Unmanned Ground Vehicle for Vineyards and Farms

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Concept

Problem: Vineyards require constant surveying.

Solution: Build a machine to survey vineyards with minimal supervision.

Method: Traverse the vineyard with an Unmanned Ground Vehicle (UGV) that collects pictures of vines, as well as temperature and humidity data.

Figure 1: A row in a vineyard, photo courtesy of Pollen Systems.

Implementation

Figure 2: Our UGV during a field test.

Vineyard UGV

- Follows pre-determined path through rows of vines
- Collects overlapping images and records the location of each image
- Records environment data
- Stores data to be processed and sent to the customer
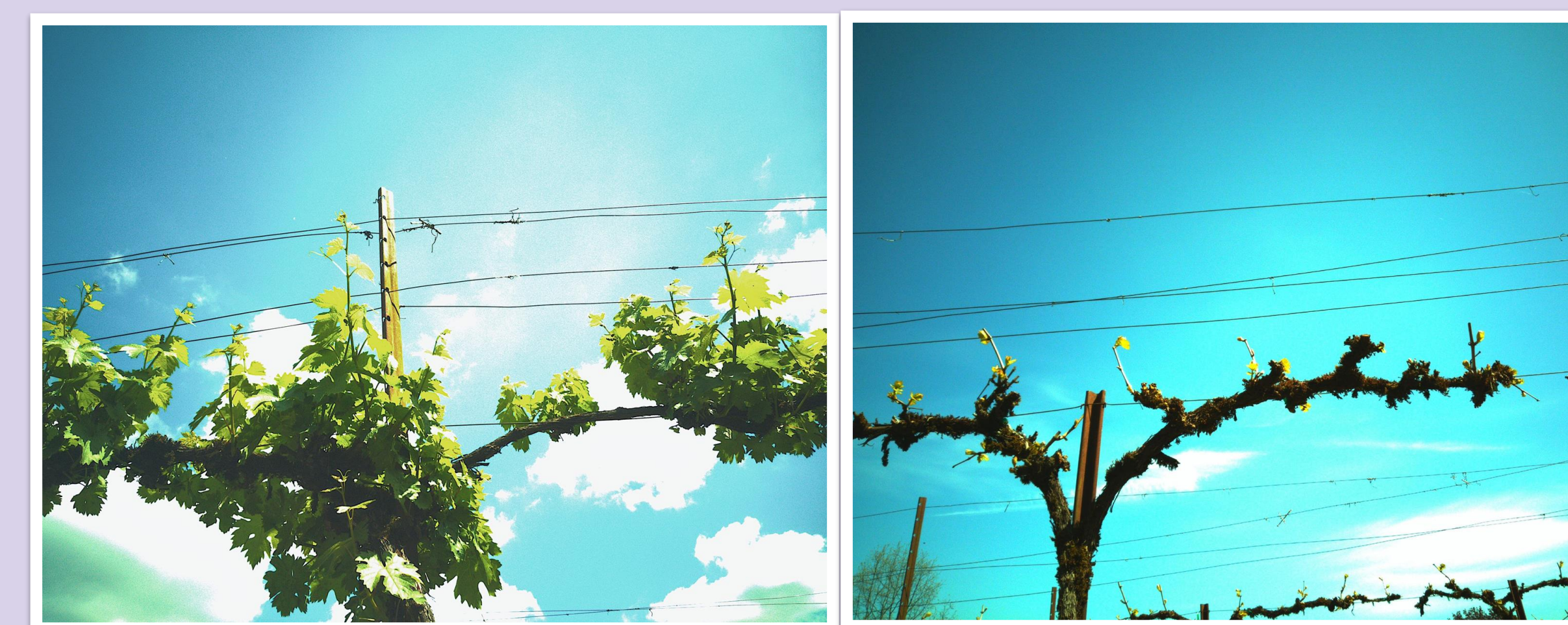
Results

Figure 3: Examples of images taken by the UGV.

Vehicle Performance:

- Travels at 1.25 ft/s
- Captures images every two seconds
- Records temperature and humidity data every minute
- Stores data and images to a microSD card
- Follows path provided by path-planning software
- Detects surrounding vines and keeps the UGV on the path
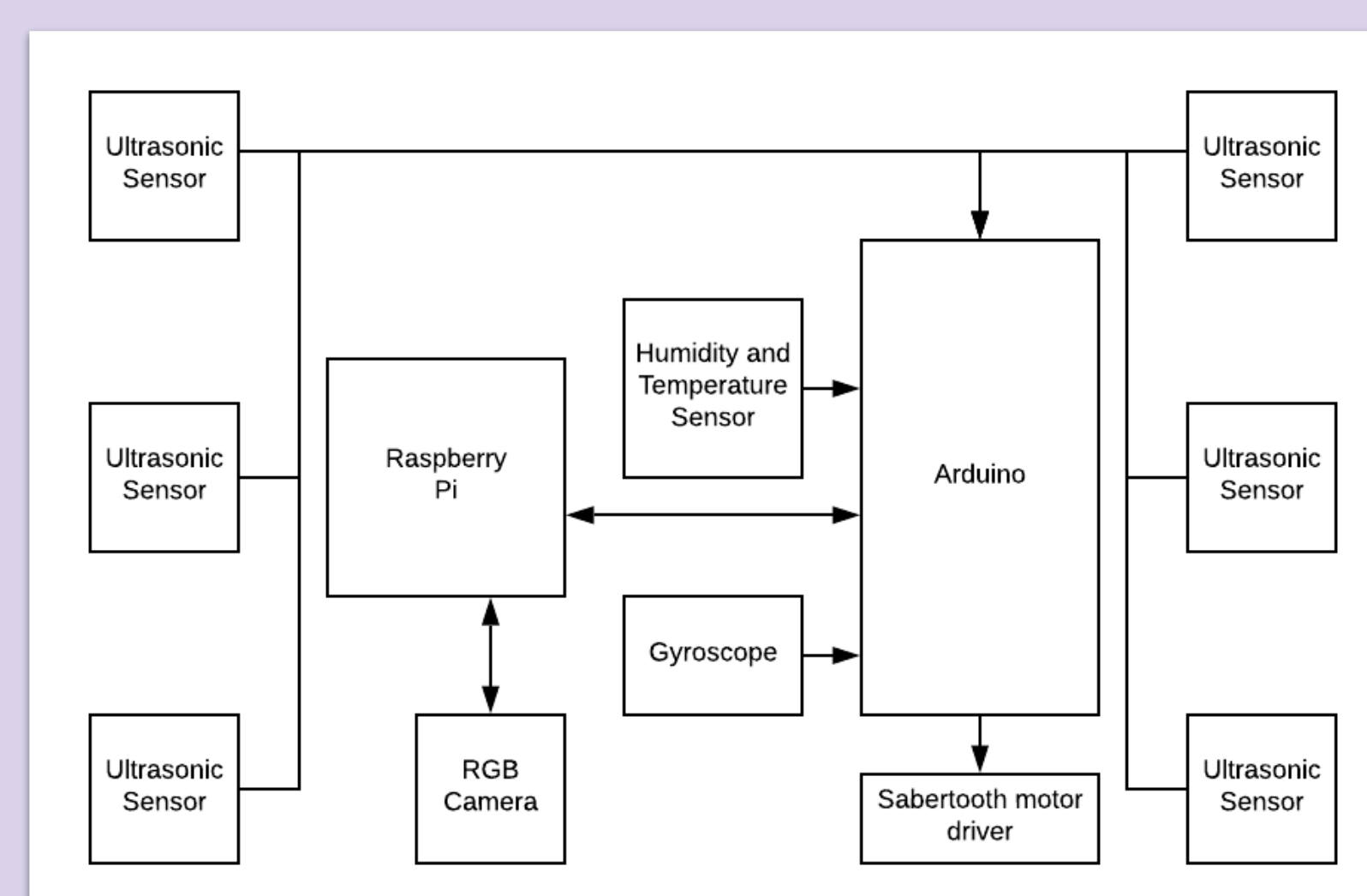- Detects nearby objects and avoids collisions by stopping

UGV Hardware

Figure 4: A block diagram depicting the layout of the vehicle's hardware.

Controllers:

- Raspberry Pi 3 B+
- Arduino Mega 2560
- Sabertooth 2x32 motor driver

Sensors:

- RGB Camera
- Ultrasonic Sensors
- Humidity and Temperature Sensor
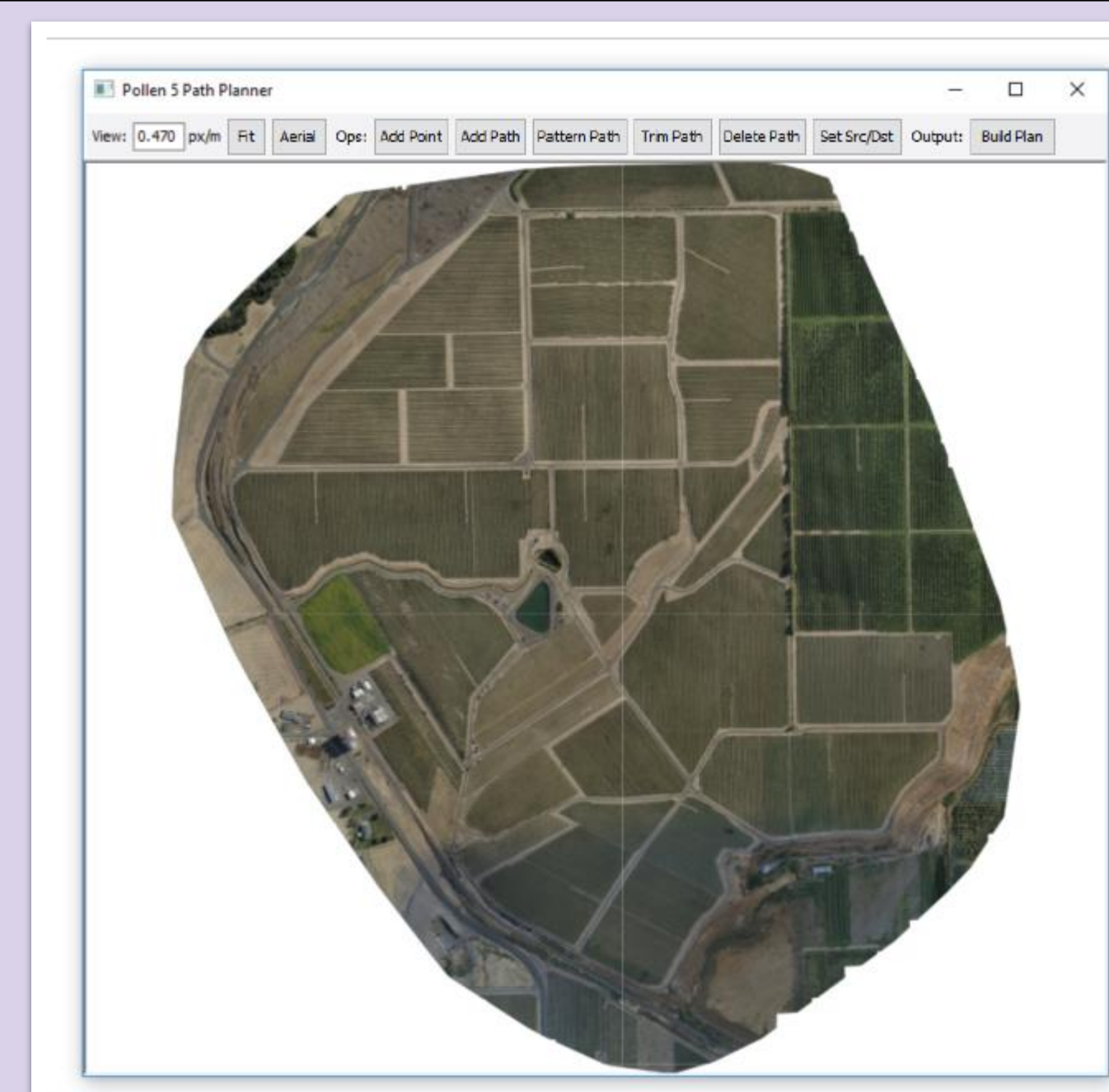- Gyroscope

Path-Planning Software

Figure 5: The user interface of the Path-Planning software.

Software Operation:

- Takes in an overhead image (TIFF) file
- Mark the rows to be traversed
- User indicates the start and end points
- Generates path file readable by the UGV

Future Development

Future versions of the vineyard UGV prototype may include:

- Use of a gyroscope/accelerometer to improve driving accuracy
- User-alert system through wireless communication with a tablet while surveying
- On-board image processing
- Lights designed for night-time operation of the vehicle
- A weatherproof exterior

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