

Plant Whisperer

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Abstract

Problem statement: This project study shows the working of an electronic device which measures the moisture content in the soil and reports its status to anyone who might be within earshot. The Plant Whisperer solves the greatest domestic problem of many who do not have the time to simply water their plants every day.

Motivation: Having grown up in a world where objects tend to beep or blink for one's attention, the stubborn silence of the average houseplant dooms it to an early death under our care. Since these plants just sit in our homes or offices silently, it is difficult to keep a track about when they get dry.

Approach: In order to make the plant whisperer, the first step was to record the resistance of the soil at regular intervals. This was done by inserting two aluminium rods in the soil of a houseplant. The data so obtained gave us the necessary range of resistance to make the PCB (Printed Circuit Board) which was then drilled onto the pot. The PCB circuit has a buzzer and a LED which reports when the plant needs more water.

Results: The Plant Whisperer hence makes itself an eco-friendly household device. The use of a Plant Whisperer can help us to make our homes or offices greener.

Conclusions: The project shows the working of a device which can be easily made for saleable purpose. The idea is not only innovative but also useful on large basis. Plant Whisperers can be used in greenhouses to keep the plants well attended. They can also be used in Vertical

Farming: The Plant whisperer can also be modified to make its working more efficient.

Keywords: Soil resistance, PCB circuit, Water retention.

1. Introduction

In today's world where everyone hopes to do their bit in making a greener environment, we often forget the small houseplants in our homes. A number of times we realize that the houseplants or plants kept in offices tend to get neglected by humans. It is difficult to keep up with busy schedule as well as water our plants daily or at least when required.

Having grown up in a world where objects tend to beep or blink for one's attention, the stubborn silence of the average houseplant dooms it to an early death under our care. Since these plants just sit in our homes or offices silently, it is difficult to keep a track about when they get dry.

This project shows the working of an electronic device which measures the moisture content in the soil and reports its status to anyone who might be within earshot. The Plant Whisperer solves the greatest domestic problem of many who do not have the time to simply water their plants every day. The Plant Whisperer helps one to keep a track of the water given to plant, hence avoiding giving excess water or less water. An optimum amount of water used, can save a plant's life as well as save water.

2. Conception

The working of this project is based on the varied resistance provided by the soil in which the plant is planted. In order to make the plant whisperer, the first step is to record the resistance of the soil at regular intervals. This was done by inserting two aluminium rods in the soil of a houseplant at a distance of 7-8 cm. The two rods being of aluminium do not get rusted by any means. The resistance of the soil varies according to the amount of soil in the water. As the water content is less, the resistance of soil increases. This happens so because water is the conducting medium here, hence less water means more resistance in the soil. By keeping a record of this resistance we can decide whether the plant needs more water or not. If the resistance is high then the plant requires water, if it is low it does not. Knowing the range of resistance we have been able to develop a circuit board which makes use of the known resistance to start-off a buzzer as well as an LED glows whenever the water in the plant reduces. Hence it is easy to notice the plant when its soil runs dry.

3. Working

After recording the resistance of the soil for some period of time, we have obtained the range of the soil resistance. In all nine resistors were required to make the circuit. A potentiometer to provide variable resistance was also used. An op-amp LM 358 was used as a comparator. Two LEDs, one green and the other red, and a buzzer were used as indicators. An external supply of 12V was provided. Having the range of resistance

a circuit was prepared applying the voltage divider fashion. One of the electrodes inserted in the soil was grounded whereas the other was connected to the required resistor. The op-amp (IC) has an inverting terminal (negative terminal) and also a non-inverting terminal (positive terminal). The 12V supply provided to the circuit is divided over three resistors (here 4.7K each). With the use of the potentiometer a voltage of approx 7.7 V reaches the non-inverting terminal. (Note: Either of the terminals on the IC can be used, here we have used the non-inverting terminal.) To the inverting terminal a voltage, approximately half of the external voltage (i.e. 6V) is given. Hence, whenever the voltage on the non-inverting terminal exceeds the inverting terminal the output is one. This means when then output is one the green LED glows, notifying that the water in the soil is sufficient. As the resistance in the soil increases the voltage across the inverting terminal exceeds the non-inverting terminal and the output is therefore zero. When the output is zero the red LED glows and the buzzer starts beeping, notifying that the water in the soil is less. A switch provided on the circuit switches off the buzzer. When the plant is watered the resistance of the soil eventually decreases as water content increases. In this case the voltage across the inverting terminal exceeds the non-inverting terminal, the output becomes one. When the output becomes 1 the green LED glows, as the voltage across the inverting terminal is more. This completes the basic working of the Plant Whisperer. The variation in the resistance causes the change in voltage which in turn leads to the glowing of the respective LEDs.

4. Design

The circuit diagram for this project is based on the range of the resistance obtained. This circuit is shown below:

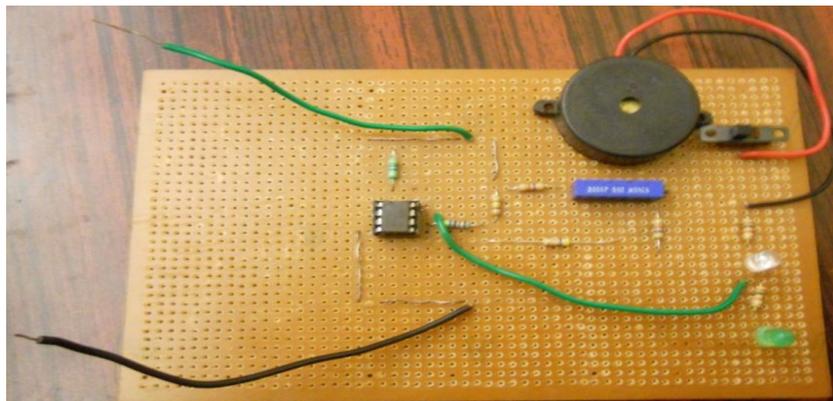


Figure 1: Plant Whisperer Circuit.

The above circuit is then drilled onto the plant pot. The wires connecting the electrodes and the circuit are connected internally. Using a pipe the wires can be avoided from getting wet.

5. Advantages

The Plant Whisperer is an easy solution to the household problem for many people. The device not only reports when the water is required but also how much. When the green LED glows we know that that amount of water is sufficient. In this way using excess of water can be avoided hence the soil does not become saline.

6. Limitations

However the Plant Whisperer cannot be used on a large scale like agricultural fields. Although only one circuit can be created for a considerable area of land, this might affect the efficiency of the device. In open fields the weather conditions are not predictable hence may cause damage to the Plant Whisperer.

7. Prospective Modifications

A few modifications which can be made in the Plant Whisperer are as follows:

- A moisture detector or sensor can be directly used which makes Plant Whisperer effective for large scale usage.
- We can also use a Parallax Propeller, ADC and audio amplifier to report the status using an audio i.e. real-time text-to-speech message. Hence, the plant can actually tell us when it is “thirsty”.
- Using a pressure pump we can modify this project in such a way that whenever the water content in the soil reduces it will not only notify the person around but also automatically water the plant through a water reservoir.
- We can also use solar cells to provide the external voltage supply hence making it even more eco-friendly.
- If six electrodes are used instead of two, we can get a more precise range of resistance, hence only the change in the potentiometer is required to make various other such projects.

8. Practical Applications

Some of the practical implications of the Plant Whisperer:

- *Greenhouse (as called Glasshouse):* Greenhouses are structures that range in size from small sheds to very large buildings, where plants are grown. Plant Whisperers can be used in such Greenhouses, as the plants are in well covered structures the climatic conditions do not affect their growth to a great extent. Using Plant Whisperers can be very useful as optimum amount of water can be given to each plant.
- *Vertical Farming:* Vertical Farming is a new concept proposed by American ecologist Dr. Dickson Despommier. Despommier argues that it is economically and environmentally viable to cultivate plant within skyscrapers, or on vertically inclined surfaces. If this concept is carried out successfully, the Plant Whisperer can prove to be a great asset to vertical farming.
- *Save Labour Cost:* With the growing awareness of environmental issues, all major companies and industries are becoming more and more eco-friendly.

Keeping this aspect in mind they have also begun initiatives to maintain small gardens or potted plants in office areas. If all such plants are installed with Plant Whisperer the expenses spent on labour for their maintenance can be incurred.

- *Cost Effective:* All the components used in the Plant Whisperer are easily available and also not very expensive. Hence making it a cost effective product.

9. Conclusion

In conclusion, we have proposed a sufficiently cost effective and eco-friendly project. The Plant Whisperer is useful on a small scale as well as it has the potential to be used on large a scale. It can be used for it maximum efficiency with minimum cost. Hence, the troublesome task of constantly remembering when to water plants can now be easily solved.

Reference

- [1] Jeff, Plant Whisperer, Electronics Technologists, Kitchener, Ontario, Canada.

