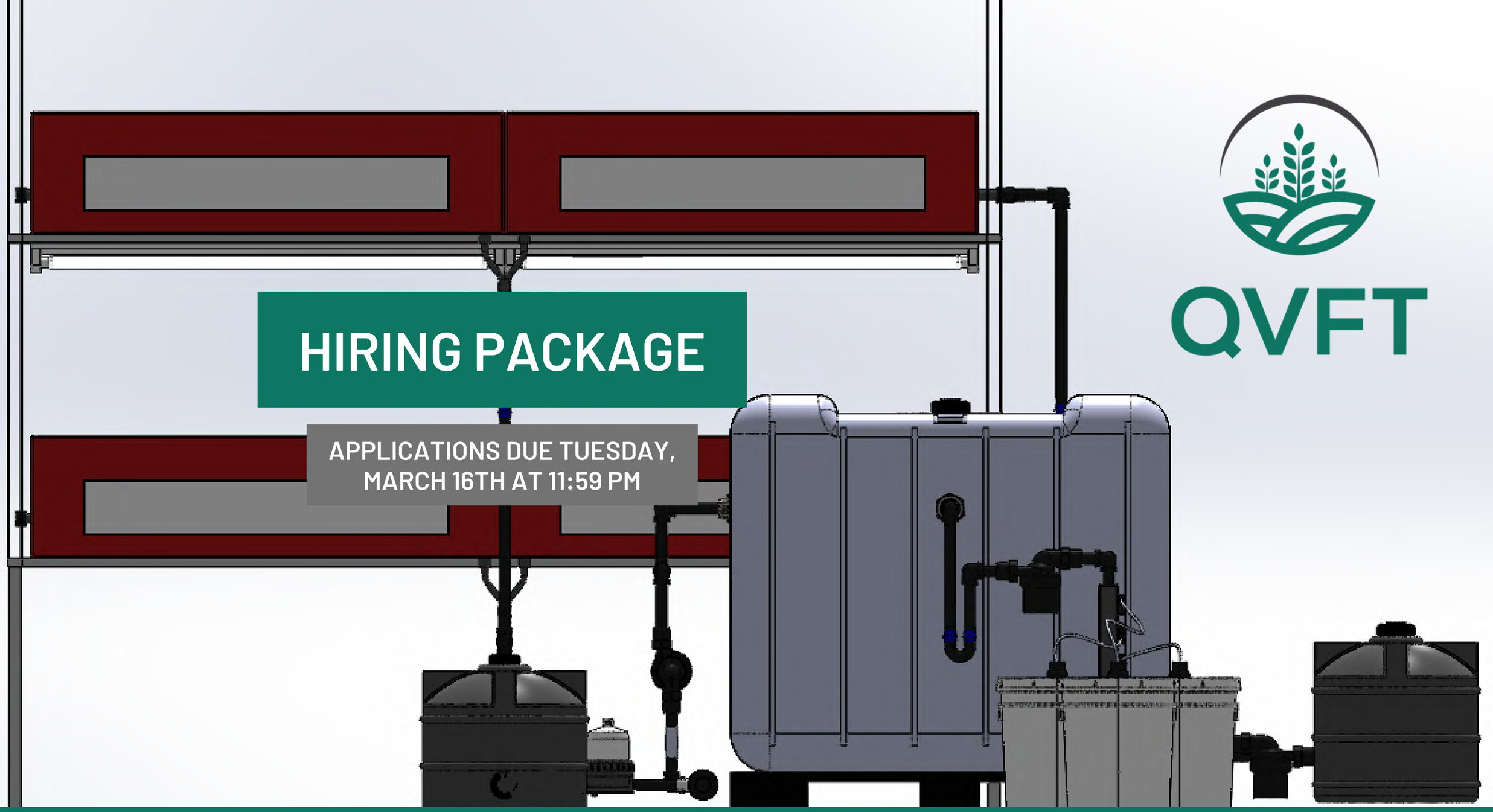


# HIRING PACKAGE

APPLICATIONS DUE TUESDAY,
MARCH 16TH AT 11:59 PM

QVFT

# ABOUT US

## OUR MISSION

Founded in Sep. 2019, QVFT is Canada's first student-led university vertical farming design team. Our mission is to develop a functional, small scale vertical farm. Drawing inspiration from the best current commercial practices, our goal is to gain a foothold as an innovator in a rapidly expanding industry.

Despite the pandemic, QVFT has made huge strides towards fulfilling its mission. The mechanical design has now been mapped out as a 3D CAD model, and the automation system has reached basic functionality.

# WHY VERTICAL FARMING?

## THE PROBLEM

A global trend of increasing concern is the diminishing supply of arable land per capita. Due to climate change, urbanization, and soil degradation, the United Nations Food and Agriculture Organization (FAO) projects that by 2050, arable land per capita will fall to one third of the amount available in 1970. A 2018 report by the Intergovernmental Panel on Climate Change (IPCC) raised further alarm,  predicting that humanity will reach an environmental "point of no return" within the next two decades.

Given the existential threat of climate change, and the enormous toll taken by unsustainable agriculture on the environment, global food security in the coming decades will largely depend on our ability to adapt and overhaul existing cultivation practices.

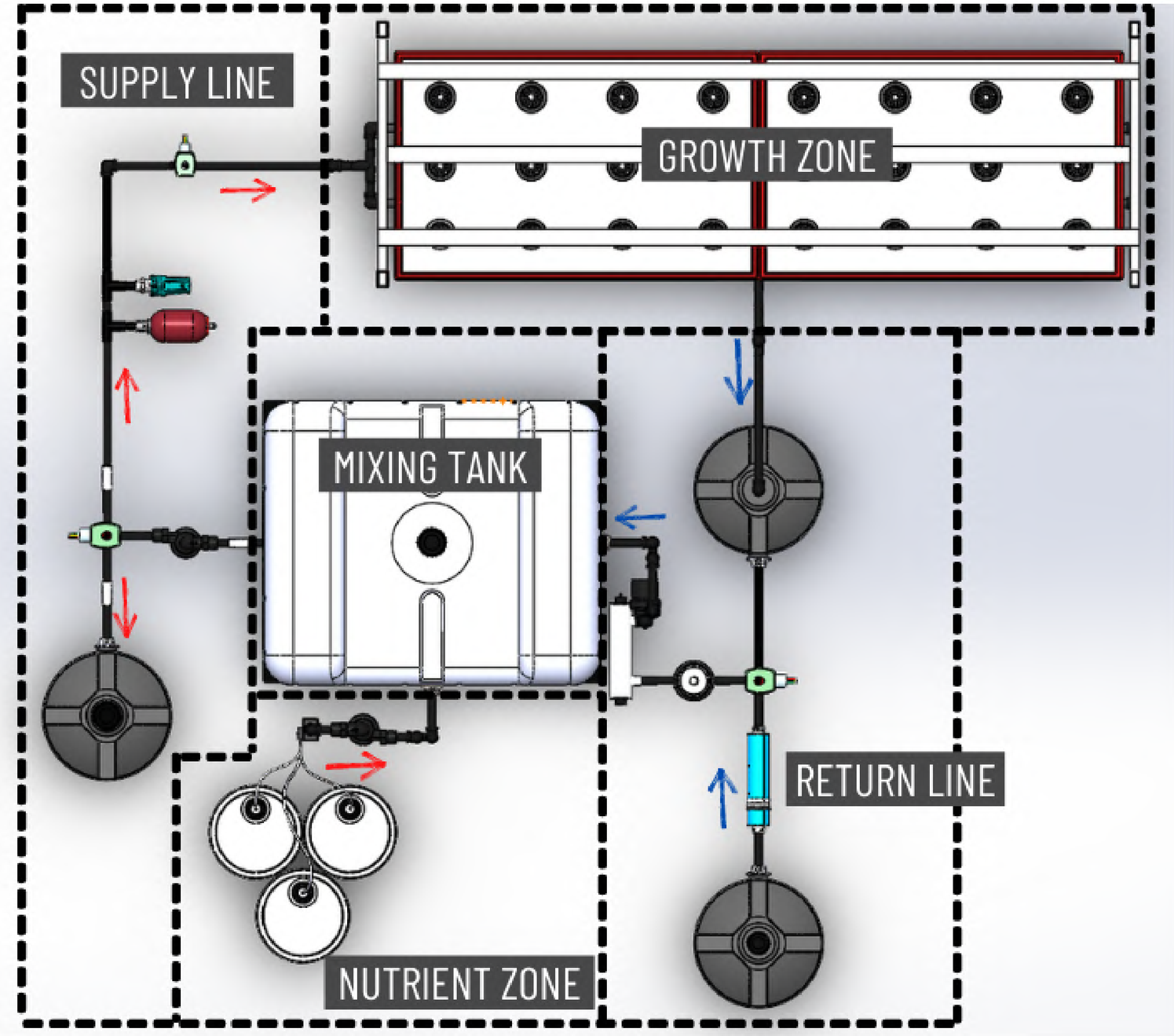
## THE SOLUTION

Vertical farming is a cultivation practice in which crops grow in an indoor, urban, climate-controlled facility. This approach is associated with dramatically reduced water consumption, slashed transportation costs, organic produce, massive improvements in per-acre land productivity, increased plant productivity, and the freedom to cultivate crops in any location, year-round. These benefits are made possible through controlled-environment agriculture (CEA), which allows for the artificial optimization of environmental inputs such as lighting, temperature, moisture, and nutritional availability.

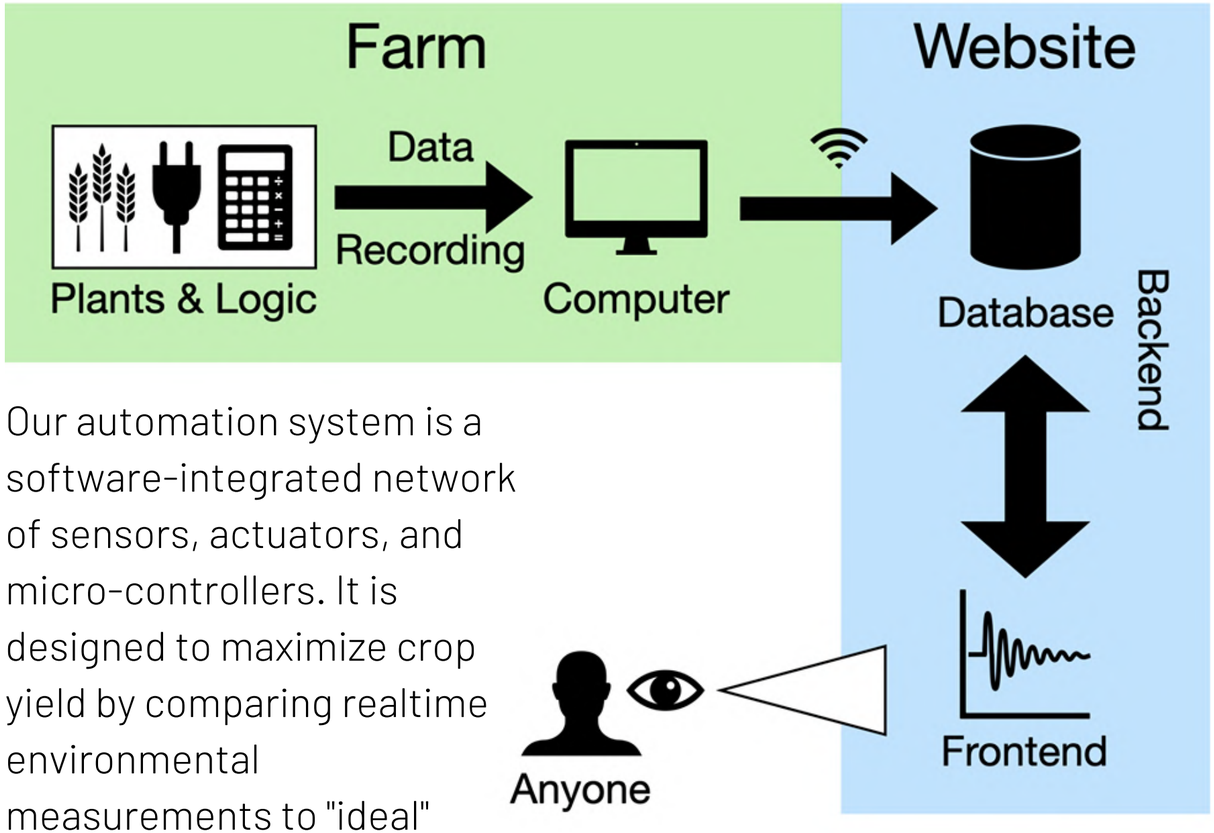
# WHAT WE DO

## AEROPONIC SYSTEM

QVFT employs an aeroponic cultivation method, in which nutrients are dissolved in water (fertigation) and misted directly onto roots via spray nozzles. Crops rest on a thin, porous substrate, through which their roots dangle in a basin below. Requiring no soil, this approach allows the grower near-complete control over the specific nutrient mix a plant receives. Shown on the right is an early-stage schematic of our proposed design.



# FARM BRAIN: SYSTEM MAP




Our automation system is a software-integrated network of sensors, actuators, and micro-controllers. It is designed to maximize crop yield by comparing realtime environmental measurements to "ideal" targets, and adjusting the growth conditions accordingly.

## Plants & Logic

Logical Farm Operation

Arduino circuitboards

Interaction Between Parts

Ex: Water Level too low -> Turn on pump

## Computer

Collects sensor data from farm

Formats to be human-readable

Connects to internet (unlike circuitboards)

Upload sensor readings to database

## Database

Raw Data Storage Online

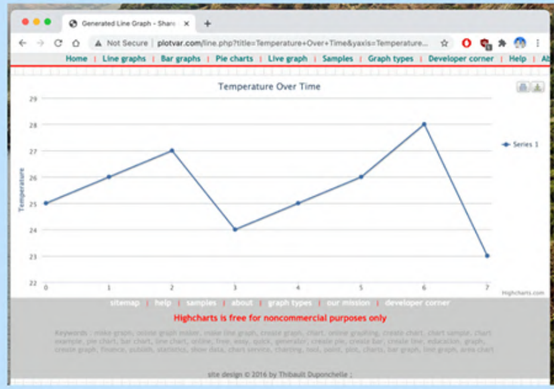
Basic Format Only

| ID | Sensor | Time | Value |
|---|---|---|---|
| 0 | temp | 2021-01-17 12:00 | 25.3 |
| 1 | light | 2021-01-18 12:00 | 53 |
| 2 | temp | 2021-01-19 12:01 | 24.8 |
| 3 | light | 2021-01-20 12:01 | 53 |

## Frontend

Arrange Information to look nice

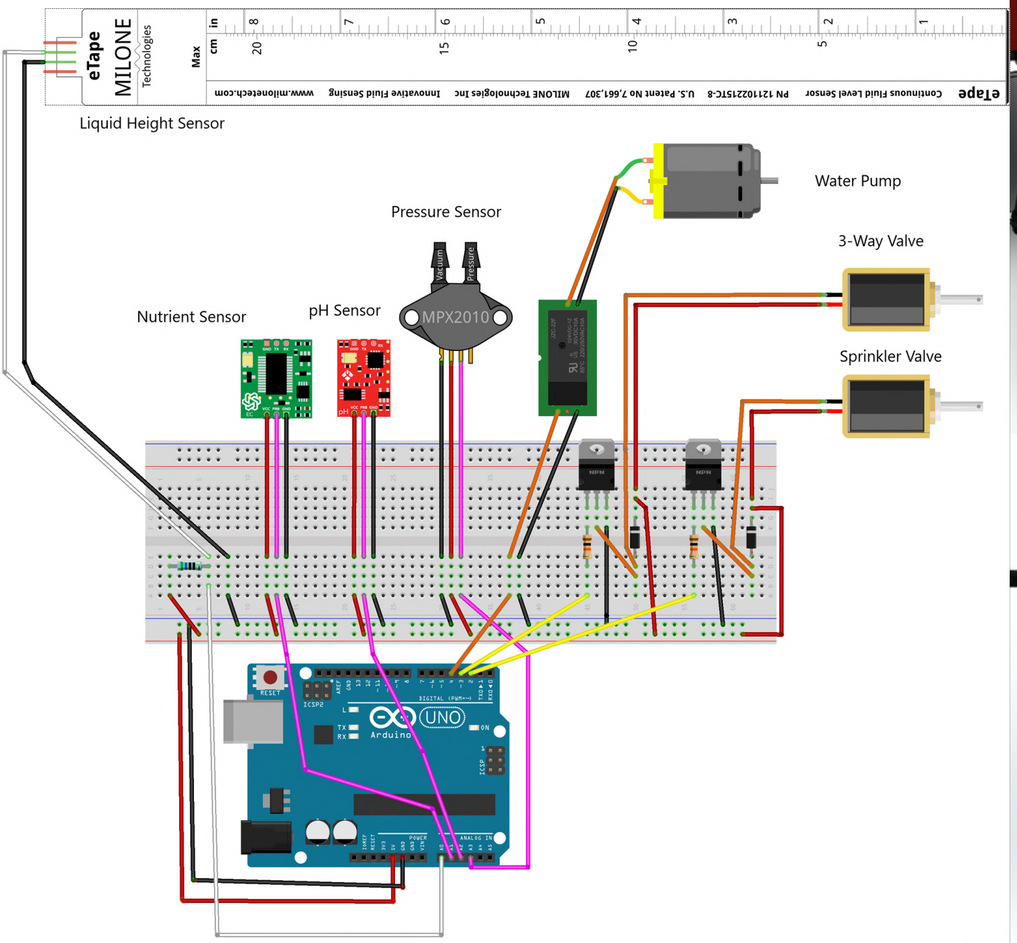
Website that anyone can access

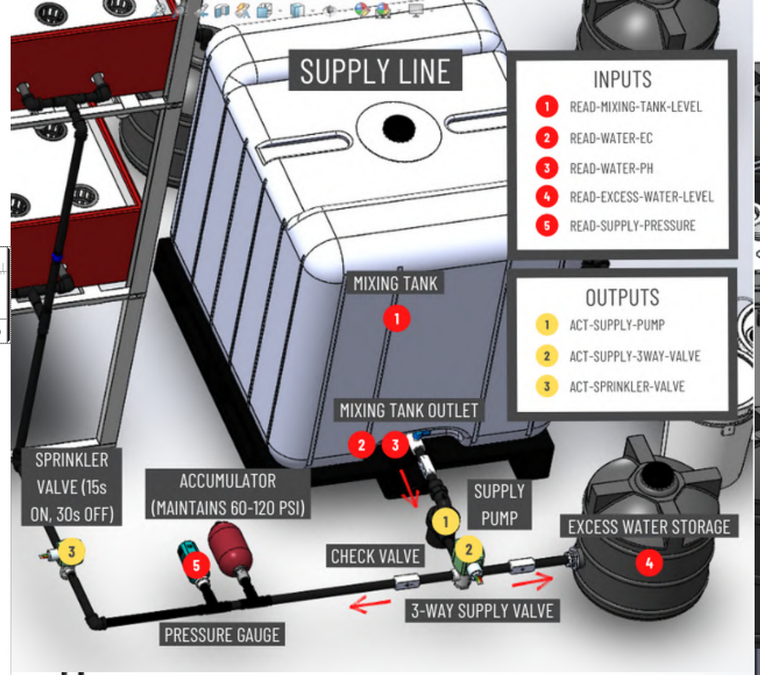


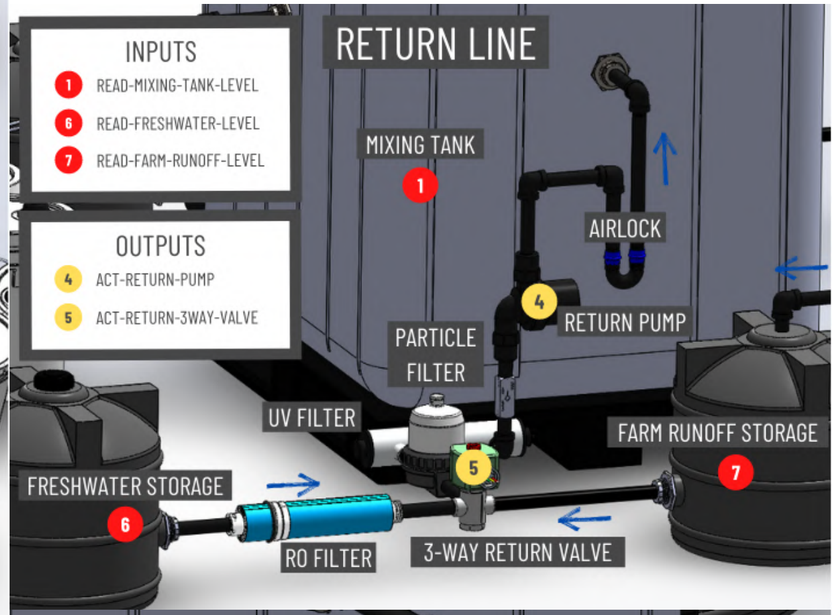

## Backend

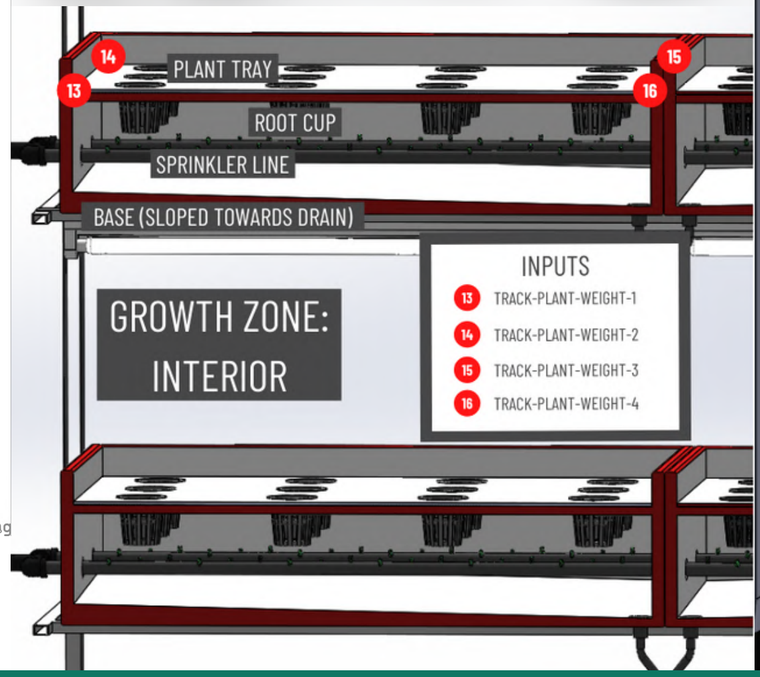
Facilitates communication between user-facing front-end and raw data

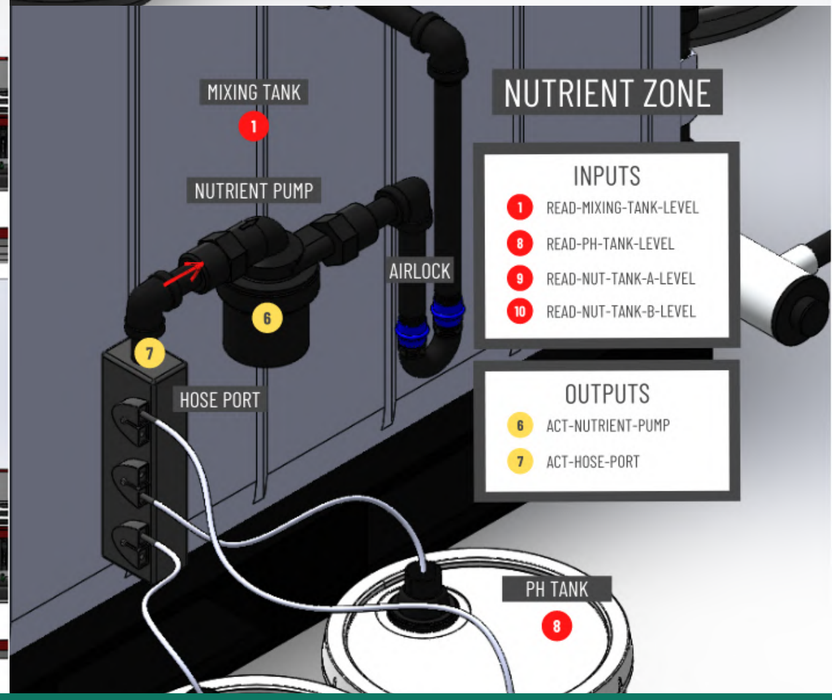
# FARM BRAIN: SENSORS & CONTROLS



# HIRING INFORMATION

## MECHANICAL DESIGNER

### KEY ROLES AND RESPONSIBILITIES

- Computer-aided design (CAD):
  - Strategically place pipe fittings (check valves, pressure release valves, bypasses, filters, etc.) in order to:
    - Maintain watertightness, line pressure
    - Ensure 'safe' failure modes
    - Prevent leakage, back-flow, cavitation, and excess pressure build-up
  - Design new system components that meet provided design constraints
  - Competently manage large CAD assemblies
- Quantitative analysis:
  - Use fluid mechanics (e.g., Bernoulli's equation) to determine pumping requirements and optimize physical system parameters
  - Model and iterate calculations with MATLAB, Python, or an equivalent tool
  - Interpret product data-sheets (e.g., pump curves) and select practical components that best meet your calculated 'ideal' values
- Prototyping:
  - 3D printing and small-scale manufacturing using available facilities on Queen's campus

### WHAT WE LOOK FOR

REQUIRED KNOWLEDGE

- CAD (SolidWorks preferred)
- Fluid mechanics and other core mechanical engineering subjects
- At least one computational tool (MATLAB preferred)

PREFERRED KNOWLEDGE

- Mechatronics
- Arduino
- Control systems design

PERSONALITY TRAITS

- Hard-working, meticulous, and driven
- Able to balance the demands of school with team projects
- Are you good at what you do, and are you able to figure things out when you don't know how to do something?

*Note: past experience in vertical farming is NOT required*

# SOFTWARE DEVELOPER

## KEY ROLES AND RESPONSIBILITIES

### GENERAL

- Improve the existing software-based automation system in close collaboration with the other sub-teams

### FRONT-END/BACK-END (WEBSITE) SPECIALIZATION

- Use web technologies (Amazon Web Services) to build an online user interface for visualizing farm data in real-time

### DATABASE/DATA SCIENCE SPECIALIZATION

- Work with PostgreSQL and ElephantSQL to store and update incoming readings from the I/O sub-system
- Use these readings to update the website in real time in collaboration with the front-end / back-end sub-system

## WHAT WE LOOK FOR

### REQUIRED KNOWLEDGE

- GitHub
- *Front-end:* HTML, CSS, JavaScript
- *Back-end:* AWS, Flask
- *Database:* AWS, PostgreSQL, Elephant SQL

### PREFERRED KNOWLEDGE

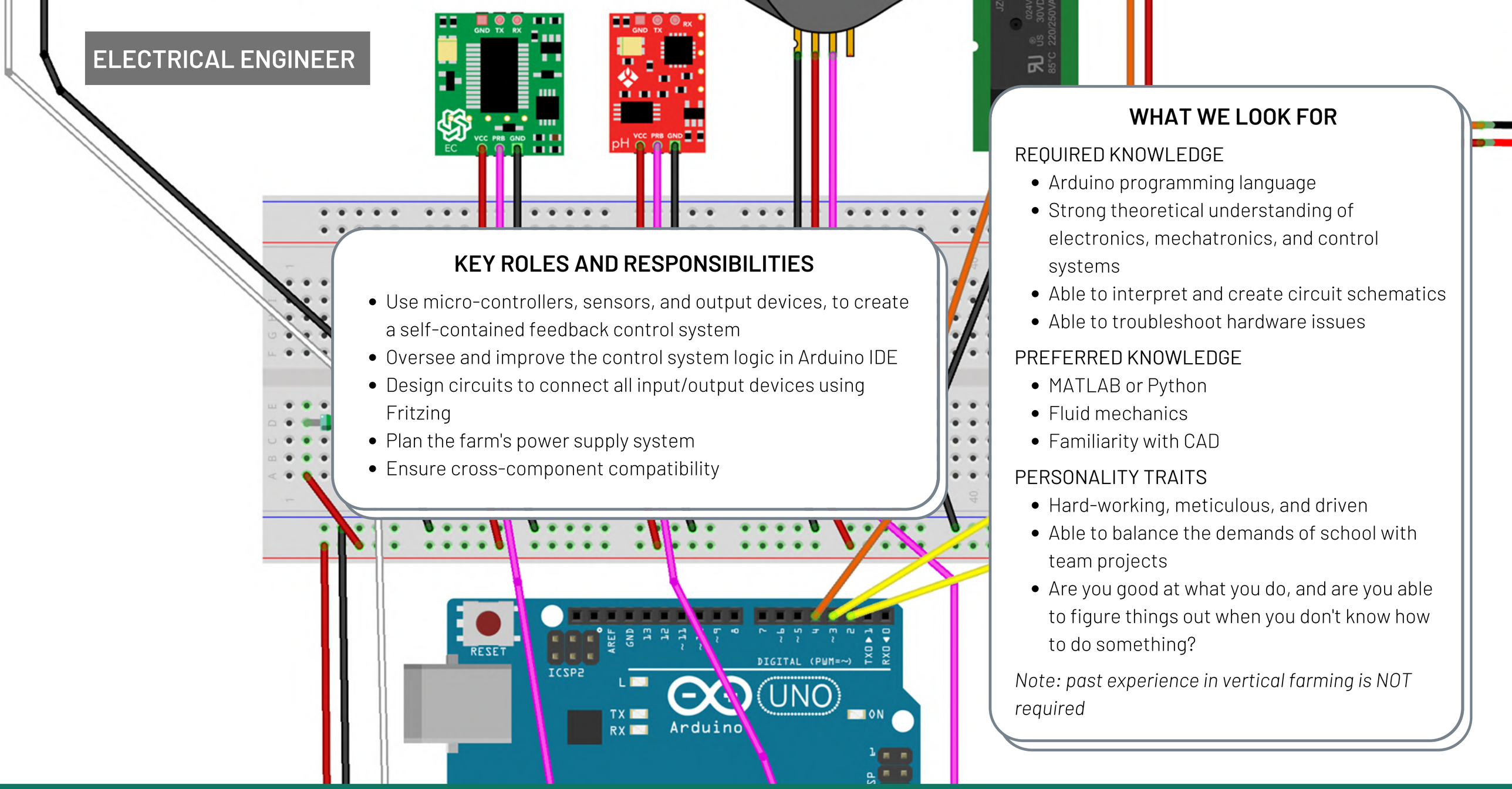
- Awareness of the tools used by the other software specializations
- Arduino IDE
- Micro-controllers, circuits, and hardware

### PERSONALITY TRAITS

- Hard-working, meticulous, and driven
- Able to balance the demands of school with team projects
- Are you good at what you do, and are you able to figure things out when you don't know how to do something?

*Note: past experience in vertical farming is NOT required*

# ELECTRICAL ENGINEER




## KEY ROLES AND RESPONSIBILITIES

- Use micro-controllers, sensors, and output devices, to create a self-contained feedback control system
- Oversee and improve the control system logic in Arduino IDE
- Design circuits to connect all input/output devices using Fritzing
- Plan the farm's power supply system
- Ensure cross-component compatibility

## WHAT WE LOOK FOR

### REQUIRED KNOWLEDGE

- Arduino programming language
- Strong theoretical understanding of electronics, mechatronics, and control systems
- Able to interpret and create circuit schematics
- Able to troubleshoot hardware issues

### PREFERRED KNOWLEDGE

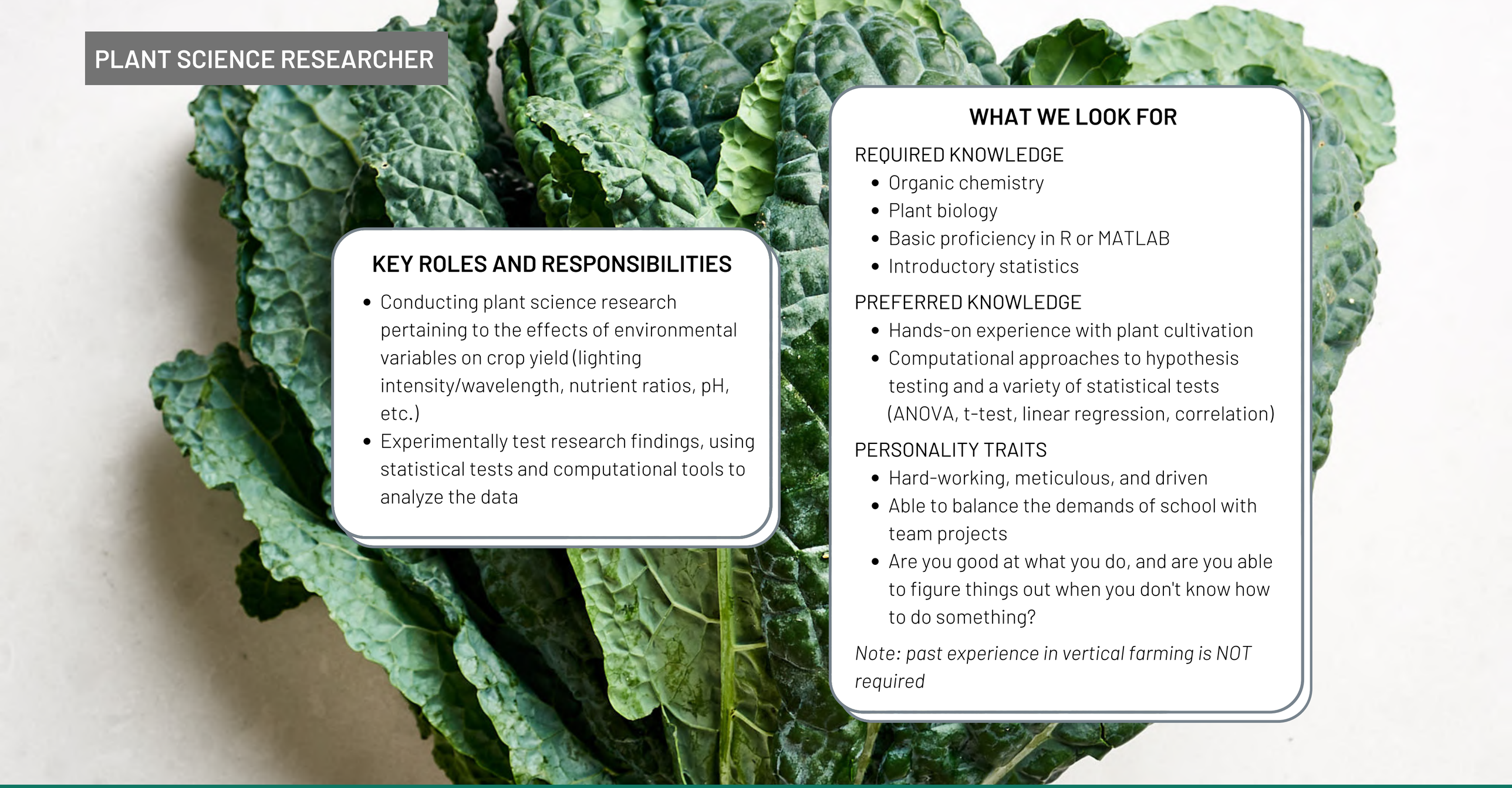
- MATLAB or Python
- Fluid mechanics
- Familiarity with CAD

### PERSONALITY TRAITS

- Hard-working, meticulous, and driven
- Able to balance the demands of school with team projects
- Are you good at what you do, and are you able to figure things out when you don't know how to do something?

*Note: past experience in vertical farming is NOT required*

# PLANT SCIENCE RESEARCHER



## KEY ROLES AND RESPONSIBILITIES

- Conducting plant science research pertaining to the effects of environmental variables on crop yield (lighting intensity/wavelength, nutrient ratios, pH, etc.)
- Experimentally test research findings, using statistical tests and computational tools to analyze the data

## WHAT WE LOOK FOR

REQUIRED KNOWLEDGE

- Organic chemistry
- Plant biology
- Basic proficiency in R or MATLAB
- Introductory statistics

PREFERRED KNOWLEDGE

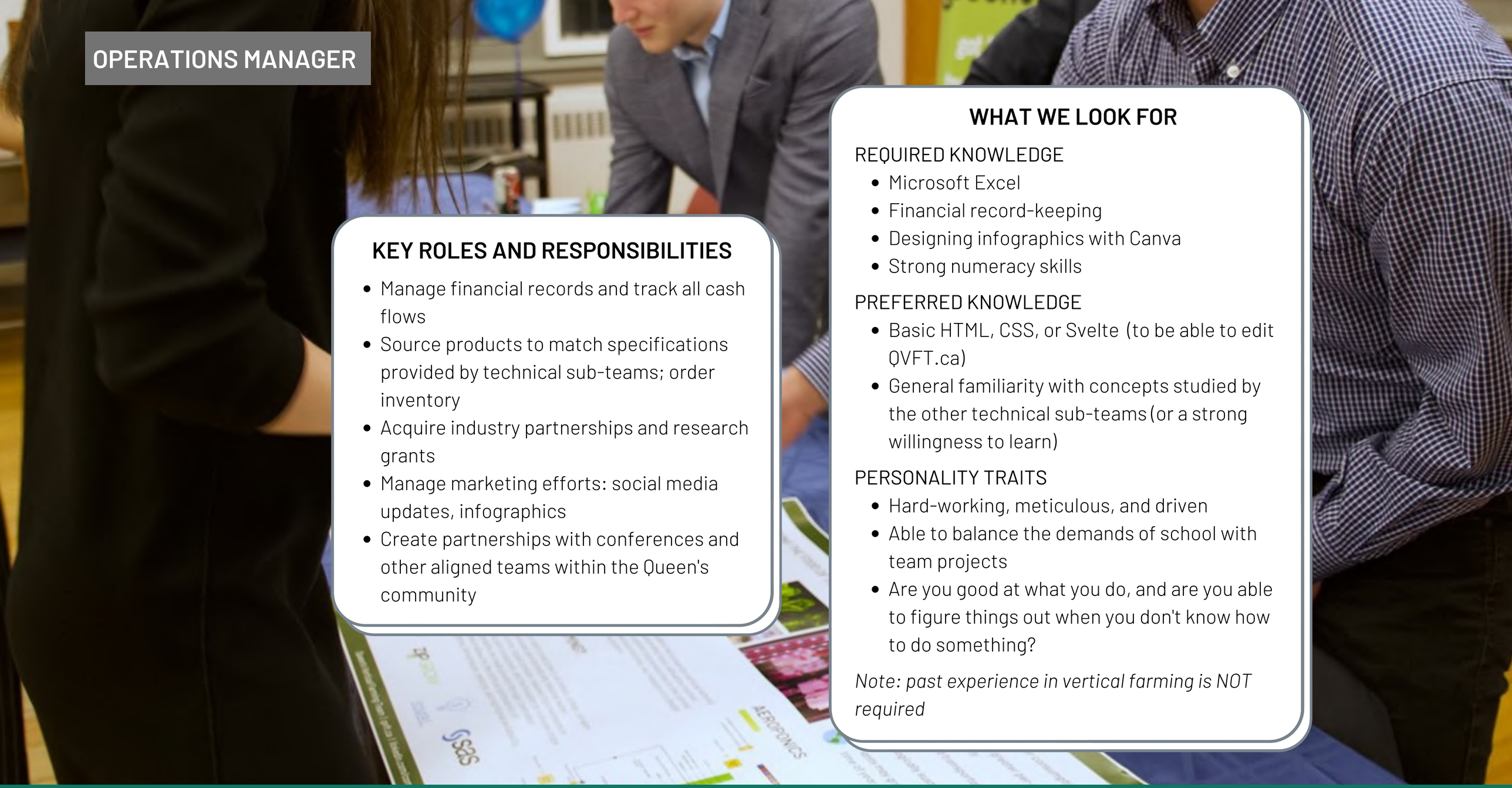
- Hands-on experience with plant cultivation
- Computational approaches to hypothesis testing and a variety of statistical tests (ANOVA, t-test, linear regression, correlation)

PERSONALITY TRAITS

- Hard-working, meticulous, and driven
- Able to balance the demands of school with team projects
- Are you good at what you do, and are you able to figure things out when you don't know how to do something?

*Note: past experience in vertical farming is NOT required*

# OPERATIONS MANAGER



## KEY ROLES AND RESPONSIBILITIES

- Manage financial records and track all cash flows
- Source products to match specifications provided by technical sub-teams; order inventory
- Acquire industry partnerships and research grants
- Manage marketing efforts: social media updates, infographics
- Create partnerships with conferences and other aligned teams within the Queen's community

## WHAT WE LOOK FOR

### REQUIRED KNOWLEDGE

- Microsoft Excel
- Financial record-keeping
- Designing infographics with Canva
- Strong numeracy skills

### PREFERRED KNOWLEDGE

- Basic HTML, CSS, or Svelte (to be able to edit QVFT.ca)
- General familiarity with concepts studied by the other technical sub-teams (or a strong willingness to learn)

### PERSONALITY TRAITS

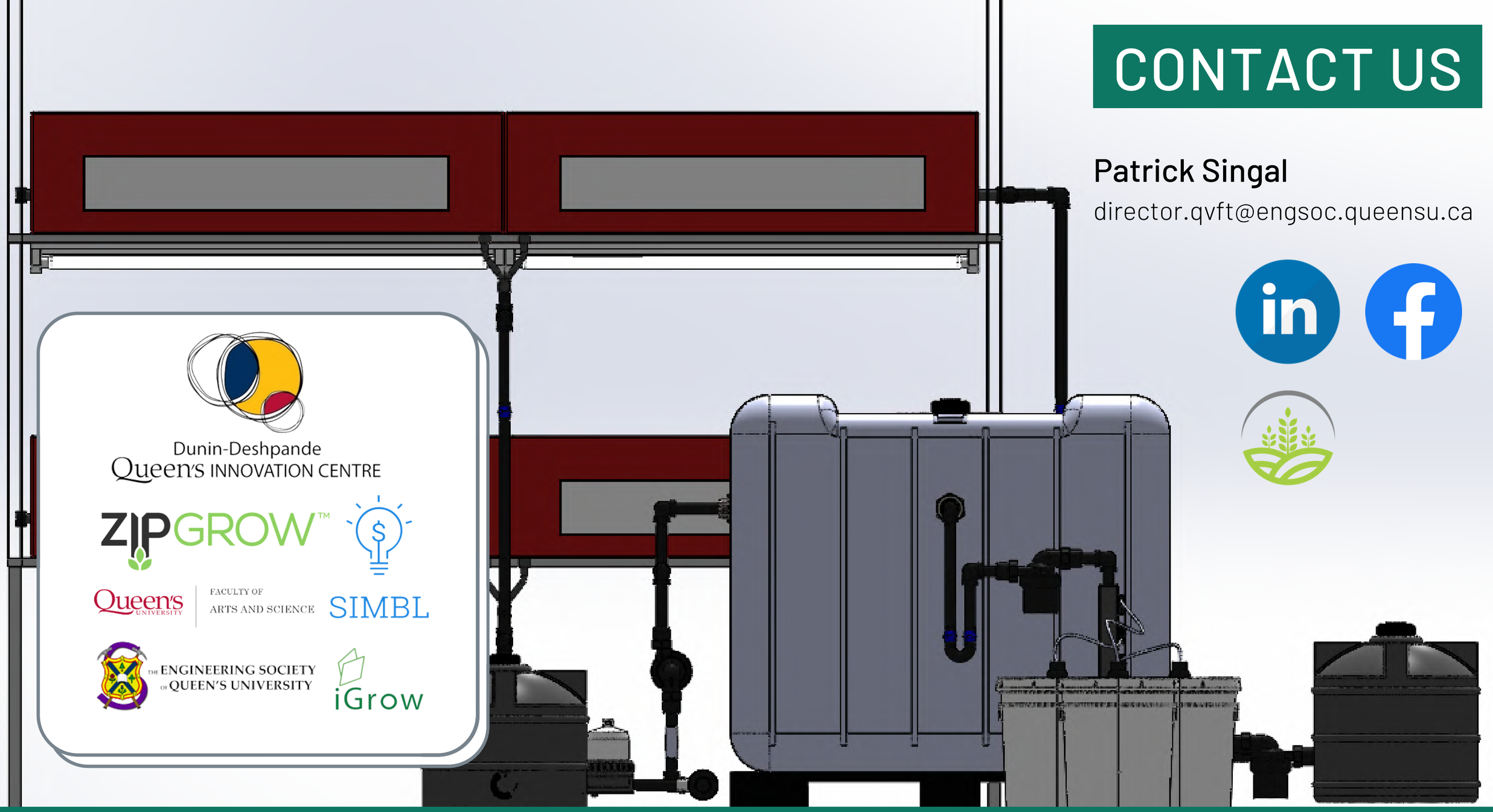
- Hard-working, meticulous, and driven
- Able to balance the demands of school with team projects
- Are you good at what you do, and are you able to figure things out when you don't know how to do something?

*Note: past experience in vertical farming is NOT required*

# CONTACT US


**Patrick Singal**

director.qvft@engsoc.queensu.ca

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