ES 115: Design, Innovation, and Prototyping

Design Project Stage 1: Project Brief

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Project statement

To design a tool or a device aiming to streamline plant care for small-scale farmers and agricultural researchers.

Profile of the target user

- The education level of the users will range from possibly illiterate to highly educated.
- Adequate knowledge of plant care is essential to effectively utilize the device.
- There is no specific age restriction for engaging in gardening and farming, and gender is not a determining factor.

Context

- In backyard gardens, potted plants, research labs, small scale farms, and educational classes.
- Wherever there is unaffordability/unavailability of Cutting-edge equipment.
- Exposed to continuous sunlight with regular exposure to water, in the presence of various pests and insects
- Prone to fluctuating temperatures.

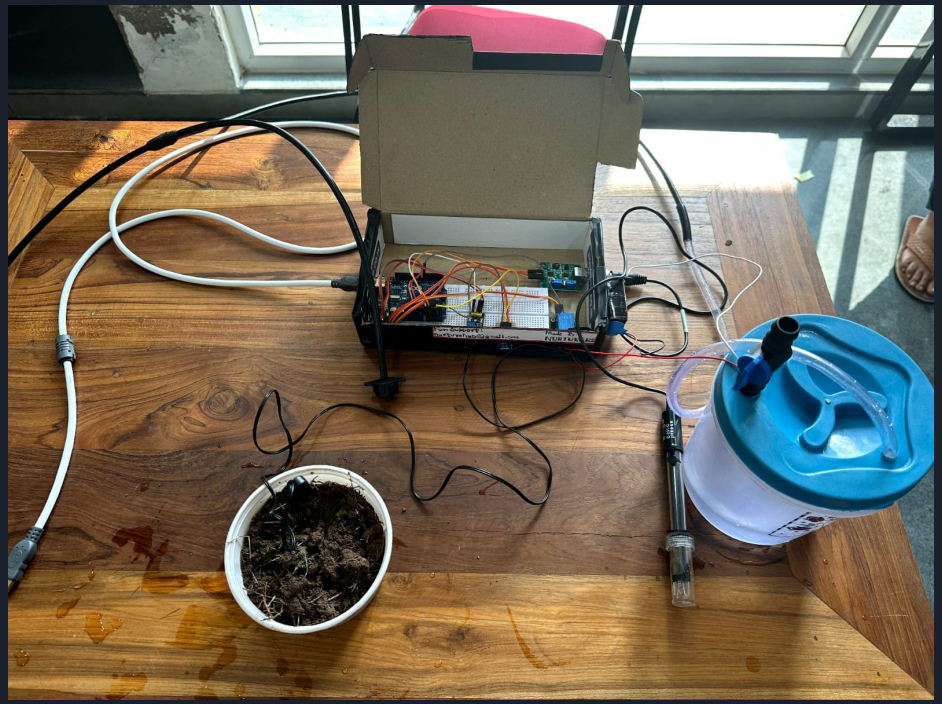
Design Opportunities

- Accessible: Intuitive design to make it easy for anyone to navigate. Make it easy to use so that even people with limited technical knowledge can use it.
- User Interaction: The product shall be adaptable to different kinds of users based on their uses. It should also be scalable as and when needed.
- Mobile: The product should be lightweight and have a compact design so that it is portable and easy to store. The product should be designed for on-the-go use, so that it can be taken to different locations.
- Integrable: This product should be able to seamlessly connect to other services to provide a unified experience. This would provide more flexibility and control.
- Data Visualization: The product shall be able to analyze the data in order to help the user identify trends and make informed choices.

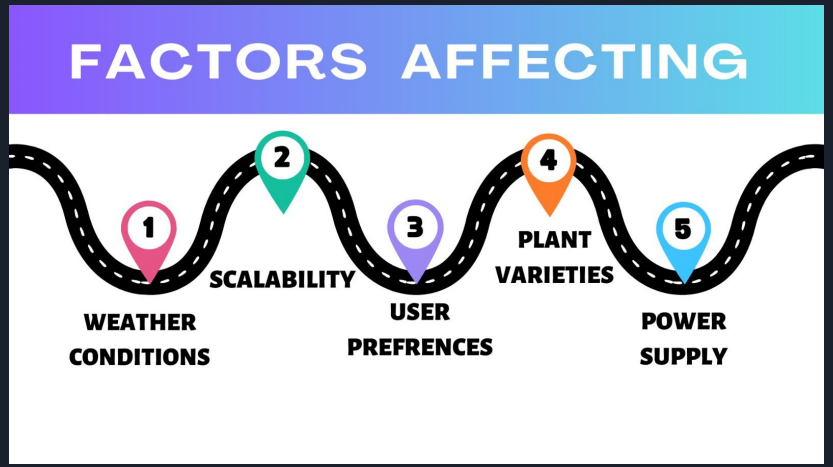
ES 117 Prototype: Plant Management System

- Successfully created a plant management system to address concerns about the rising costs of plant and garden products due to issues such as improper watering schedules and equipment failures.
- The system optimally supplies water depending on the type of plant via the drip irrigation method. Achieved using an Arduino Uno board and moisture sensor.
- Displays real-time data on moisture, humidity, temperature, and pH level of the surrounding conditions, by integrating various sensors. Also used a motor to pump water with a relay module for power supply.
- Designed a webpage to handle real-time data, along with a comprehensive database.
- Scope for improvement: additional sensors, improving app connectivity, neat user interface.

ES 117 Prototype: Plant Management System



Task Analysis



[1] An indoor potted plant requires care despite the busy environment.

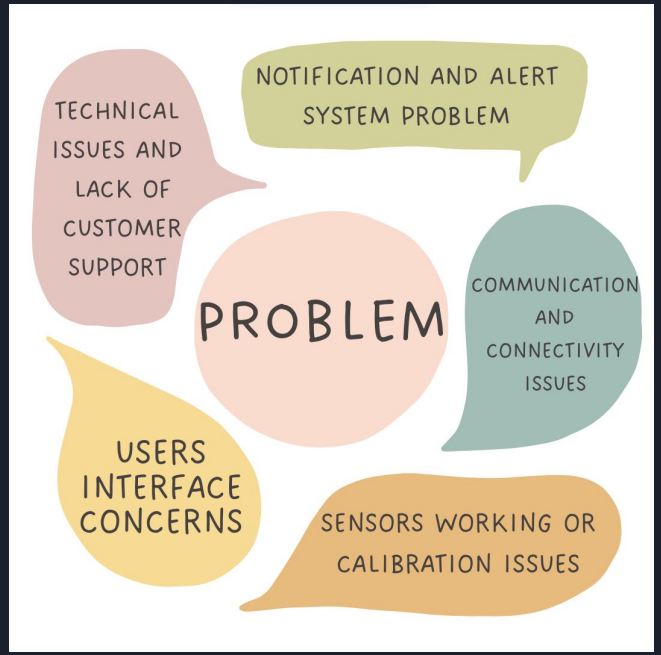
It will die if no care is taken frequently.

It will die if adequate conditions like temperature, humidity and pH are not met.

[2]

An independent automated system could be used to give the plant water when needed and provide the owner with other plant conditions.

Task Analysis



TASK

what our product do

01
- Display the moisture level and humidity level of plant

02
- It show the Temperature received and Temperature required

03
- Automatic water supply to the plant

04
- Show all the data on the webpage

Interview of Users

Speaker 1: We have Safia Nasser, a second-year master's student in Biological Sciences and Engineering at IIT Gandhinagar. We're discussing automated irrigation models for plant care. Safia, have you heard of these models?
Speaker 2: Yes, I'm familiar with them. They're crucial for farmers to manage crops and water content efficiently.
Speaker 1: Any specific additions to current models?
Speaker 2: Automatic pH and moisture detection would be beneficial. It could stop water flow when optimal conditions are reached, preventing overwatering.
Speaker 1: What about fertilizers?
Speaker 2: pH sensors are crucial as fertilizers impact plant growth. Monitoring and controlling the quantity used would be helpful.
Speaker 1: Thanks for your insights!

Expert Opinions and Supporting Articles

Aspiring for a greener, more prosperous world- As container gardening continues to gain popularity, cutting-edge products are transforming the way we approach plant care and cultivation. Devices like smart plants, vertical gardening systems, self-watering containers, and aeroponic systems are some groundbreaking products that are revolutionizing container gardening.
Source:
https://www.greenandprosperous.com/blog/5-innovative-products-to-transform-your-container-garden

Top 13 Innovations in Agriculture/Farming in 2023- Jiva is already combining a number of these new agricultural technologies to help improve the livelihoods of smallholder farmers around the world. We've also helped our rural entrepreneurs better understand market price fluctuations so that they can be more effective on the ground and earn a better income for their families
Source: https://www.jiva.ag/blog/top-13-innovations-in-agriculture-farming

Expert Opinions and Supporting Articles

Agricultural Innovation

In an age where environmental concerns and climate change fears are at an all-time high, sustainable farming is a hotbed issue. Our population is growing, and increasing shortages of land and water pose a significant threat to the longevity of the human race as we know it. From advancements in precision agriculture to farm automation, genetics, and water management tech, innovations in agriculture technology provide the means of smarter, safer, more productive farming.

Source: https://masschallenge.org/articles/agriculture-innovation/

Existing Products Available for the Same Purpose

CropX

CropX, a precision farming solution, uses soil sensing technology for real-time data on moisture, temperature, and conductivity. Pros include water conservation, increased yield, and scalable applicability. However, there are cons like initial investment, technical understanding required, technology dependencies, integration challenges, and data security concerns. Farmers should consider these factors for suitability.

Existing Products Available for the Same Purpose

Davis Instrument

Davis Instruments, a top weather station provider, offers precise sensors for temperature, humidity, and soil moisture, aiding informed agriculture decisions. Pros include accuracy, comprehensive sensors, and user-friendliness. Cons involve higher cost, potential complexity for novices, limited connectivity, power consumption considerations, and regular maintenance requirements. Farmers should weigh these factors based on their needs, technical proficiency, and budget.

Existing Products Available for the Same Purpose

Aerobotics specializes in precision agriculture, offering drone-based solutions for farm management. Pros include high-resolution aerial imagery for detailed crop monitoring, advanced analytics for crop health assessment, pest detection, precise interventions, and actionable insights. Cons involve upfront costs, technical skill requirements, weather dependency, regulatory compliance, and potential limitations in large farms. Farmers considering Aerobotics should weigh these factors based on their needs, budget, and team capabilities, staying informed about regulatory changes and drone technology advancements.


Thank
YOU