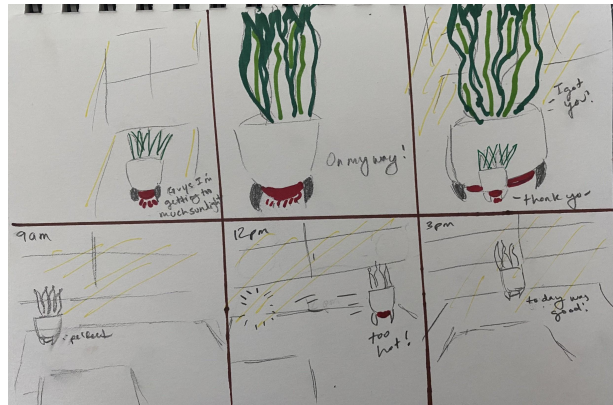


Moving Pots: Rhythmic and Smart Plant Pots
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Abstract

According to the USDA 54.4 million people in the United States live in a food desert[1] where they have limited access to fresh produce. There are many initiatives to combat this form of food injustice from community gardens to food access programs in elementary schools in the United States. However, none of these solutions account for the culture of house plants in the United States and the ability of growing vegetables and produce indoors would revolutionize how we combat food insecurity in food deserts. Moving pots uses multi-robot systems to flock and group houseplants to make them interactive and help the user grow their plants. Moving pots use flashing lights and raspberry pi sensors to help provide the important information to take care of the plants.

Introduction

The United States Department of Agriculture's [1] Economic Research Service defines a food desert as an area "with limited access to affordable and nutritious food, and particularly such an area composed of predominantly lower income neighborhoods and communities," [2]. Food deserts are not unique to the United States and there have been many attempts to define and identify food deserts in Australia, UK, and Canada. The consensus is that in the United States, food deserts disproportionately impact marginalized communities of color [3] [4]. There are many studies that have plotted the spatial or

statistical correlations of race and the absence of supermarkets [5] [6].

Researchers have even found that small corner stores and ethnic groceries or bodegas are abundant in food deserts in the United States, but their produce tends to be of poorer quality and less healthy, high in sugars and saturated fats [7] [8]. One way communities combat this is by growing house plants that communities can consume; this may take the form of justice for these communities.

There have been many efforts to ease this from urban community gardens to growing kits for plants [9] [10][11]. Community gardens have several benefits,

but ultimately fall prey to vandalism and a long waitlist to even begin to partake in the garden[12]. This doesn't address the fact that underfunding in community gardens and even the lack of education on how to maintain and grow plants makes them difficult to gather as a community garden[12]. But to enable food justice is to empower citizens to grow and maintain plants regardless of perceived limitations the alternative is to just enable people to grow their own plants.

According to the National Gardening Association growing a consumable garden can save a person \$600 with just an investment of \$70 [13]. This could help communities out of food deserts by providing their own source of food. However, low-income is tied to having smaller living spaces or even an interior courtyard that may not receive the same amount of sunlight as other places of living[14]. House plants are not the easiest to maintain and they require care and attention. Not every person can regularly maintain their plants and not every living space makes that accessible. For example some spots in a living space may get more sun than others and not all plants are meant to be in the sun for very long. Or even physical barriers are presented in moving heavy pots around to sustain a plant.

Considering the question of how we can make growing produce accessible we present Moving Pots. By using a multi-system of robots that carry the pots we can provide better care for the plants and allow for some of the logistical burden and understanding of taking care of plants indoors. By using different LED lights we

can show when a plant is under watered, overwatered, getting too much sun, getting too little sunlight, or even if they should be repotted. By using flocking algorithms we can get pots to group by blinking light and make it easier for their caretakers to identify issues and take care of their plants. As shown in the cartoon above the plants make formations to support each other. It also helps the plant pots themselves make formations to take care of one another by placing plants that can take more sunlight than others in front of plants that need very little sunlight.

Implementation

The design of the moving pot is taking a normal clay pot and cutting a hole out of the bottom. To fit a raspberry pi and 4 omni-directional wheels. We use the sensors associated with raspberry pi to sense luminosity, humidity, and moisture from the soil.

By using tactics for flocking and finding rhythm in different multi-robot systems. For example systems like Blueswarm that have a school of robotic fish that align and group by just using flocking algorithms and flashing LEDs[15]. We then add a low quality camera and two LEDs at the bottom of the pot. These lights will be used to signalize the quality of life for that plant and it's current needs. These lights will be used to flash to group of plants that need the same quality of care as well by using basic flocking light and counters that will line up together once they have grouped together the flashing will stop and only one light will be kept on to follow their lead. Otherwise they will match light and use the

camera to take care of each other either by positioning themselves in the way or away from light.

The stretch of this implementation would be it playing into the IoT or having a smartphone app that helps process and use the information gathered from this endeavor.

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