HIRING PACKAGE

Applications due Friday, April 8th at 11:59PM
Founded in Sep. 2019, QVFT is Canada's first student-led undergraduate vertical farming design team.

We are designing and building a functional, software-automated aeroponic vertical farm.

The majority of existing research in this field is conducted by private companies and is thus inaccessible to the public; through its open-source approach, QVFT aims to democratize vertical farming knowledge and research.
A global trend of increasing concern is the diminishing supply of arable land per capita. Due to trends such as climate change, freshwater depletion, and soil degradation, arable land per capita will fall to one-third of the amount available in 1970 by 2050. The unsustainable practices of conventional agriculture exacerbate the problem. The world population is also expected to increase from 7.7 billion (2019) to 9.7 billion (2050). The intersection of these climate and population challenges means that global food security depends on our ability to adapt to increased demand and develop better farming techniques.
Vertical farming is a cultivation practice in which crops are grown in an indoor, climate-controlled facility. This approach is associated with dramatically reduced water consumption (~95%), minimal transportation costs, and massive improvements in per-acre land productivity. Vertical farming can grow nutritious, organic produce in any location, at any time of year. Given these advantages, this technology is projected to become a major contributor to global food production in the coming decades. The vertical farming industry's global market value is projected to grow from $2.23 billion in 2018 to $12.77 billion by 2026, representing a compounded annual growth rate of 24.6%.
QVFT employs an aeroponic cultivation method, in which plants grow without soil and are fed by a nutrient-enriched mist. Crops rest in thin, slotted plastic root cups, through which their roots hang into a basin below. Aeroponics lend well to automation and can allow for near-complete control over the plant growth environment. The system is broadly divided into five zones: mixing tank, nutrient zone, supply line, growth zone, and return line.
Entails the database, back-end, and front-end and ultimately aims to provide a publicly accessible repository of real-time vertical farming data.

An electromechanical feedback control system that automatically maintains optimal growth conditions using interconnected sensors and actuators, which interact through a logical framework programmed into their Arduino micro-controllers.

- Allows technicians to remotely monitor farm equipment, Provides a record for future tuning and improvement of the farm by comparing data to commercial vertical farms and conventional producers.
Farm Brain: Sensors and Controls
KEY ROLES AND RESPONSIBILITIES

- Computer-aided design (CAD):
  - Strategically place pipe fittings in order to:
    - Maintain water tightness
    - 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 and read drawings.

- Quantitative analysis:
  - Use fluid mechanics to determine pumping requirements and optimize physical system parameters.
  - Model and iterate calculations with MATLAB, python or equivalent tool.
  - Interpret product data-sheets and select practical components that best meet your calculated ‘ideal’ values.

- Manufacturing
  - 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.
- Computational tools such as MATLAB or python.

PREFERRED KNOWLEDGE:
- Mechatronics
- Arduino
- Control systems design
- Machine shop experience

PERSONALITY TRAITS:
- Hard-workings, meticulous, and driven
- Able to balance a healthy school and team project balance
- Are you good at what you do, and are you able to figure out when you don’t know how to do something?

Note: past experience in vertical farming is not required.
STACK 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 Elephant SQL 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
MECHATRONICS 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