
Product Development & Innovation

Modular Terrace Garden
Automatic Watering System

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Aim

To design an automatic irrigation system for terrace gardens.

Problem space

The system to be developed is to be used in household. It is to be used for watering plants in a small garden/terrace garden. The basic purpose of the system is to water potted plants in the absence of users, so that if the user has gone out for an extended period of time, the plants do not die out because of the lack of water. The goal is to come up with a water supply system that could be turned on and off at regular intervals using a timer and which could supply water to various plants according to the water need of the specific plant. A secondary goal is to make the system able to wash the leaves and branches of the plant as well, so that in case the system is put up for use even in the case when the users are not away, they won't have to clean the plant by themselves.

Approach followed

We took the following steps in order to solve the problem given to us:

- User study
- User study analysis
- Using the analysis and brainstorming to come up with a practical design
- Procured materials like pumps, pipes etc for the first iteration
- Making the first prototype
- Changes in the first iteration to come up with a better design

Competitor study

In an initial study using the internet it was found that products that serve a similar purpose are indeed available, but they don't fulfill the condition of modularity and are very costly. Moreover, through interaction with the local market suppliers we found out that such products are not at all available in India. However some alternatives are indeed available in the market. Various hydrophilic materials are available that can absorb water in large quantities. These materials can be mixed with soil or compost and plants can be planted into this mixture. This mixture can retain water for at most 1-2 months depending upon the quality of the material. However this material does not provide nutrients in required quantity and that hampers the growth of the plant drastically. These materials include polymer gel crystals, peat moss, composted pine bark, etc.

User study

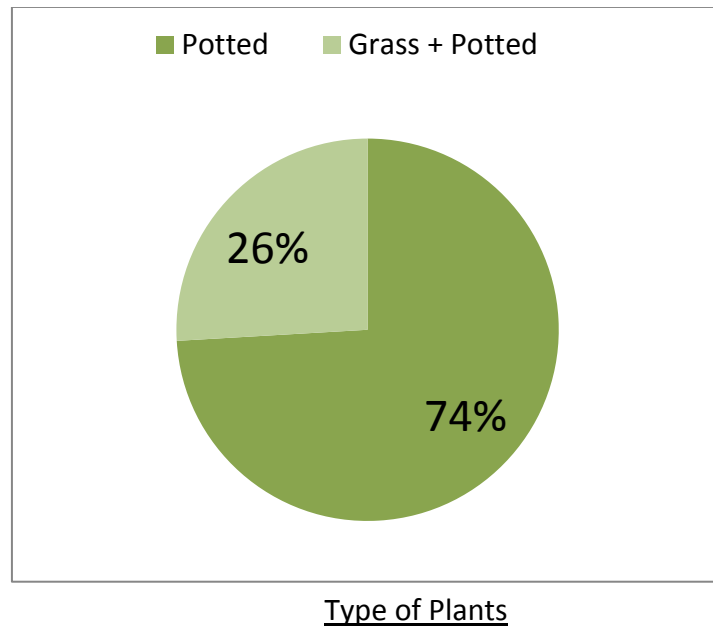
To get to know about the problem statement well and to get user inputs as to what their requirements are, we conducted a user study survey. The survey was based on a questionnaire that had questions related to various aspects of the product and user needs. The questionnaire included the following questions:

- Do you have garden at you home?
- It is a roof top garden?
- What type of garden is it? Potted / grass, etc.
- How many potted plants do you have?
- How are they placed on the roof? Is it along the walls or some specific arrangement?
- Do you change their location? If yes, how often?
- Do you have 'mali' at your place?
- How do you water the plants when you go out?
- What are the problems faced by you in watering the plants?
- Would you buy a system to given water automatically?
- How much would you invest in it?
- Is availability of water a problem?

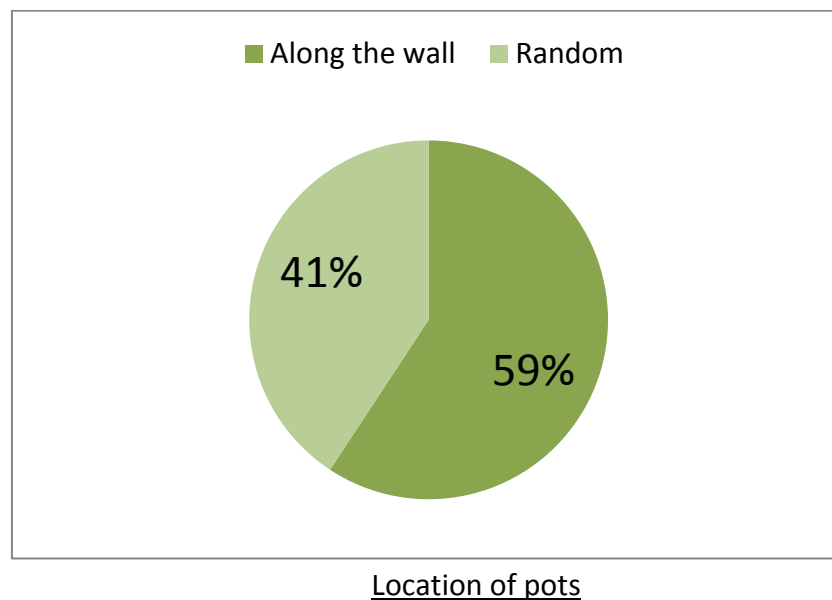
We talked with 27 people. So the general observations that we got out of the survey are as following:

- All have potted plants
 - Range of plants per household varies from 5 to 40
 - The average number of plants per household was about 20 plants
- No watering is required for 4-5 days
- If the users have to go out for more than 4-5 days, they usually ask their neighbors or their gardener to water the plants. But many users were apprehensive about this approach, as they have to trust the security of their house with a third person by handing the keys over to the neighbors or the gardener.
- One general observation that was made that in India, 1-2 pots are there in every household. These are generally tulsi plants which are considered sacred in India.

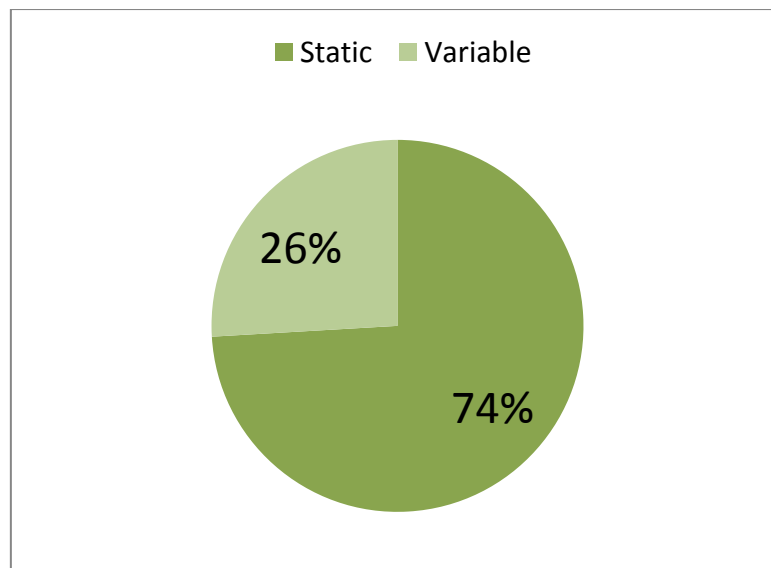
The following data was also obtained from the user study survey:



It was inferred that a majority of people have potted plants at their homes and, such, there is a greater need for a system that could water potted plants, than a system that could water whole gardens.

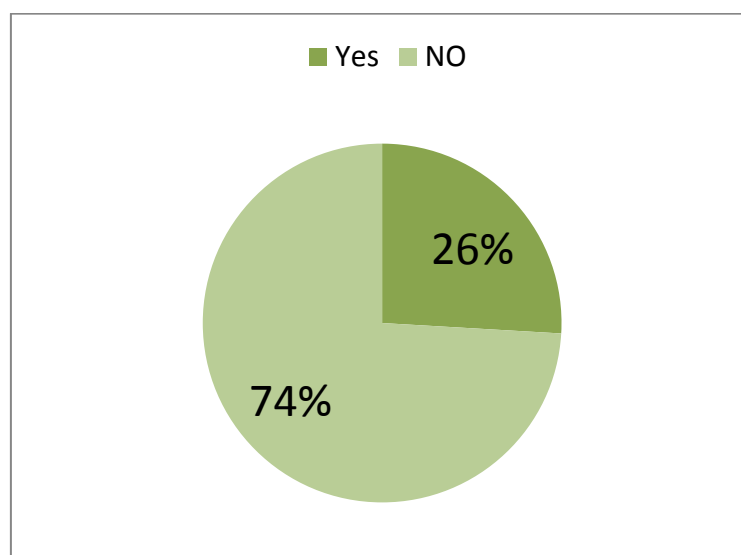


It was inferred that a majority of people prefer to place their pots along side walls. Plants are generally placed along the boundary walls on a terrace. Thus a single pipe could be used as a main pipe, which would run around the periphery of the wall and secondary outlets could be taken out of it, which would then supply water to the plant.



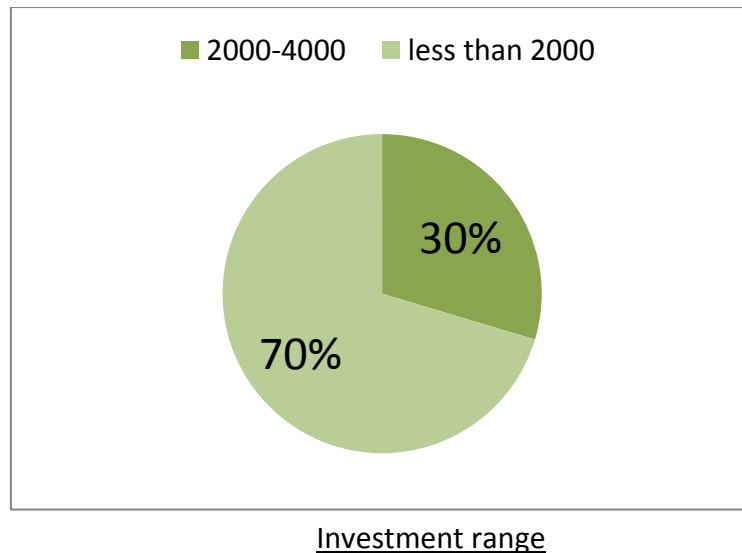
Arrangement

It was observed that mostly the arrangement of the plants is kept static. After a pot is kept at a certain position, its position is seldom changed. So once setup, there would seldom be a need to change the configuration of the system.



No. of households having a gardener

Most of the households didn't have a gardener. So it was inferred that the users have to water their plants manually. Hence, a system that could water plants automatically would really be appreciated by the users.



Majority of people are ready to invest between the range of Rs. 2000- Rs. 4000. This information is to be kept in mind while coming up with the design for the system, because if the cost of the product is too high, then the product won't sell.

Problem definition

The aim is to develop an automated system that could be used for watering plants on a terrace gardens when the users have gone out of the home for a extended period of time. Alternatively the system could be used to water plants in normal routine, i.e., even when the users are at home, thereby, reducing the need for the manual watering of the plants by the user.

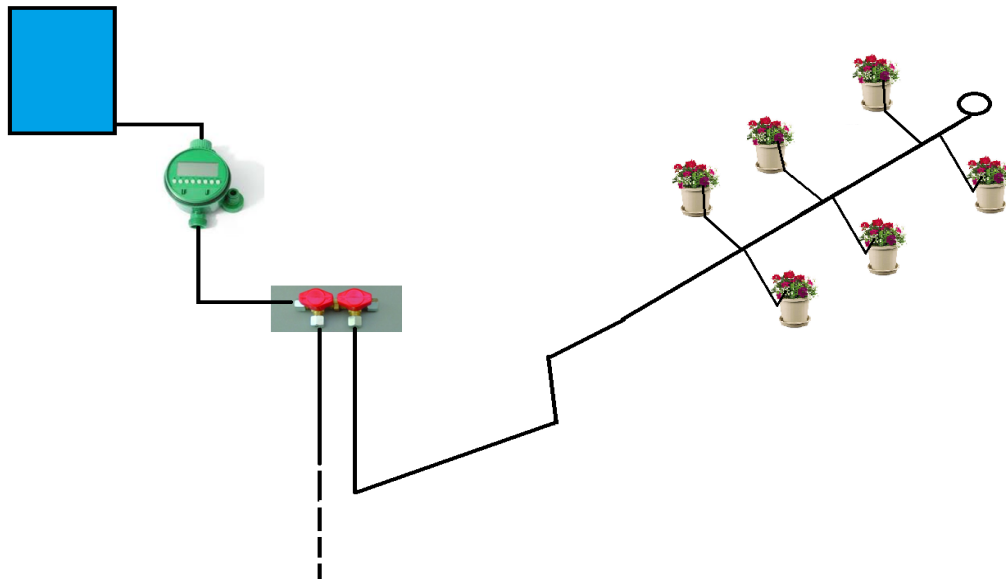
Basic product requirements

The system was required to have the following attributes:

- Modularity – Since the number of plants per household, heights of the plants distance between pots are all variable parameters, therefore, the system needs to be a modular one.
- Easy to use – The system should be easy to use.
- Low cost – Cost should be kept low, as majority of the people are not willing to pay only in the range between Rs.2000 to Rs.4000.
- Automated – The system should be automated to as much extent as possible, so that the human effort required is minimum.
- Assembly time – The system should be such that it could be assembled by any layman, and the time required fo assembly should be as small as possible.
- Indian context – The system should take account for irregular water supply and water quality in Indian homes.

Concept 1

First of all we came up with a design based on our user study analysis. Based on the findings, we came up with a design that incorporated a network of pipes that lead from the water tank to the individual pots. The water supply was to be regulated with the help of a pump and a timer that would turn on after a specified period of time. The ends of the pipes that led to the pots were to be fitted with nozzles that worked on the principle of drip irrigation. So after the timer fires on, the water from tank would go through the pipes to the plants assisted by the water pump. Nozzles of variable openings were to be used, based on the water requirement of each plant, so that for the same head, different amounts of water would empty into different pots, based on the water required by the plant.



Concept 2

In the second iteration, we focused our attention on a mechanism that would wash the leaves of the plant while watering it. So for that we came up with a stand on the base of which the plant would be placed. The stand would not be made as a complete entity. Rather it would be made of modular components. Hence its height could be varied according to the height of the plant. The stand would be provided with a shower at the top which would be connected to water supply. So as the water would cascade down from the shower, it would wash the leaves of the plant. This way the tasks of watering the plant and washing the leaves would both be accomplished.



Final Prototype

System Specifications

The system specifications along with the product photos are given as part of the user manual attached.

Final Product

Please follow the link to see the final product. The image is as shown above.

Link: <http://www.youtube.com/watch?v=tQAoTXG3le0>

User Evaluation

The product is nice. It is cheap and very easy to assemble. One can assemble it in just 2 minute of time. The users were satisfied as they said their work was reduced a lot. Also, some who were never interested in keeping the terrace garden now were willing to put up garden.