
Statement of Work (SOW)

Project: *Field Phenotyping Rover*

GENERAL INFORMATION

- 1.0 Scope of Work:** *The goals are to quickly and accurately phenotype corn plants in the field in order better understand their growth under different agronomic and environmental variables.*
- 2.0 Background:** The project requirement is a field phenotyping rover/robot that can be driven through corn fields with row spacing of 25-30 inches and record video/images of the corn plants from the front, both sides, and the top of the rover looking upward. The rover must also be capable of recording LIDAR data that captures the plants on both sides of the rover starting from the ground to the height of the plants. The rover must be programmed to be driven by someone walking behind, but not attached to it, as well as to drive itself semi-autonomously for a single pass in the field (with someone following it and stopping it in case of emergency). The rover must have onboard integrated GPS with RTK compatibility, and this data must be recorded to tag the imagery and LIDAR data taken. The rover must have 4-wheel drive and the wheels, as well as the whole rover, must be rugged enough to withstand the conditions of a crop field (crop residue, dust, mud, bumps, high temperatures and humidity, sunlight). The software for running the rover and uploading data from the rover to the cloud must be included and fully functional. Support services and warranty for at least one year must be included. The company must also be able to demonstrate that comparable data from the rover can be processed to extract meaningful results, although the actual costs of processing of the data do not have to be included in the purchase. The field phenotyping rover/robot for agricultural row crops needs to be manufactured by EarthSense, Inc and be the 2023 TerraSentia Robot in order to be compatible with another TerraSentia robot that has already been purchased.

CONTRACTOR REQUIREMENTS

3.0 Technical Requirements/Tasks:

The phenotyping rover must be fully integrated, including appropriate software, and functional upon delivery. No assembly or engineering should be needed to make the rover functional. The rover must include the following specifications and sensors:

- a) 4 wheel drive body no wider than 20 inches. The rover must be 4-wheel drive and capable of maneuvering in dirty, dusty, muddy environments.
- b) Onboard integrated computer that controls the movement of the rover and controls and receives data from the attached accessories described below. Rover must be capable of storing the data gathered from accessories and uploading that data to cloud computing resources over wi-fi or ethernet cable.

- c) At least 3 Gimbal Stabilized UHD (or higher quality) cameras with LED illumination (for dark understory imaging). The three cameras must be positioned so as to record data from the front and both sides of the rover and at variable angles (-30 degrees to +60 degrees relative to the plane of the ground the rover is driving on).
- d) 2 or more LIDAR sensors. One sensor must be mounted to capture data in front of and on both sides of the rover on the same angle as the plane of the ground. The second must be mounted to capture data on both sides and above the rover at a 90 degree angle to the plane of the ground.
- e) Upward facing fisheye camera for recording videos of the underside of the canopy.
- f) Integrated GPS with RTK capability for use in tagging video and LIDAR data GPS points.
- g) All accessories described above must be mounted and integrated with rover body as well as the computational systems of the rover.
- h) Handheld tablet or other means for controlling the rover while driving it in the field.
- i) Software for controlling the rover, driving it through the field and recording data at the same time (in an autonomous or semi-autonomous way), and recording metadata manually.
- j) Software and Technical Support for minimum of 1 year
- k) Minimum 1 year warranty
- l) Delivery by August 3, 2023

4.0 Government Furnished: *None*

5.0 Deliverables / Schedule:

Fully integrated and functional phenotyping rover delivered by August 3, 2023. Deliver to 269 Ag Engineering Bldg 1406 E Rollins St. Columbia MO 65211

6.0 Travel: *None*

7.0 Contractor's Key Personnel: *None*

8.0 Security Requirements: *None*

9.0 Data Rights: USDA-ARS retains all rights to data generated by the rover/robot. Company may use data provided to them by the rover for internal improvement of its products and services.

10.0 Section 508 – Electronic and Information Technology Standards: *None*