



University of Regina Modular Cube Farm

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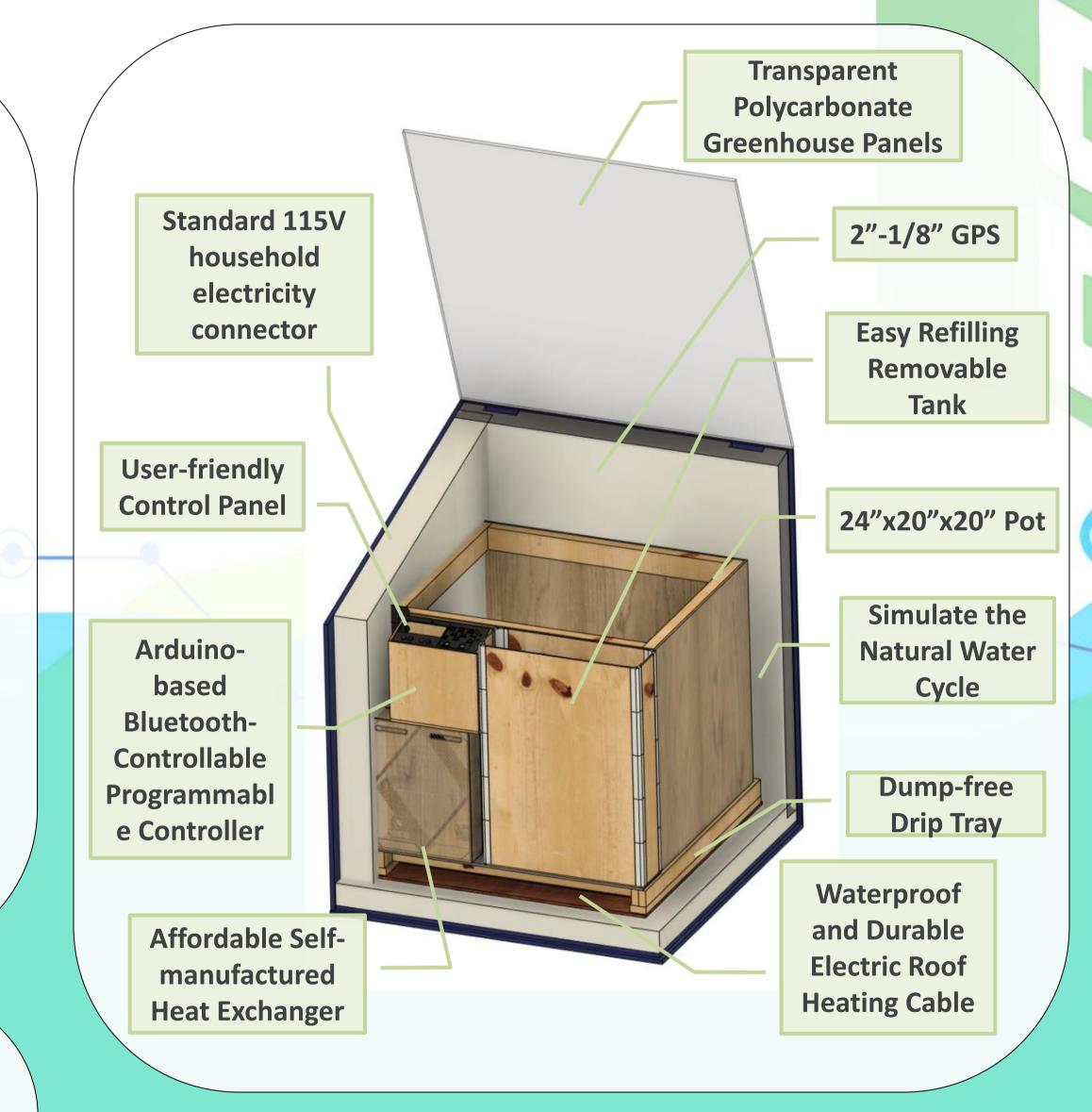
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Abstract

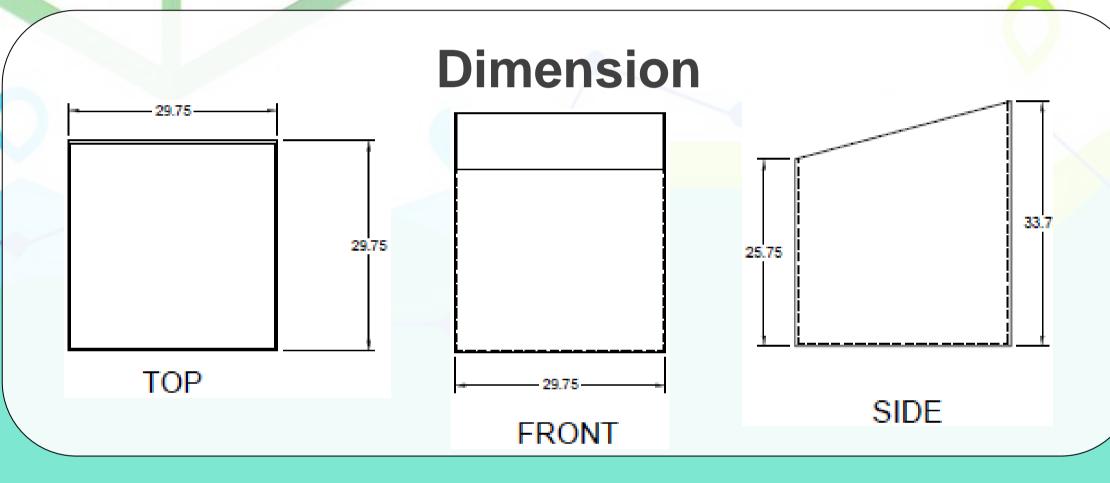
The Modular Cube Farm is an affordable and easy to use garden tool for the average Saskatchewan user. Plants can grow while the temperature dips to -45°C((-49 °F). The angled polycarbonate top panel absorbs a significant amount of sunlight to reduce the consumption of electric light. Remotely controllable Arduinos are used to monitor the temperature and humidity while maintaining a user set temperature and soil moisture inside. The plywood frame is treated with epoxy with a 2-inch Durospan R10 insulation to ensure the heat loss is minimized when exposed to cruel weather. A heated water tray underneath the soil collects the excess water after watering and evaporates the water till it condenses at the top panel and is recollected by the water tanks. A plate crossflow heat exchanger is also present to introduce fresh airflow into the system while recovering some part of the heat loss.



Objectives

Design & fabricate a semi-automated greenhouse that:

- Extensible, Customizable and Affordable
- **Environmentally friendly & Weather resistance**
- Operates under -45 °C (-49 °F) outdoor
- Easy to build, Durable and Easy to maintain



Control System

Logic Controller

Arduino

Nano

Control

Panel

Mobile

Device

Control

Capacitive Soil Moisture Sensor *3

Thermometer DS18B20 *1

INPUT

Non-Contact Water Level Sensor *1

Momentary Push Button *4

Maintained Push Button *2

Optional

Air Humidity Sensor DHT11 *1

One More Thermometer

Tilt Switch for Lid *1

OUTPUTS

300W Heating Cord*1

Dosing Pump *1

40mm Fan*2

HC-05 Bluetooth Module *1

LED Green *1

Optional

Grow Lights

Wifi Connectability

Thermodynamics

Condensing Condensate Collection & **Back to Tank Heat Recover** Heating + **Evaporating**

Dump free drip tray

Heat Recovery Ventilator



3D printing frame + Copper foil



Low Cost & Customizable Size

Conclusion

- A finished self-operating prototype
- **Consumes 245W @ -45 °C (-49 °F)** windy outdoor
- Functions expandable & Controller reprogrammed
- Recommend to build larger scale to reduce applied cost and energy consumption



Acknowledgments

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