinguish between good/bad measurements
7. Transmit data wirelessly to smartphone

4.2 Non-functional Requirement

1. **Portable**, **low power** and **safe**
2. Easy-use-interface. (tutorial, easy to find settings)
3. Be shielded from water and dirt damage
4. 10ml water is acceptable amount to test with
5. Be able to remain powered wirelessly for 1000 trials
6. 95% accurate with reading
7. Smartphone app size should be less than 6MB
8. Total time of analyzing water sample on smartphone application should take less than 30s
9. Communication from device to smartphone should take less than 2s
10. Wireless range should be up to 2m

4. Concept Sketch



5. Subsystem Description

In this project, group will take charge for each of the subsystem.

Haisong Lin: Microcharge Device and voltage booster

Liuchang Li and Yang Tian: interface between spectrometer and microcontroller and Bluetooth transmitter

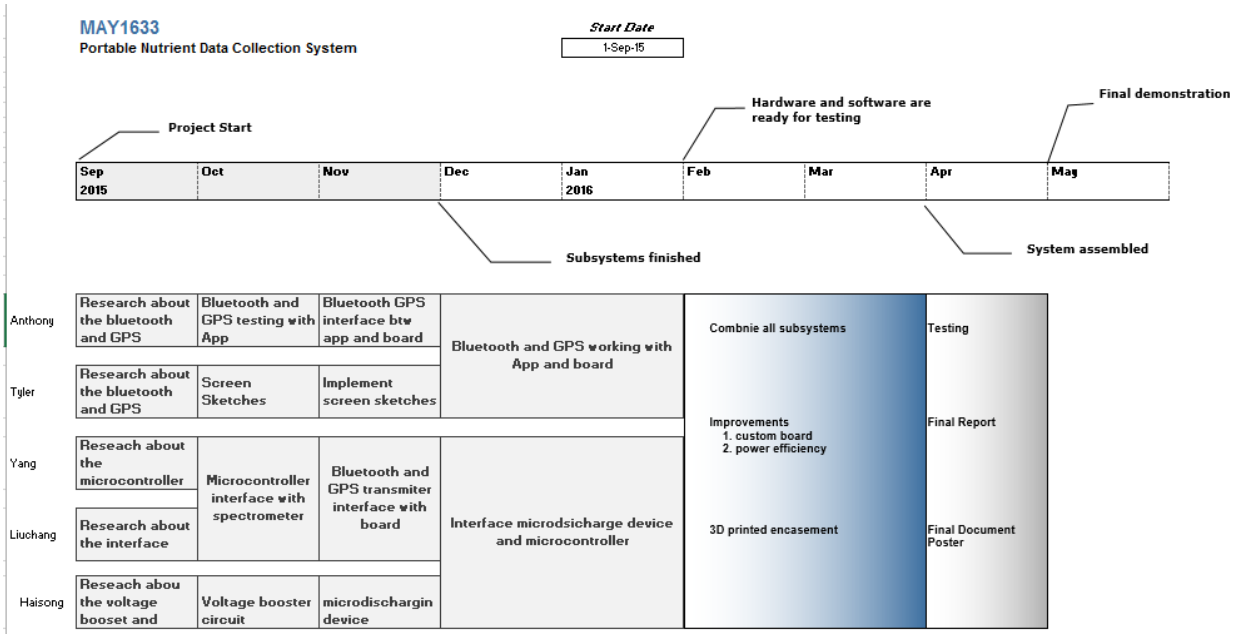
The spectrometer will transfer data to microcontroller by certain format, USB or RS232, etc. Students need to figure which would be a stable and fast method to collect data and transmit data to cell phone.

Anthony Schilling and Tyler Bennett: Bluetooth, GPS and smartphone app.

6. Components required

Components	How to get	Estimated cost
Voltage booster circuits	Electronics distributors	$30
MEMS sensor	Made by student, material are provided by advisers	$20
Microcontroller	purchase	$40
Spectrometer	Provided by advisers	N/A
GPS and Bluetooth	Electronics distributors	$ 40
Smartphone	Provided by advisers	$ 100

7. Project Timeline



8. Risk

8.1 Risk of project timeline

The biggest risk is how long the whole project will took. The system is more like research project that there are many unknown factors, such as the interface between the spectrometer and microcontroller. The current spectrometer is a wall-powered and customized spectrometer, it require extra official software to deal with the output. If the format of the data cannot be transmitted to the microcontroller successfully, it would be an issue.

8.2 Risk of power supply

The second risk would be a power supply. As the current spectrometer needs a wall plug-in to provide power, it would be hard to make it as a portable device with low power consumption. Besides, the microcontroller may also require a lot energy. To provide power for microcontroller, a phone battery may be applied but there is also the risk about back powering and burn circuit.

9. Conclusion

The system would help farmers to manage the nutrient in the fields easily, decrease the risk of over fertilizing and monitor the plant status. Implementation of this system may also save effort for research involved in elements measurement.