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Smart Drip Irrigation

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Overview

We are looking forward to building an autonomous system for plant irrigation. When we use the term autonomous, we mean it. The system will not need any human intervention. This would be a plug and play product for the agricultural industry.

The problem we are trying to solve can be listed as:

1. **Smart gardening:** It has been noticed gardening is a vast sector. People do not always know what type of soil, how much water and what weather conditions are needed for the betterment of the type of plant or vegetable that has been planted. Our prototype will act as a plug and play product that would cater to these conditions and feed the users with the requirements of the plant at all times in real-time.
2. **Eco-friendly:** With the use of technology we would first devise an option for the optimal usage of water for irrigation. Commercially available automated irrigation systems water periodically only on specific time intervals, without considering the actual requirement of water by the plants. With our knowledge base and Artificial Intelligent algorithms, we would analyze a set of features (namely weather conditions, type of plant, weather analysis for a timestamp) and then output the amount of water needed.
3. **Economical:** With years to come, water is going to be costly, especially in places where water is scarce. This can be contained with our product. The intelligent and efficient usage of water will not only turn out to be economical but would turn out to be great for the environment too.

Proposed Solution

We propose a drip irrigation system that alleviates most of the above problems. Drip irrigation is conventionally a type of micro-irrigation system that has the potential to save water and nutrients by allowing water to drip slowly to the roots of plants, either from above the soil surface or buried below the surface. The goal is to place water directly into the root zone and minimize evaporation.

To do so the product has the following functional components:

1. **Irrigation mechanism:** The actual hardware including pumps and hoses which will provide water to the plants.
2. **Sensors:** In order to use optimal water for irrigation, water must be provided only when it's required. An array of sensors will be used to monitor the soil. Currently, we are using soil moisture sensors. If the moisture of the soil I below the needed moisture by the plant we tend to provide water to the soil.
3. **Server:** This is where all the monitoring of the data generated by the sensors takes place. Intelligent processing of the data to decide to automatically irrigate the soil is done here. This also provides data to the user for handy monitoring of the irrigation.
4. **Mobile application:** A very easy to use mobile app will empower users to monitor the automatic irrigation. The user can manually control other aspects of the process using this mobile app.

The product will be modular and can be readily used by the user.

Product Description

We divide the product into three working modules, described below:

a) **Sensor/Controller Box:** This will be the brain of the system, which reads the data from all the sensors and make decisions based on user-provided data for a specific plant. It is an always-on internet-connected device that interacts with the cloud server and provides mobile monitoring 24x7 possible. We thought of two types of connectivity for this device, as follows:
   i) Wireless LAN based internet connectivity (Urban and small scale use)
   ii) Mobile Network (2G/3G/4G) based internet connectivity (Rural use case)

b) **Mobile App for Control and Monitoring purposes:** The mobile app will provide the user controls for adjusting the threshold levels of each plant, which would dictate when the user wishes to water the plants should the moisture level of the soil(whose information the user can see) falls below the set value. Soil type can also be selected from the app that helps to improve efficiency. The app also gives information about the ambient illuminance, humidity, and temperature by fetching data from the sensors of the device through the internet.

c) **AI-based Automated Irrigation:** We will apply machine learning to analyze water requirement trends and improve the efficiency of the system based on real-time data and agricultural research. After the product is operational in the given land the data generated by the sensors will be used to model a prediction model to predict the requirement of the water-based on temperature, humidity, etc. Thus drip irrigation will eventually be performed without the use of sensors. Thus the farmer will not have to pay for the sensors or the same sensors can be used in multiple locations. Thus low price point.

Application Area

The sectors where our product relates to are:

1. **Irrigation sector:** Our product can be used in small and large farms. The product is modular so it can easily be scaled to the requirement of the user, farmer here.
2. **Gardening:** Anyone with a garden can utilize automatic drip irrigation. Required units can easily automate the process.

The uniqueness of our product

The unique selling points of the product are:

1. Unlike most of the products in the market, our product provides a modular architecture for drip irrigation. The resources allocated will depend entirely on the area of the plot to be irrigated.
2. The irrigation will eventually be performed using decisions made by a machine learning algorithm. Thus the same array of sensors can be used multiple times. This is not done currently.

Customer Segment

The target customers for the product are:

1. Greenhouse Gardeners
2. Botanists
3. Farmers

Business Plan

This is how we would be going about seeding, developing, and commercializing our product:

The initial fund will be used for building the concept to proof of concept to finished product. We will launch the product on a small scale garden and small farms. We shall be charging with a minimal amount and focus on feedback. This feedback and generated revenue will be put back in the product to refine it.

PERT Chart												
Sl.	**Activity**	**Month**										
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	Conceptualizing the complete product												
2	Prototyping the circuit												
3	Building the server												
4	Making the server communicate with the hardware												
5	Building an android application												
6	Converting the prototype circuit into a product												
7	Scaling up the application												
8	Automation based on Artificial Intelligence												
9	Active Learning aspect												

Detailed economics, funding requirement expenses income plan over the next 5 years after the start.

Unit Development Cost:

Sl.	Category	Component Name	Quantity	Unit Price(in ₹)
1	Electronic Component	Microcontroller	1	500
2		Wifi Module	1	350
3		Moisture Sensor	1	100
4		Humidity Sensor	1	300
5		Temperature Sensor	1	150
6		Light Sensor	1	150
7	Mechanical Component	Small Pump	1	160
8		Pipes and fittings		20/mtr
		Total	7	1730

- We want to develop 10 such units and test it on a practical scenario like a small farm. Which will cost around ₹. 17300.
- We estimate an overhead charge of additional ₹. 6000.
- We shall be developing the units ourselves during the initial stages.
- Estimated Labor charges and logistic charges is of ₹. 4000.
- Cloud Server expense would be ₹. 500 per month for 10 units.
- Thus we require a fund of ₹. 30000 for field trials.

Farmers looking to invest in a drip irrigation system should calculate ROI versus alternative irrigation methods. Because drip irrigation delivers significant increases in crop yields while saving on inputs (water, fertilizer, energy, and labor), it can pay for itself in a relatively short period of time and give farmers more profit in their pockets.

Our business model will compromise of:

- The farmer or individual can select from our curated plans based on the type of crop. This plan will act as the base price.
- Depending on the size of the plot the installment charge will vary.
- The mobile app will have premium features to provide better analytics into the growth of the crops. This premium features can be charged on a monthly/quarterly/yearly basis.

Team Members

The following are associated with this project (in alphabetical order):

1. **Anurag Roy:** 4th-year undergrad in Netaji Subhash Engineering College, in the field of Electronics and Communication.
2. **Aritra Roy Gosthipaty:** 4th-year undergrad in Netaji Subhash Engineering College, in the field of Electronics and Communication. Finalist in Smart India hackathon (2019 Software Edition), Finalist in TCS Inframind (2019), speaker at Google Developer Group Kolkata.
3. **Ayush Thakur:** 4th-year undergrad in Netaji Subhash Engineering College, in the field of Electronics and Communication. Currently chair of IEEE EDS Student Branch Chapter of NSEC. A Google Code-In mentor in TensorFlow.
4. **Snehangshu Bhattacharya:** 4th-year undergrad in Netaji Subhash Engineering College, in the field of Electronics and Communication. Finalist in Smart India hackathon (2019 Software Edition), Finalist in TCS Inframind (2019).