STUDENT PROJECT FUNDS APPLICATION SUMMARY

This form serves as a cover sheet for your actual proposal. It is required of all applicants.

NOTE: 1) This form must be typed or neatly printed. 2) Do not say "See Attached" when asked for information. At least a summary of the answer is required. 3) Include the checklist. 4) Submit the original and one copy of the entire proposal using this form as the cover sheet on each. 5) Submit the original to the Cowell Provost Office before 3:30 pm on or before the deadline. 6) Keep a copy for your records.

Name of Lead Student: Mark Moreno

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Complete Mailing Address: 1398 Pacific Ave, San Leandro CA

Project Title: Vertical Farming utilizing technology

Project Category:

Research (Specify academic area) Agriculture and Computer Science

Brief Abstract (Please limit length to this space): This project aims to build a farm that utilizes space vertically rather than horizontally, which results in a greater yield for the amount of space given. This design will grow products on vertical pillars and use a hybrid of sunshine but primarily led lights for lighting. The farm will require no soil, and plants will receive water and nutrients from a mist sprayed at their roots. This design will use a substantial amount of less water compared to a conventional farm. This farm will be built to produce leafy green vegetables, and through learning and modification, it will later be utilized for different types of crops. The product grown from this project could be distributed and sold locally.

Total Budget for this project: $15,000

Funds requested/received from other sources*: $[redacted]

Amount requested from Student Project Funds $[redacted]

*If no other funding has been received or requested, please explain what efforts have been made.

Are you willing to release your proposal and the results of your proposal as sample material for others writing proposals?

Include one copy of this sheet with your original proposal.

Grant Proposal

Vertical Farming

image-asset.jpeg

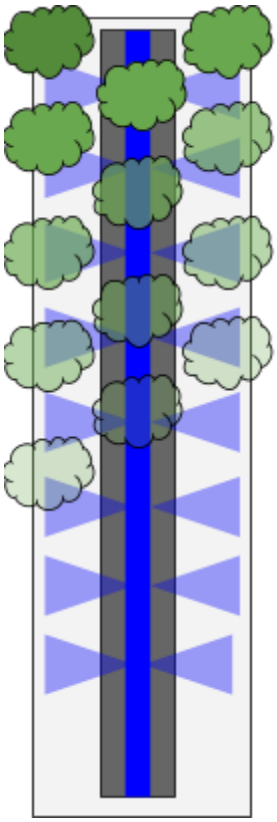
Project Summary

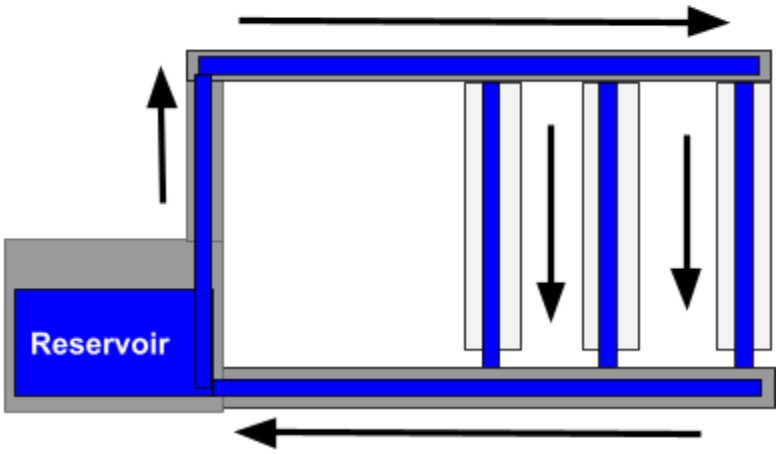
Vertical Farming is not a new concept and has already been established with rewarding results. My goal with this project is to build upon current designs to make these systems more resource-efficient and yield higher quality products. My plan will achieve these results by utilizing solar power, circular irrigation, and natural sunlight. This design will also use machine learning to estimate how much light is required and discover what concentration of nutrients are required for optimal growth. I want to demonstrate that it is possible to create an effective design at a low cost.

Methods

This project will aim to minimize costs by using relatively inexpensive building materials. The most expensive part of this design will be Solar panels for renewable energy. Because this design will also rely on sunlight, the solar panels will not be placed directly above the farm. Doing it this way will increase our resource efficiency; unfortunately, we require more land.

The roots of the plants will be held within the piping. The main pillars that hold the product will be made of PVC pipes, which will also serve as the irrigation system, providing nutrients and water for these plants. The excess water will drain to the bottom of the pipe and be recycled into the system for reuse, thus saving the amount of water required. Nutrients will be provided through the water for more robust and healthier growth.



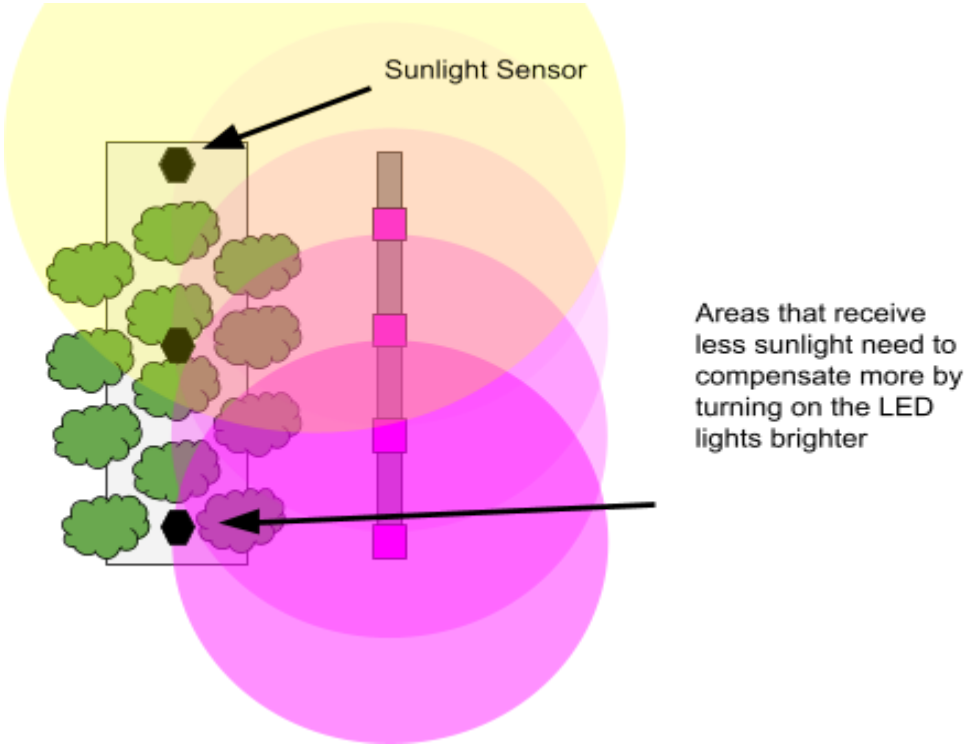


Machine learning will be used to estimate the proper amount and mixture of nutrients. This will be achieved by collecting data on plant growth and the nutrients used. For example, if mixture 1 achieved the fastest plant growth, then we will use mixture one as our base mixture and make slight adjustments while collecting the results. If a mixture reaches speedier plant growth, then that mixture will be our new base mixture when we begin a new yield test. The plan is to let the system do these calculations automatically and without much supervision.Ex.

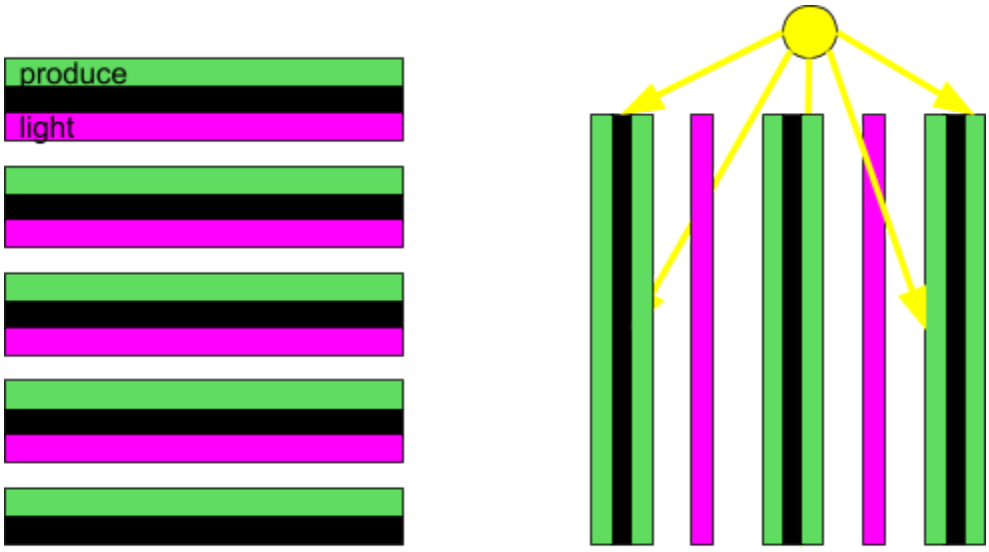
Yield 1	Yield 2	Yield 3	Yield 4
Mixture 1: 15.30 lb	Mixture 1.0: 15.10 lb	Mixture 1.1.0: 16.43 lb	Mix 1.1.2.0: 16.50 lb
Mixture 2: 12.20 lb	Mixture 1.1: 16.34 lb	Mixture 1.1.1: 15.92 lb	Mix 1.1.2.1: 15.93 lb
Mixture 3: 11.89 lb	Mixture 1.2: 13.10 lb	Mixture 1.1.2: 16.45 lb	Mix 1.1.2.2: 16.00 lb

The design will be open roofed to allow natural sunlight into the system, allowing us to turn off the LED lights whenever they are not required. This will save us energy. There will be sensors in

different areas of the design, which will let the system know where LED lighting is required for more manageable growth.



The layout will be parallel to the sun's line of travel to minimize the amount of shade; hence lights are required operational in the system. The LED lights will be used during nighttime, shaded areas, and non-clear skies for constant lighting. In the drawing below, we can see that most common designs use lights right above the product, allowing the plants above the light to receive light. My proposed method will have a horizontal source of light that will provide light to plants all around the source, making the design less costly to operate.



Expected Results

We expect the farm to be operational within a year of beginning construction. The farm will be able to provide produce for the local area and begin distribution to surrounding areas. The system will produce similar quantities of a product as a small farm. The product will be fresher and cleaner than conventional farms because it eliminates shipping time from the farm. Since it does not use soil, there is no need for fertilizer and chemicals for pesticides.

The system's success will be measured by the value of the product produced compared to operational costs. The biggest challenge with vertical farming is profitability due to the high operating costs. The article "Vertical farming sector struggles with costs" by Hugo Claver explains numerous bankruptcies due to the electricity cost of running a vertical farm 24/7. This could be the result of many farms choosing overly complex designs which require a lot of energy. The plan for this system is to think about the ways one could become resource-efficient. The best-case scenario would be to use the solar panel to produce the same amount of energy as the farm consumes. The likely outcome would be that the system requires only little energy assistance from outside sources. This is because a larger solar panel would equal an increased initial cost which far exceeds current funds.

The major benefits to vertical farming are land resourcefulness and low consumption of water. It is estimated that nearly 80% of all freshwater use is dedicated to agriculture. In the short section NW Farms in Lacey, Washington, claims their vertical farm only consumes 2% of what an outdoor farm that produces the same amount uses. My design will aim to reach the same level of efficiency. The electricity price will only decrease as we discover new ways of producing energy, but freshwater is becoming increasingly scarce.

Timeline

Month	**Objective**	**Activity**	**Expected Completion Date**
1	Research how to build a resource efficient system	Begin design and start collecting material	Month 2-3
2	Locate building location	Begin construction	Month 5-6
6	Start collecting data	Begin planting	ongoing

	for optimal nutrient distribution and resource management		
8-9	Plan for new additions such as automatic farming and machine learning	First harvest	Month 8-9
12		Complete system	
24	Begin planning for larger farm	Begin farming different fruits and vegetables	24-30
60	Keep adding improvements	Project gains have outweigh total costs	Month 60 - 100

Itemized Budget and Justification

Part	Supplier	Unit Price	Quantity	Total Cost
LED lights	Amazon	$0.05	40,000	$2000
Solar panel system	tesla	_	1	$7000
Pvc pipes	Home Depot	$25	40	$1000
Irrigation System	Home Depot	_	1	$1000
Electrical System	Fry's electronics	_	1	$1000
Farming product/ nutrients	Local supply store	20$	50	$1000
Labor For assembly	contractor	20$/hr	50hrs	$1000

Relevant Experience

What makes me a strong candidate to carry out this project is my desire to create autonomous systems and my academic background. I am a computer science major with a focus on machine learning and artificial intelligence. In my machine learning courses, I have learned to extract data to form accurate decisions. Some of the relevant projects I have worked on are using machine learning to match images to words or symbols and creating decision trees based on given values. This could prove helpful when designing a system that collects data about plant growth to determine changes such as resource allocation. I have experience with programming, which will be used to create a system that will be self operational. We will need to engineer a plan that will be able to control water regulation and lighting.

I am also qualified to complete this project because of my love for plants. I have had experience with farming from a young age with producing my fruits and vegetables for consumption.

References

Hugo Claver Web editor for Future Farming. (2020, April 20). Vertical farming sector struggles with costs. Retrieved May 07, 2021, from https://www.futurefarming.com/Smart-farmers/Articles/2020/4/Vertical-farming-sector-struggles-with-costs-569801E/

Bryan, A. (2021, May 07). Lacey is home to the largest vertical farm on the west coast. Retrieved May 07, 2021, from https://www.king5.com/article/money/business/small-business/nw-farms-vertical-farming-lacey/281-74462c98-2d9f-499f-bda3-1322021b0ad9