Project Cyclops

Introducing All New Laser Killing Weeds

In Collabration with

FarmBot Inc and Center of Excellence Aritificial Intelligence and Robotics

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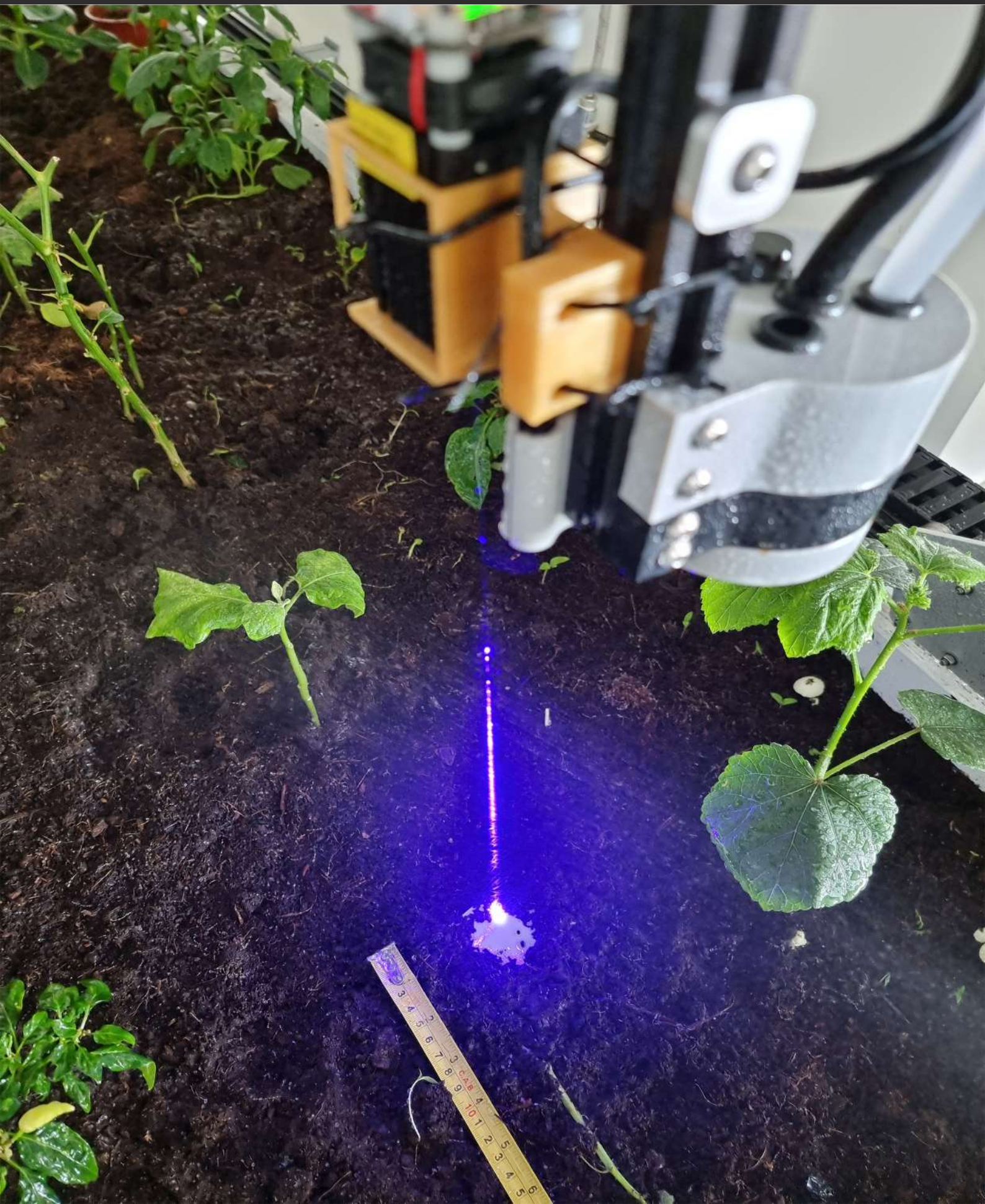


Acknowledgement

The Project Cyclops was possible due to our own hard work and the help and support of friends, family and members of the Farmbot and Center of Excellence of Ai and Robotics. We take this opportunity to acknowledge their help and thank them for their assistance

We would like to thank Director of Robotics & Artificial Intelligence at GEMS Education, Mr. Sreejit Chakrabarty, for his never-ending support and trust in our capabilities. He has been a great person throughout the history of the Project and gave us access to the farmbots to work on the project

Huge thanks to Mr.Ram Kumar who has helped us throughout the Project by sourcing the parts and helped us in teaching us on how to use different prototyping machines such as 3D printing

Special thanks to Marc from Farmbot who believed in us and helped us on working on this project and Farmbot Community

And last, but not the least, special thanks to Center of Excellence : Artificial Intelligence and Robotics who gave access to their labs and farmbot for the project

Team of Project Cyclops thanks each and every one of you for your valuable contributions.

Acknowledgement

Mr. Sreejit Chakrabarty
GEMS Education

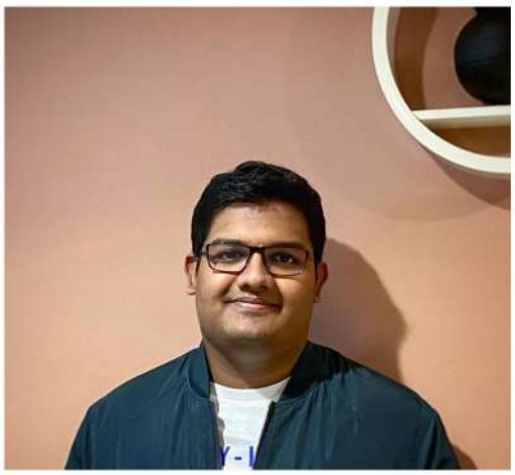
Mr.Ram Kumar
GEMS Education

CENTER OF EXCELLENCE
ARTIFICIAL INTELLIGENCE & ROBOTICS

FarmBot

Meet the Team

Rahul Arepaka
Project Lead and Designer
1st Year - MU



Sanjay Pramod
Farmbot Sequence Programmer
1st Year - NTU

Ethan Hadimani
3D Mount Designer
1st Year - ASU

Atin Sakkeer
Programmer
1st Year - NUS

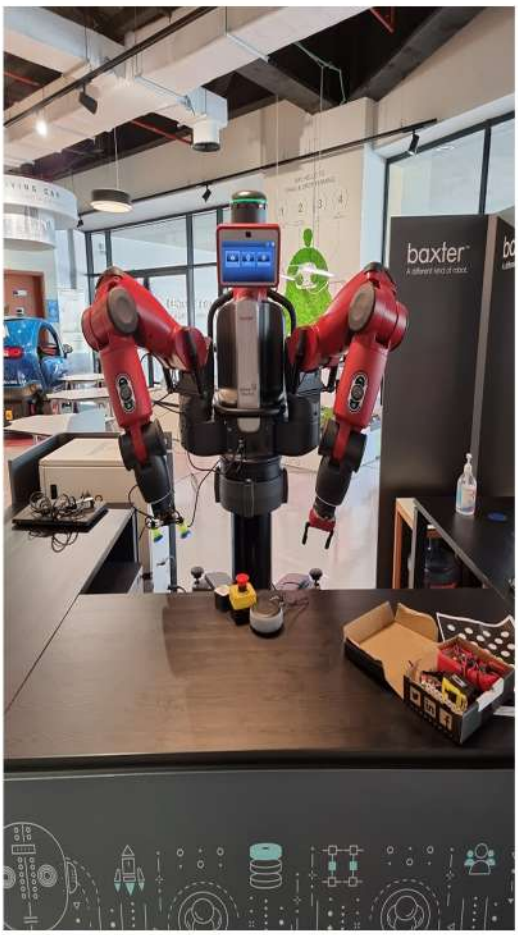
CENTER OF EXCELLENCE
ARTIFICIAL INTELLIGENCE & ROBOTICS

FarmBot

Ai Lab | Farmbot - DAA

FarmBot - DAA

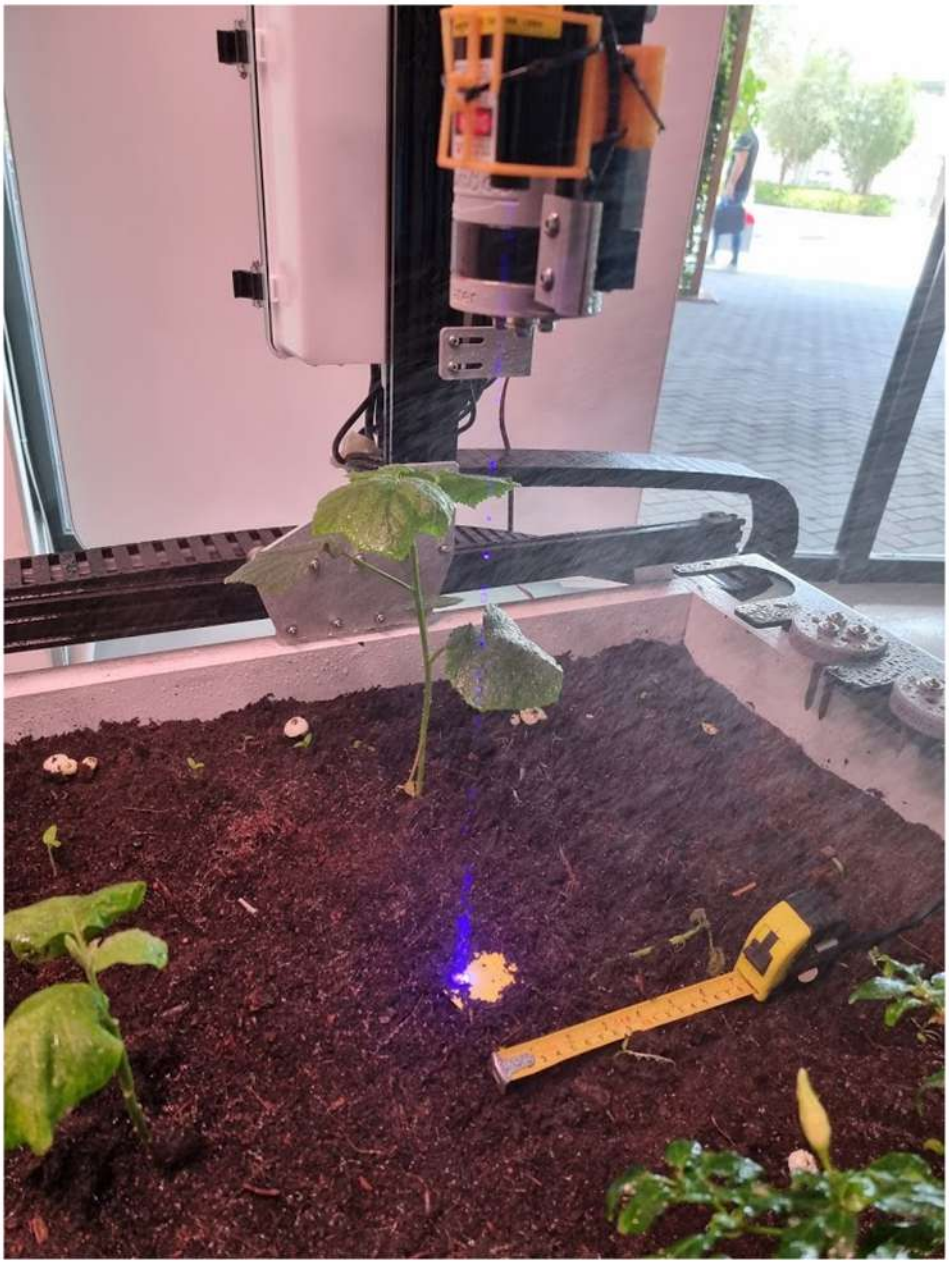
Makerspace - DAA



Baxter - DAA

Self Driving Car - DAA

FarmBot Laser Weeder Tool



Ready to Destroy weeds FASTER and BETTER !!!

This is all-new laser killing weed removal for the Farmbot designed by our team. This tool is designed to destroy weeds using Thermal Technique : Laser by detecting weeds using Camera and weed detection

Specific Design Details

LASER POWER
500 mW

WAVELENGTH
405 nm

INPUT VOLTAGE
12v DC

INPUT CURRENT
5 Amps

BEAM SHAPE
Dot

Size
33 mm x 33 mm x 50 mm

COOLING
5V Fan and aluminium Heatsink

COLOUR
Blue- Violet Laser

MODEL
FB03- 500 PMW

Manual Weed Removal

The current process of removing weeds is manual process by identifying the weeds and removing them is extremly tiring and time-consuming

Disadvantages :

- Removing incorrect plants
- Time Consuming Process

Weeder on Farmbot

It works by driving the tool vertically into the soil in order to push any small weeds under the soil, and disrupt their young fragile root systems

Inspiration to Project Cyclops

The experiment showed that laser treatment of the apical meristems caused significant growth reduction and in some cases had lethal effects on the weed species

The biological efficacy of the laser control method was related to wavelength, exposure time, spot size and laser power

Solvejg K. Mathiassen, Thomas Bak, Svend Christensen, Per Kudsk,
The Effect of Laser Treatment as a Weed Control Method,
Biosystems Engineering

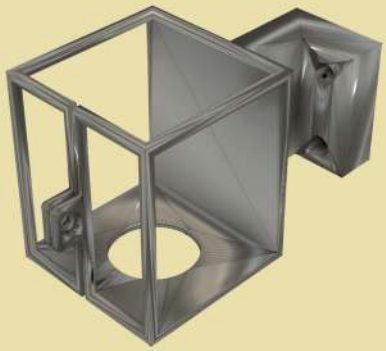
https://www.sciencedirect.com/science/article/pii/S1537511006002984

About Farmbot

FarmBot is a robotic open hardware system that assists anyone with a small plot of land and a desire to grow food with planting, watering, soil testing, and weeding it. It uses a raspberry Pi, Arduino, and other awesome components, including weather resistant materials. Currently, there are over 300 devices in operation all around globe.

Laser Killing Weeding Tool

The Camera will detect for weeds and give those coordiantes to the farmbot and give add/subtract the off-set of the laser mount location and turn on the laser for 500ms and spray water on the location to complete the sequence



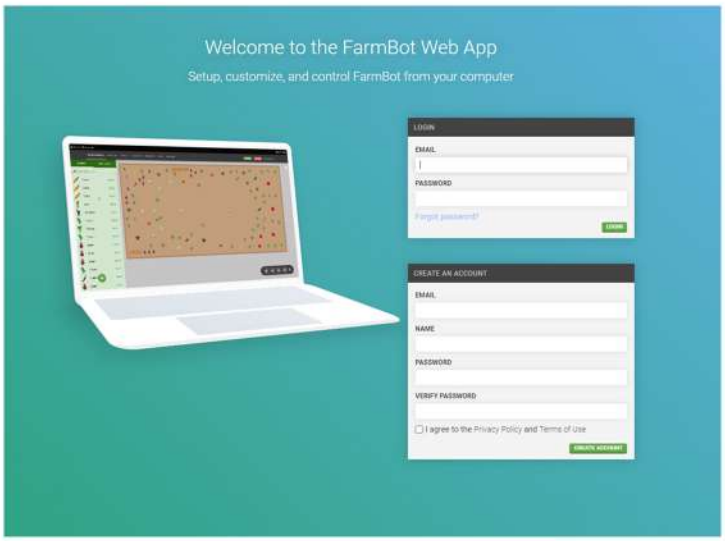
Programming using Arduino

Step 1 : Connect Arduino to the Computer using the usb cable
Step 2 : Open Ardunio IDE and Write down the below code
Step 3 : Verify the code and Upload the code the arduino by selecting the COM port

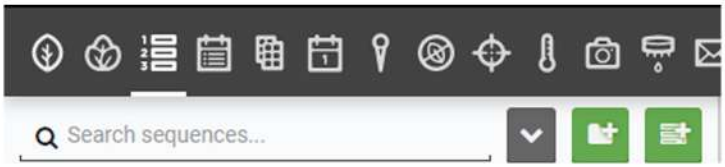
```
int relaypin = 6;

void setup(){
  pinMode(relaypin,OUTPUT);
}


void loop(){
  //digitalWrite(relaypin, HIGH);
  //delay(1000);

  digitalWrite(relaypin, LOW);
  //delay(1000);
}
```

Programming using Web App

Step 1 :
Visit the Website my.farm.bot and login using farmbot account details



Step 2:
Select on the sequences icon from the webapp and select new sequence



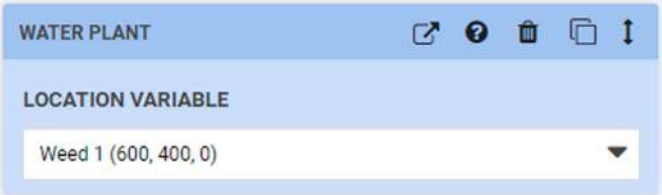
Step 3:
Upon clicking on the new sequence,then click on “Add Command” and then select “Move” and choose weeds from the drop-down list

Step 4:
Click on “Add Command” and then select “Control Pheripheral” and choose Port where the Laser is connect,choose Digital Mode and set it to “ON”

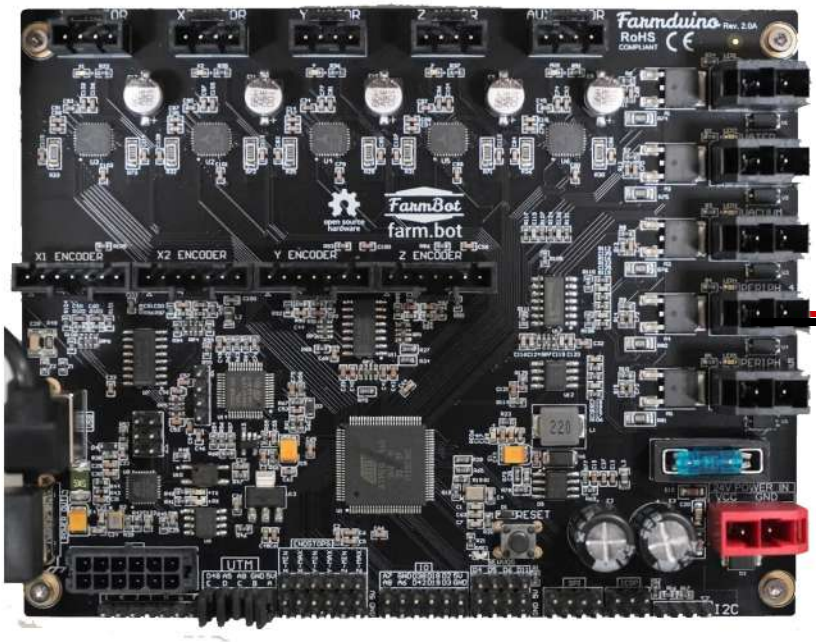
Step 5:
Select on the “Add Command” and choose “WAIT” command and input 500ms (ie, 5s)

Step 6:
Select on the “Add Command” and choose “Choose Peripherals” and select the Pheripherals port and set mode to “OFF”

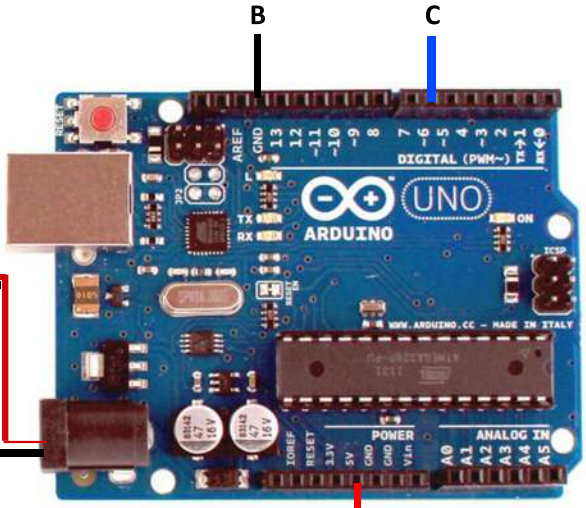
Step 7:
Select on the “Add Command” and choose “Water Plant” and choose Weed Location from the drop-down list



Wiring



Farmduino

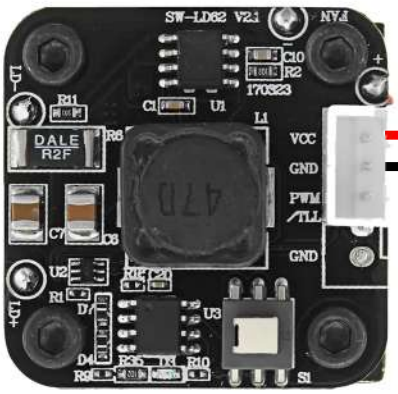


Ardunio UNO

A

5V Relay

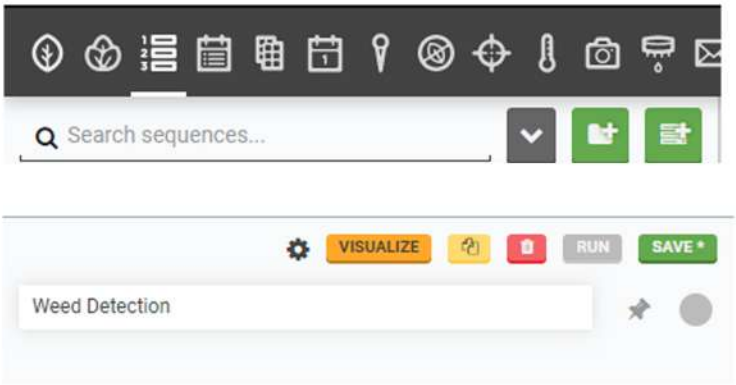
Power Supply Stepdown 12V 30A



Laser FB03-500 Control Board
TTL/PMW

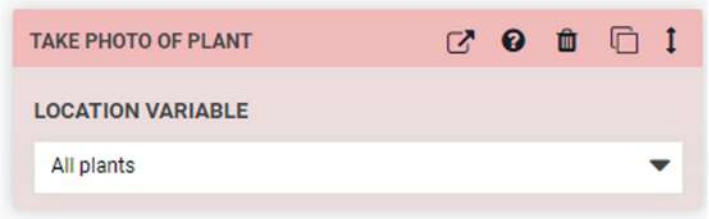
How Does it Work ?

Step 1 :
On the Farmbot WebApp and click on sequences and create a sequence called “Weed Detection”

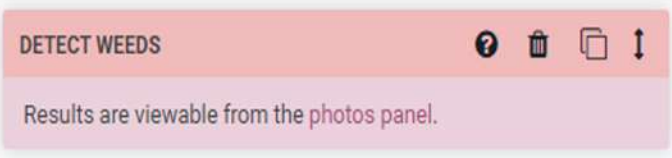


Step 2:
Select “Add Command” and choose Find Home to calibrate the farmbot location to home

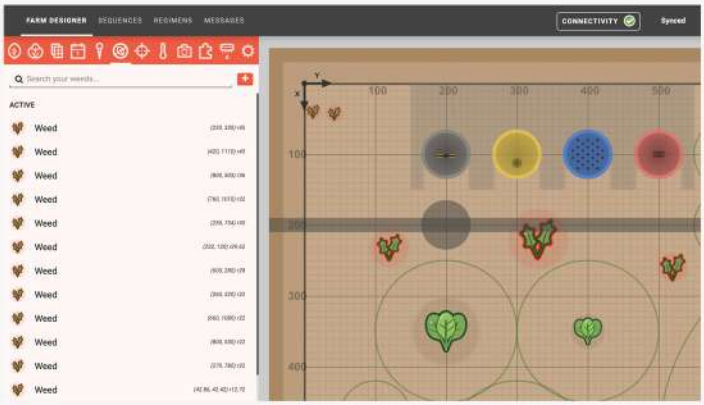
Step 3:
Upon clicking on the new sequence,then click on “Add Command” and then select “Take a Photo” and choose “All Plants” from the drop-down list



Step 4:
Click on “Add Command” and then select “Detect Weeds” and then automatically the weeds points will be created on the Farmbot Webapp

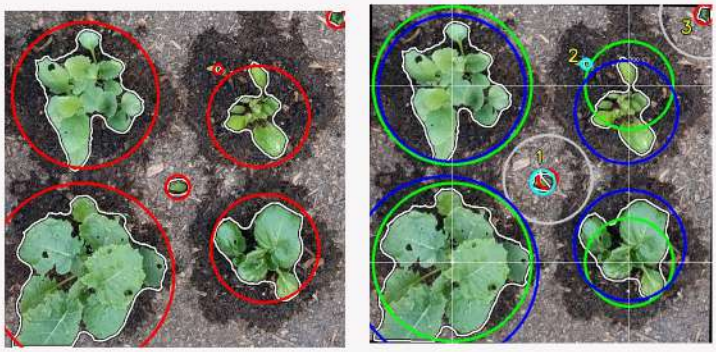


Step 5:
Select on the “Weeds” from the WebApp and you can find list of active weeds



Step 6:
Run the New Sequence Created to kill the weeds using laser

Weed Detection

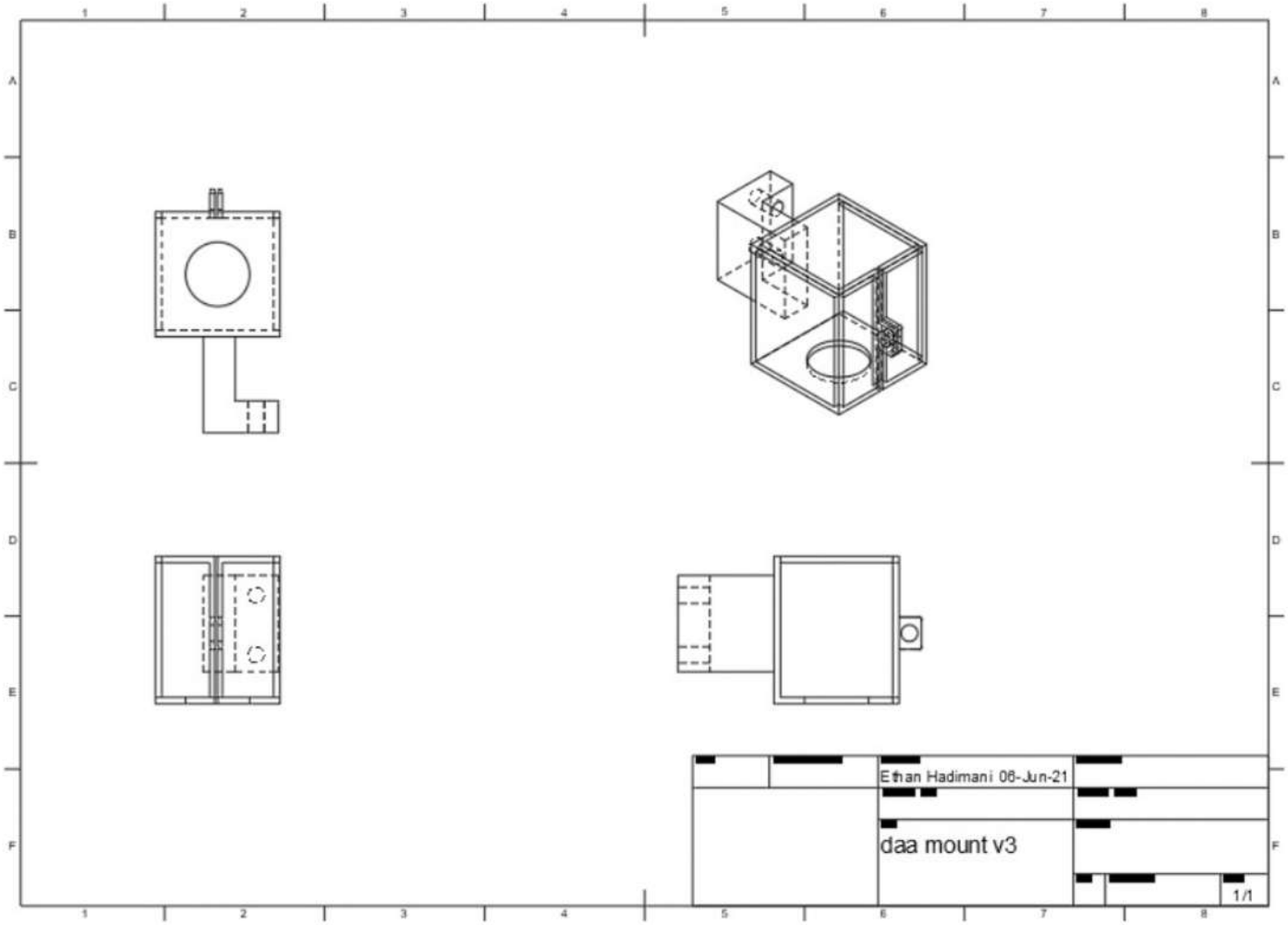


```
7 plants detected in image.

4 known plants inputted.
Plants at the following machine coordinates ( X Y ) with R = radius are to be saved:
    (   600   400 ) R = 45
    (   600   500 ) R = 45
    (   700   400 ) R = 25
    (   700   500 ) R = 25

2 plants marked for removal.
Plants at the following machine coordinates ( X Y ) with R = radius are to be removed:
    (   743   541 ) R = 6
    (   654   447 ) R = 6

2 plants marked for safe removal.
Plants at the following machine coordinates ( X Y ) with R = radius were too close to the
    (   651   446 ) R = 7
    (   676   512 ) R = 3

4 detected plants are known or have escaped removal.
Plants at the following machine coordinates ( X Y ) with R = radius have been saved:
    (   700   410 ) R = 31
    (   596   396 ) R = 53
    (   698   485 ) R = 29
    (   600   499 ) R = 42
```

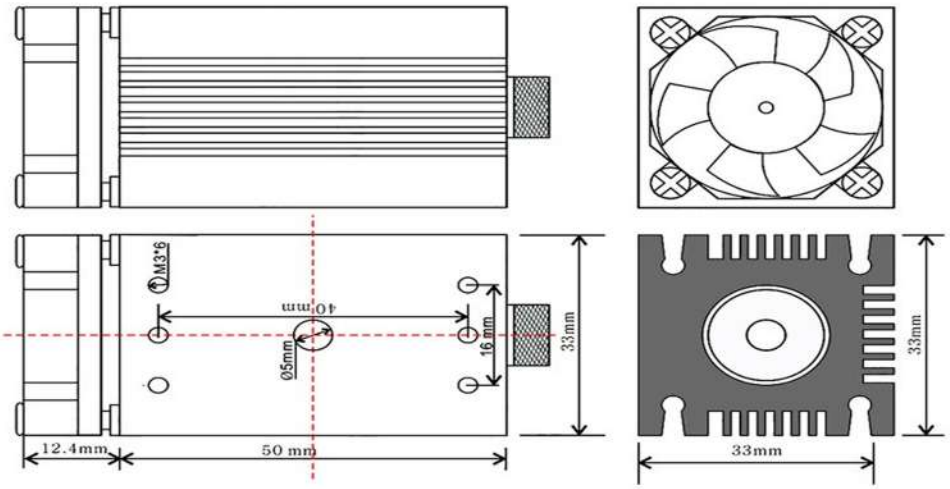

https://software.farm.bot/v14/The-FarmBot-Web-App/photos/weed-detection.html

Drawing

Drawing of Laser Mount



Drawing of Laser FB03-500



Farmbot Laser Weeder