Washkewicz College of Engineering

Greenhouse Heating and Monitoring System

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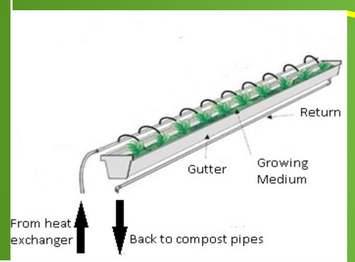
Hydronic System

- Once the seeds have germinated and have enough root structure, they will be arranged in gutter where the roots dangle freely
- A continuous pump circulates water and nutrients, heated by heat exchanger
- The liquid nutrients run down the gutter, flowing past the roots, then flowing back into pipes



Vertical Farming

Objectives

- Generate sustainable heat source
- Monitor temperature and humidity
- Maintain water temperature between 70°F to 80°F in hydroponic system
- Reduce manual labor

Design Components

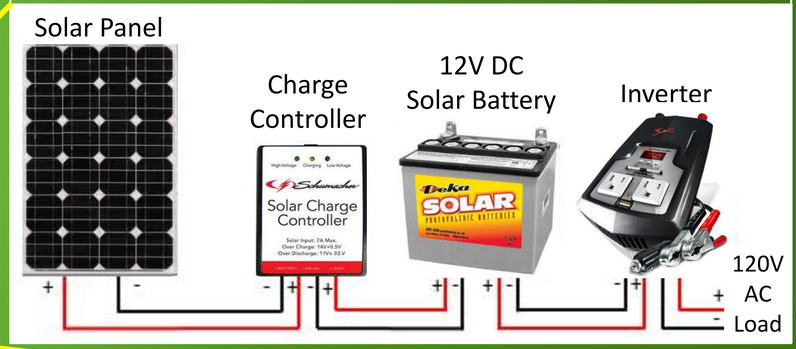
- Wireless Sensor Network
- Photovoltaic Power System
- Jean Pain Compost Heater
- Temperature Based Pump Control

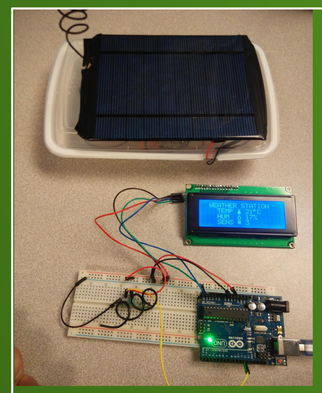
Site Map:

Google Maps

Photovoltaic Power System

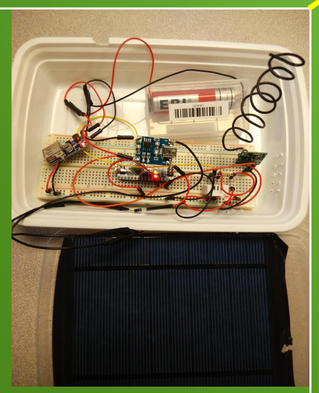
- 50W/17.8V Solar Panel
- 12V Photovoltaic Battery
- 22V 7 Amp charge controller to regulate charge on battery from solar panel
- Inverter to go from 12V DC to 120V AC and power the pump system





Sensor Nodes

Base Station



Wireless Sensor Network

- Wireless sensor network system operated by Arduino hardware
- Solar powered sensor nodes collect temperature and humidity information
- Enters low power state after data transition
- Base station receives information from sensor nodes, and sends to LCD display and computer serial port in real-time
- Computer reads data from serial port, adds time stamps, and labels it into a file

Jean Pain Compost Heater

- Made of layered decomposing mulch and food waste
- Dimensions of 10' wide, 20' length, and 4.5' high
- Wire mesh and metal posts to hold in place
- Perforated tubing for aeration to keep pile active and eliminate turning
- Water flowing through coiled pipe to absorb heat
- Heat exchanger transfers heat to hydroponic system

Temperature Based Pump Control

- Thermocouple used for temperature regulation
- Hydroponic water less than 70°F activates pump until water reaches 80°F
- Flow rate varies between 1-4 gal/min
- Pump is relay activated
- Controller integrated into pump by manufacturer

Future Work

- Retractable cover for greenhouse
- Expanded sensor network to entire facility
- Large scale photovoltaic power system for entire facility
- More compost piles to ensure high temperature output
- Optimize compost mixture for high quality, predictable output