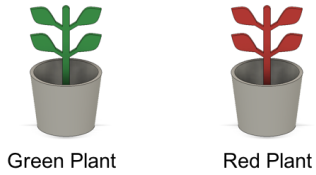
2019 ASABE Student Robotics Challenge
Tentative Event Challenge

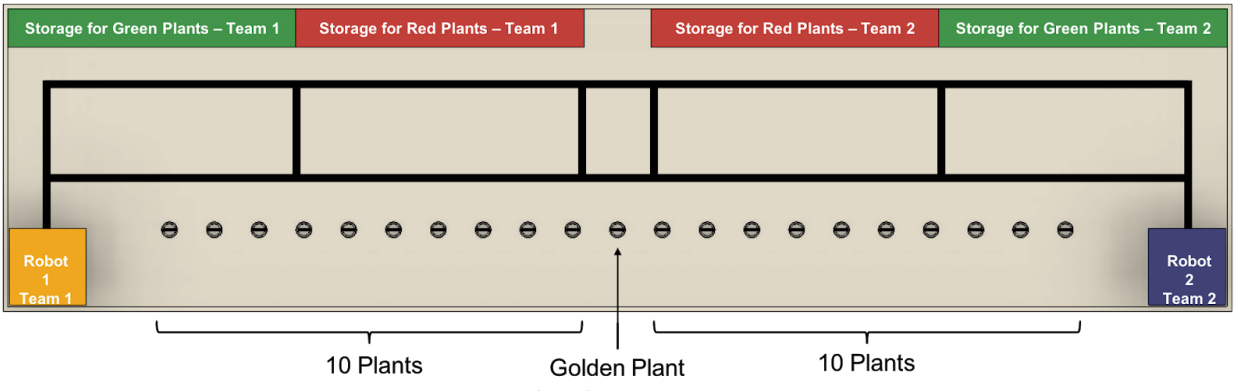
The committee responsible for designing and implementing the 2019 ASABE Student Robotics competition is working diligently to design the event. The goal is to provide a final set of rules and regulations in November 2018. We recognize that the school year has started and that teams are anxious to get started with the design and construction of their robot.
To enable teams to begin planning, here are some tentative details for the 2019 event that will be held in Boston, Massachusetts. Please recognize that more details will be forthcoming with the release of the official rules in November.

Goal: Teams will be challenged to design a robot that will conduct autonomous inventory management and selective fertilizer application in a plant nursery.

Playing Field: Both the advanced and beginner divisions will have a playing field that is 4ft x 16ft and can use only one robot to complete the challenge. Below are the layouts for the two divisions. There are 21 simulated plants on the board and robots need to identify them and move them to the storage area. One plant, called the "Golden Plant," will be placed in the center of the board and will have extra points for the robot that collects it first. The competition will be divided into a "Beginner's" and an "Advanced" division. The Beginner's division is mainly geared towards undergraduate students with limited coursework in programing or microprocessors, while the Advanced division will be targeted towards upperclassmen and graduate students majoring in robotics or remote sensing. For the beginner division, there are two types of plants identified with green or red colors. Beginner robots need to identify the plants' color and move them to the correct storage location on the board. There will be black tape (as indicated below) on the board to aid the beginner teams with navigation.



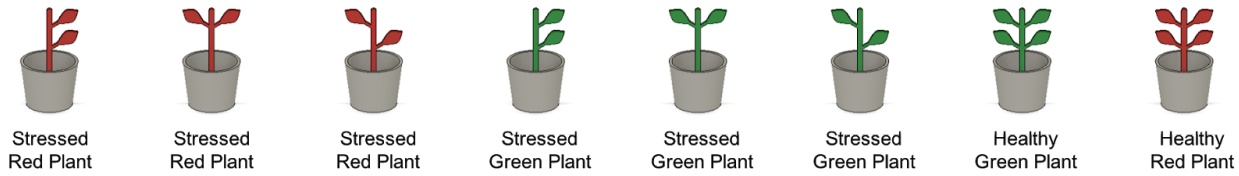
Two types of plants for the beginner division



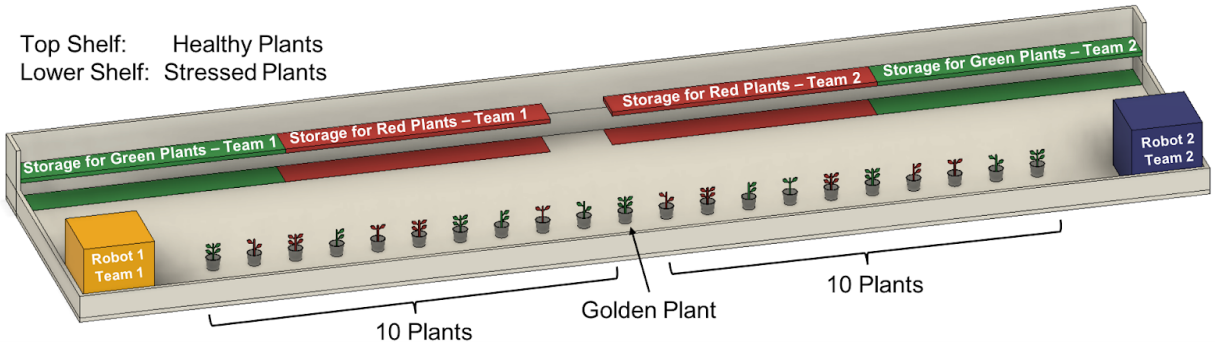
Playing field for the beginner division

For the Advanced division, there are two types of plants (red and green). However, the number of leaves per plant will vary: plants with four leaves will be identified as healthy plants while plants with two leaves will be identified as stressed plants. Moreover, the arrangement of the

leaves in stressed plants will vary. Examples of the possible arrangements are shown below. The advanced robots need to identify the type of plant (color) and monitor them for stress (number of leaves). If stress is detected in a plant, the robot will need to apply fertilizer before placing it in the storage area. The blueprints of pots and plants will be provided so that teams can 3D print them for practice.



Different types of healthy and stressed plants for the advance division



Playing field for the advance division

The board for the advanced division has the storage area arranged in two shelves. The advanced robot needs to place the healthy plants on the top shelf and the stressed plants on the lower shelf. No black tape will be placed on the board for the advanced robots.

Scoring:

The competition will be held in a tournament format and in each match two teams play against each other. Rounds will be won based on the number of points each team scores in that round. The type of tournament will be decided based on number of teams registered for the competition. Points will be earned as follows:

- Beginner
    - 1 point per plant that is moved to the storage area (must be upright)
    - 1 extra point per plant that is moved to the correct location in the storage area
    - 3 points for the golden plant hat is moved to the storage area (must be upright)
    - 2 extra points for the golden plant that is moved to the correct location in the storage area
- Advanced
    - 1 point per plant that is moved to the storage area (must be upright)
    - 1 extra point per plant that is moved to the correct location in the storage area
    - 2 extra points per stressed plant that is correctly identified and fertilizer applied.

- -2 points per plant that is incorrectly identified as stressed or not stressed and fertilizer incorrectly applied (either applied to a non-stressed plant or not applied to a stressed plant).
- 5 points for the golden plant that is moved to the correct storage area (must be upright)

Cost Controls and Processing Power:
Devices such as consumer-grade computers, laptops, NUC-like devices, smartphones, tablets, or gaming devices may not be integrated into robots for the 2019 competition. Wireless communication to the robots may be restricted or completely outlawed. Following are the metrics that will be utilized per processor and RAM restrictions:

- **Processor Restriction:** In an effort to level the playing field and reduce costs for teams, processor restrictions will be implemented for the 2019 competition. The processor restrictions are as follows:
  - Processors may not be embedded in consumer- or enterprise-grade electronics, such as laptop computer, NUC-like devices, tablets, mobile phones, or gaming devices.
  - Processors and RAM will be limited based on a credit allocation system.
    - Teams have a total of
      - 6 credits to utilize per robot for beginner teams and
      - 8 credits to utilize per robot for beginner teams.
    - Teams may utilize the credits in any manner they wish for either the processor or RAM. Credits will be allocated in the following way:
    - 1 credit for each 1.0 Ghz of processing speed, rounded to the nearest 0.10Ghz of manufacturer stated clock speed.
    - 1 credit for each 1.0 Gb of RAM, rounded to the nearest 0.10Gb of manufacturer stated RAM.
  - Teams must present detailed manufacturer-supplied spec sheets of any Ram or processors at the time of the competition. Processors and RAM cards must be positioned on the robot such that they can be visually inspected by the judges during the competition.