Group 5: Electric Weed Control

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Table of Contents

[1] Executive Project Summary 3

[2] Protocols and Standards Table 4

[3] Engineering Requirements 5

[4] Project Timeline..8
[4.1] Internal Timeline 8
[4.2] External Timeline...9

[5] Risk Assessment 10

[6] Risk Register Summary.... 11

Executive Project Summary

For many people, unwanted weeds grow very commonly in spaces such as driveways, sidewalks and even cracks in the roads. It can be difficult or time consuming to manually kill each and every weed growing in undesired places. This project will make that much easier, it will get rid of all the weeds in a very environmentally friendly way by electrocuting the weeds to kill them using a probe.
After contact between the probe and the plant, the current flowing out of the system will cause the plant to naturally resist, which will cause the water inside to boil, therefore killing the plant.

The project will be using a probe that would electrocute weeds using a high voltage that is stepped up using a transformer. Its main power source would be a power supply, then stepped up using a voltage booster. It should have sensors that will read the data which will then be sent automatically to the user. The developers are in charge of building the device and coding it if needed, and the project partner will give feedback, and specific requirements.

The project developers will update the project partner with bi-weekly progress videos that include all the work that has been done so far by each individual, as well as all designs and prototypes developed. The partner will give feedback and instructions as desired.

The project developers need to have a solid timeline to stay on track with their progress, all deadlines need to be determined as follows:

Term	**Progress**
Fall	• Learn project scope. • Finish all research about the system, the plants and start making plans on building the system. • Create a block diagram with 3 blocks for each group member. • Start individual work on blocks. • Grow plants for the testing process • Make a 30 minute presentation
Winter	• Start building the system. • Start the testing process. • Make adjustments as required. • Create a project poster for the Ece44x class.
Spring	• Finalizing the system. • Final Testing • Finishing the project website. • Presenting the project at the engineering expo. • Making a summary video.

The final product is a system that should kill the weeds by electrocuting them using a handheld probe. It should have enough power to do so through all weather conditions, and should be designed in a way that can later on be added into a small automated system such as a vacuum robot.

Protocols and Standards Table

Topic	Protocol	Standard
Task Management	How tasks and responsibilities will be divided up among the group members	Tasks and work division will be verbally decided. Team members will say with work they wish to do, and if there's conflict to come to a compromise or both members work on it together.
Filing structure	How does the team store the information for the project? How is the research and documents stored where all members have access to?	Documents, research notes, and team meeting notes regarding the project (each will have their own folders) will be placed into a shared Google Team Drive Folder
Team Note Etiquette	How team notes should look	Team notes will be recorded in the Google Docs folder while the meeting goes on. One team member will be the recorder (the member who records can change based off who wants to)
Google Drive Folder	How should the Google Drive look	Each document or notes must be titled properly and placed in their correct folder.
Attendance/Absences	What is the rule on meeting attendance, and what to do if someone is absent from a meeting	The general rule is to attend all meetings, whether it's just the team, or if it's with our Project Partner. It's a general practice within the group to find a time that works for everyone. If something were to come up, and a member couldn't make it, they would let another team member know before the meeting.
Progress Dates/Deadlines	When work should be completed	Work should be completed before the due date, with minimal changes/edits needed.
Communication	How does the team communicate, and in what manner do they communicate?	The team mainly communicates over WhatsApp, since one of our members is out of the country. Communication between members is to be respectful. This includes not talking over each other.
Work Ethics/Checks	What is the standard in terms of work on documents	Work on the documents should be done to the person's best efforts
Project management	A method for updating the project	The team will keep each other in

	management plans as the project develops	check as the project develops. We will also use a Gantt chart to keep things in check
Distribution Structure	describing what information goes to whom, how, and when	Any new information that comes up will be distributed to the team either through WhatsApp, or through email

Engineering Requirements

<u>Boost Converter</u> :

Project Partner Requirement: Probe must use high voltage to kill plants

Engineering Requirement: The module will increase voltage from 6V-12V to 5kV-15kV

Verification Method: Test

Testing Process:

1) Input voltage of 6V - 12V is read.
2) Converter steps voltage up to 5kV - 15kV depending on user input.
3) Readout displays desired voltage from 5kV - 15kV

Testing Pass Condition: Boost converter properly steps up voltage and readout displays 5kV - 15kV

<u>Sensors</u> :

Project Partner Requirement: The system should have an autonomous element

Engineering Requirement: Device that collect data every 1/10th of a second

Verification Method: Test

Testing Process:

1) once the device is turned on all sensors would be working
2) Sensors collect and update data in less than a second
3) Results will be given on the LCD screen

Testing Pass Condition: Sensor would update the data every 1/10 of a second giving us update every often

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<u>On/Off Button</u> :

Project Partner Requirement: System must be able to turn On / Off via switch

Engineering Requirement: System must consume 0V and 0A when not in use and draw Voltage and Current when turned on

Verification Method: Demonstration

Testing Process:

1) System must be able to turn on and off using a switch

2) User is able to turn off the system anytime

Testing Pass Condition: System won't use voltage or current until it is On and in use

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Portability :

Project Partner Requirement: The device must be no larger than an average woman's purse

Engineering Requirement: The microprocessor and wiring must be contained in a custom-designed 3-D printed enclosure that is approximately 12" x 6"

Verification Method: Test

Testing Process:

1) An ammeter will be connected to the system and the voltage over time will eventually be read.

Testing Pass Condition: Use of voltage would allow the ammeter to read the voltage and electrocute plants

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Power Supply :

Project Partner Requirement: Project must use a portable power source.

Engineering Requirement: System will use a 3.7V 18650 Li-Ion cell battery pack.

Verification Method: Test

Testing Process:

1) Battery pack is charged to the full capacitance (3500 mAh).

2) Battery pack delivers 6V-12V depending on the user input.

Testing Pass Condition: Readout on voltage input should be within 6V - 12 V.

Interface :

Project Partner Requirement: The system should display data for the user.

Engineering Requirement: Resistance (ohms), current (amperes), temperature (Fahrenheit), moisture (percentage), and oxygen (percentage in volume) levels are displayed on LCD.

Verification Method: Test

Testing Process: 1) System switch is turned on.

2) Data from sensors is displayed on the LCD screen.

3) Users give system owners input on the system interface.

Testing Pass Condition: User easily reads resistance, current, temperature, moisture, and oxygen values that are displayed on screen.

Electric Probe :

Project Partner Requirement: The device used to kill the weeds should be taser-like.

Engineering Requirement: The system will use a high voltage spark gap probe that ranges from 5kV - 15 kV.

Verification Method: Test

Testing Process: 1) Probe electrodes are positioned around the plant stem

2) Voltage is stepped up to 5kV-15kV

3) Plant is "tasered" and LCD displays readout

Testing Pass Condition: Readout on voltage input should be within 6V - 12 V.

Plant Death :

Project Partner Requirement: The system should ensure that the plant is objectively dead.

Engineering Requirement: The system will use a sensitive oxygen detection sensor to compare oxygen readings (percentage) before and after plant death.

Verification Method: Inspection

Testing Process: 1) Plant is tasered with 5kV - 15kV

2) Plant is covered with tissue paper

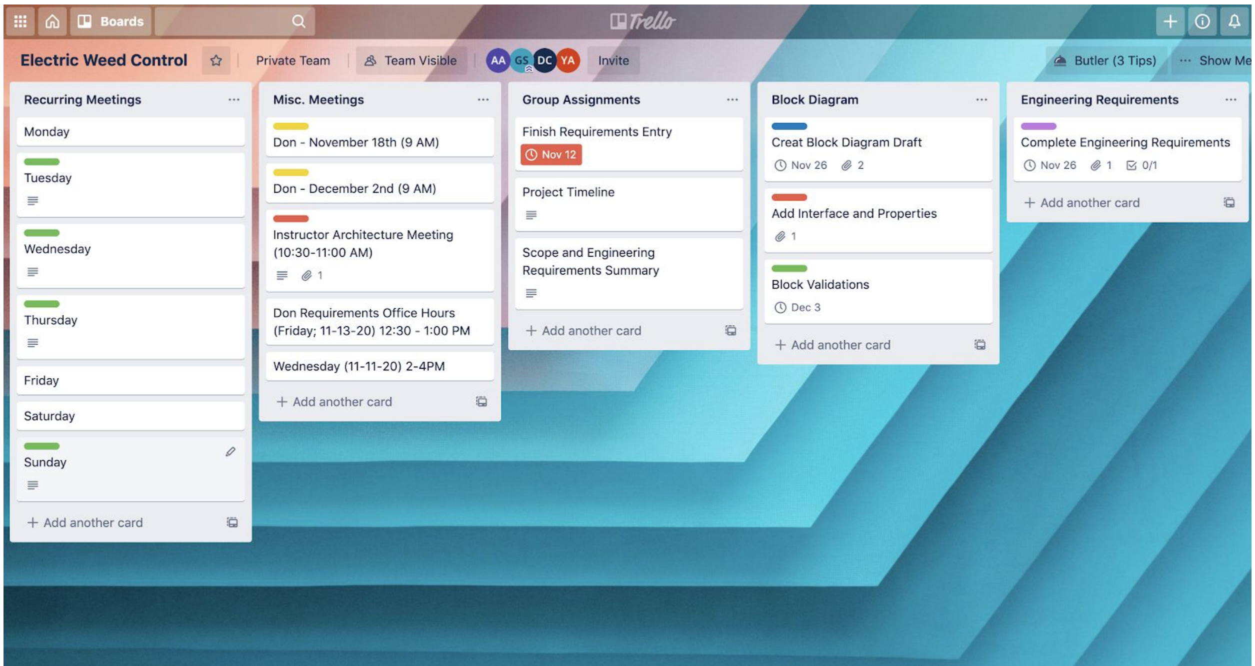
3) 24 hours pass

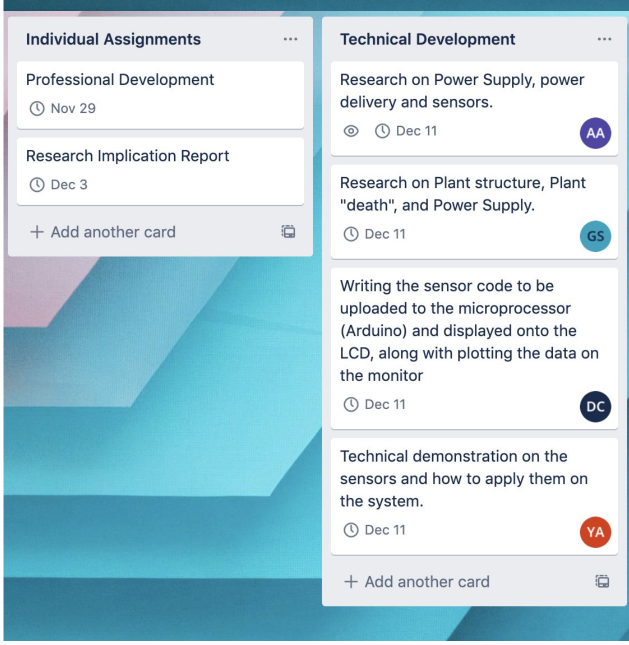
4) Infrared Sensor detects new levels of CO_2

Testing Pass Condition: Readout on voltage input should be within 6V - 12 V.

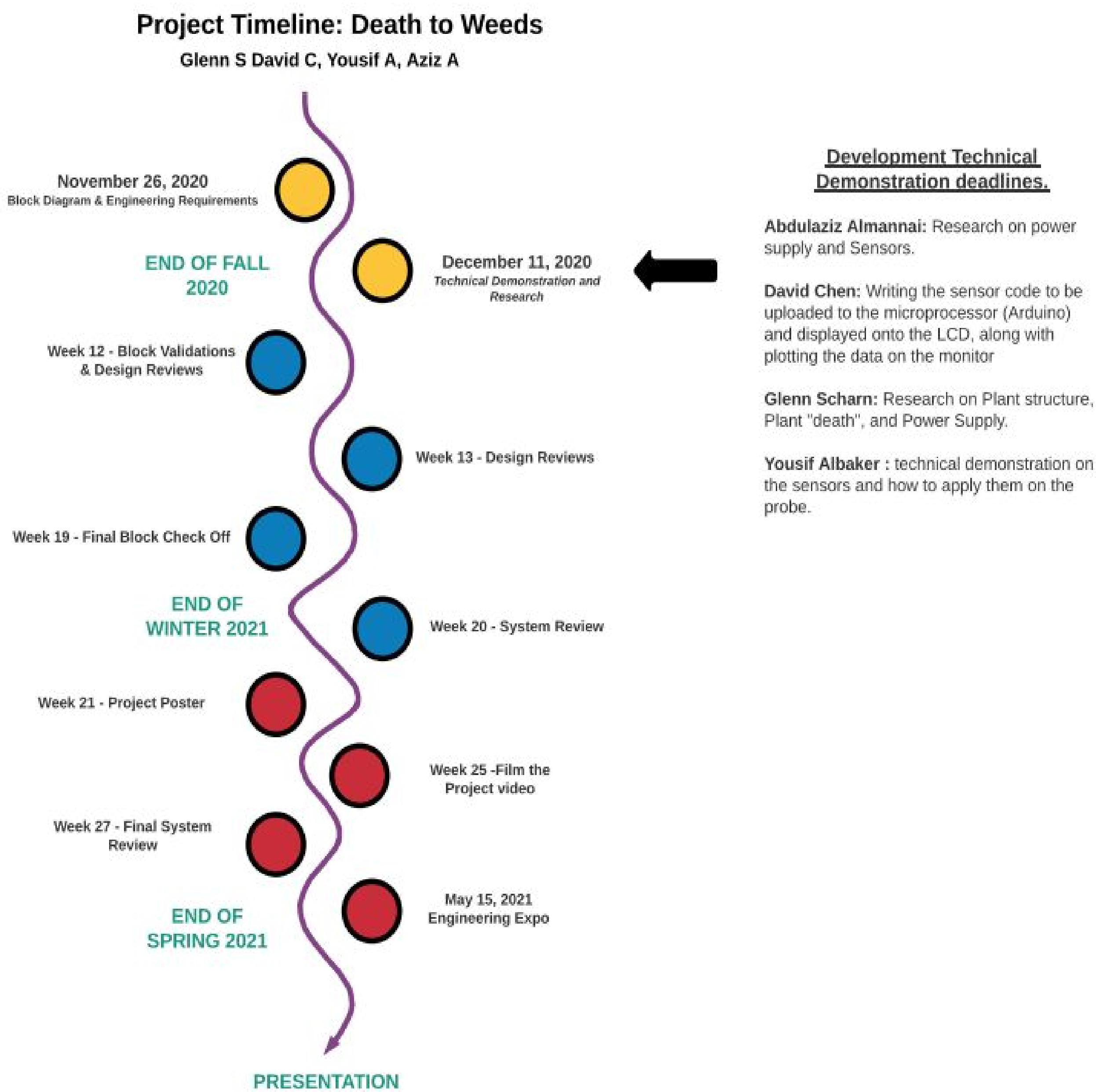
Project Timeline

Internal Timeline





External Timeline:



Risk Assessment

Risk ID	Risk Description	Risk Category	Risk Probability	Risk Impact	Performance Indicator	Responsible Party	Action Plan
Risk1	The team goes over the given budget.	Cost	30%	L	Not looking for parts from different suppliers. Last minute purchasing. Not having a financial plan.	Glenn	Reduce by having one person manage the financials, plan ahead of time what needs to be bought.
Risk2	The team does not communicate properly/well.	Timeline	40%	M	Not staying active in the text group chat causes miscommunications. Everyone works individually without accordinating with group members.	Aziz	Reduce by communicating more often, meeting with group members to update on progress is very helpful. Speaking of problems when they occur straight away.
Risk3	The power delivery system malfunctions.	Technical	20%	L	Using parts that we did not research enough. Building PCB without making theoretical calculations to see if everything works.	Aziz	Get the backup device up and running
Risk4	Plant death does not occur.	Technical	50%	H	Using low voltage boosters. Power supply is not built in a stable way to perform constantly.	Yousif	Reduce by testing everything we build before moving on to next task
Risk5	Having trouble troubleshooting the code or system because of the group being in different countries.	Technical	40%	M	Making a code for a different part than the one used. Not sending the code for testing and adjusting.	David	Retain. This risk can not be eliminated but can be worked with.

Risk Register Summary:

Communication, Voltage booster, Plants Death

Those are the top three risks that we are facing with the project because communication is key and without it there would be chaos and things would not go accordingly, meanwhile the voltage booster and the plants death are related to each other because if for example the voltage booster malfunctioned and did not draw enough voltage for the taser gun to use then the plants would not be electrocuted and would not be killed from one hit and might require more than one zap in order for it to completely dry up resulting in its death.