SCS 3214 / IS 3113: Group Project II - 2020

Project Proposal

Proposed Project Title: Green Core - "The Smart Gardner"

Project Group Details

1. Group number: G27

2. Group members:

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Details of Project Supervisor, Co-supervisor, Advisors and Clients

Proposed Project Supervisor (Academic Staff of UCSC):

Name of the supervisor: Dr Dinuni K Fernando

Signature of the supervisor:

Date:

Proposed Project Co-Supervisor (Assigned by Course Coordinator):

Name of the co-supervisor: Ms. Sithara Fernando

Signature of the co-supervisor:

Date:

The client of the Project (If applicable, otherwise supervisor will be considered as the client)

Name of the client: Dr Dinuni K Fernando

e-mail address of the contact person: dkf@ucsc.cmb.ac.lk

Project Details:

1. Project Title: Green Core - “The Smart Gardner”

People have busy lifestyles, most of the working crowd has very limited time at home, yet people tend to grow their own produce for sustainability. This aims to develop a smart garden environment that allows the user to provide real-time gardening experience via a mobile phone. Our project aims on developing a mobile application that is capable of monitoring the water level of each individual plant, humidity levels, intensity of light levels, etc of a real garden. Our mobile application with the help of sensors collects real time sensor data to control and manage the garden.

2. The Goal and Objectives:

Our main goal is to develop a smart garden environment that allows the user to provide an real-time gardening experience via a mobile phone.

Objectives

- People can get fresh vegetables and food from their garden with aid of a mobile application.
- Track the progress/ status of each individual plant's status.
- Adjust the growing environment remotely and in an automated way.
- Check the garden lively.
- Get real-time notifications of individual plat status via mobile App
- Administrator can collect, view data of all gardens via web application and use those for predictions, etc

3. Tentative Problem Definition

With busy lifestyles people tend to stay at home leisurely for limited time. However, with the current sustainable trend, people tend to grow their own produce. With this growing trend, people with limited time should have a feasible way of gardening with a minimum effort. So, there should be a convenient way of getting organic produce to the household with a minimum effort. Also, an agricultural revolution is going on these days because of the pandemic which occurred in the recent past. But after this is gone people may not have time to take care of their plants. For the above problem, we introduce a smart garden concept which is an automated way of gardening by using a mobile phone.

4. A brief introduction to the project

A smart Garden which allows the users to control their garden while they are away. The automatic gardening feature will check the environmental conditions and maintain the conditions required for the plants to grow, Manual method allows the users to control the plant conditions which will give full remote control of the garden to the user. This includes an IoT device, a mobile app and an admin portal.

The system mainly consists of two main deliverables.

1) Mobile Application and Iot Device

   System for the user consists of one or more IoT device units and a mobile app. The users can register to the system using the app and then connect the units for their account. A unit contains multiple sensors and actuators which are used to control the garden.

   Using the mobile app the users can control actions such as watering the plants, adding nutritions when the soil nutrition (Ammonia) level is low, changing lighting conditions, etc. Users can see a live view of their garden and with help of our mobile app people can get fresh vegetables and food from their garden,.They can track the progress of their harvest, adjust input levels and growth settings remotely.

With Bug repellent system to repel bugs a buzzer will automatically play a noise when bugs get nearby. Also users will be notified about bug attacks via mobile application. Plant watering system will automatically and manually water the plants when the soil moisture level is low and the surrounding temperature is high. If the user does not have sufficient knowledge of the plant, once the user starts cultivating the seeds, the app monitors the status of the plant and provides suggestions to improve the status of the plant .

2) Web Application

Web application helps administrators to manage user accounts , devices and get statistics about them. This also helps to collect data of our users' gardens.This data collection will help us to improve our system in terms of better predictions. Users' privacy will be retained safely and only sensor readings will be utilized for statistics and future predictions.

5. The scope of the project

Users (possible actors) of the system:

- Admins - Web Application
- Users - Mobile Application

Main functionalities of the system:

- Mobile Application
  - Control and get feedback of the IoT units
  - Manages IoT units
  - Manage the settings related to user accounts
  - Show notifications related to IoT devices
  - View the status of the garden (water levels, moisture levels)
  - Give planting tips to users

- IoT
    - Plant watering system
    - Lighting system
    - Add nutritions when the soil nutrition (Ammonia) level is low etc
    - Live view of garden via a mobile app
    - Bug repellant system

- Web Application
    - Analyze the data from all the gardens with web Application
    - Manage Plant Data (Admin)
    - Report generation (graphs etc)
    - Monitor each IoT device's health and notify if something is wrong
    - Manage the data related to the tips provided by the mobile app .

Out of Scope

- Train a machine learning model using the data gathered by the sensors to predict optimal conditions to grow specific plant types
- Monthly report generation for mobile app

6. Tentative Technologies

- Mobile Application - React Native
- Web Application - React JS
- Web servers - Nodejs and ExpressJs
- IoT - Arduino Mega and ESP8266
- Database - MongoDB

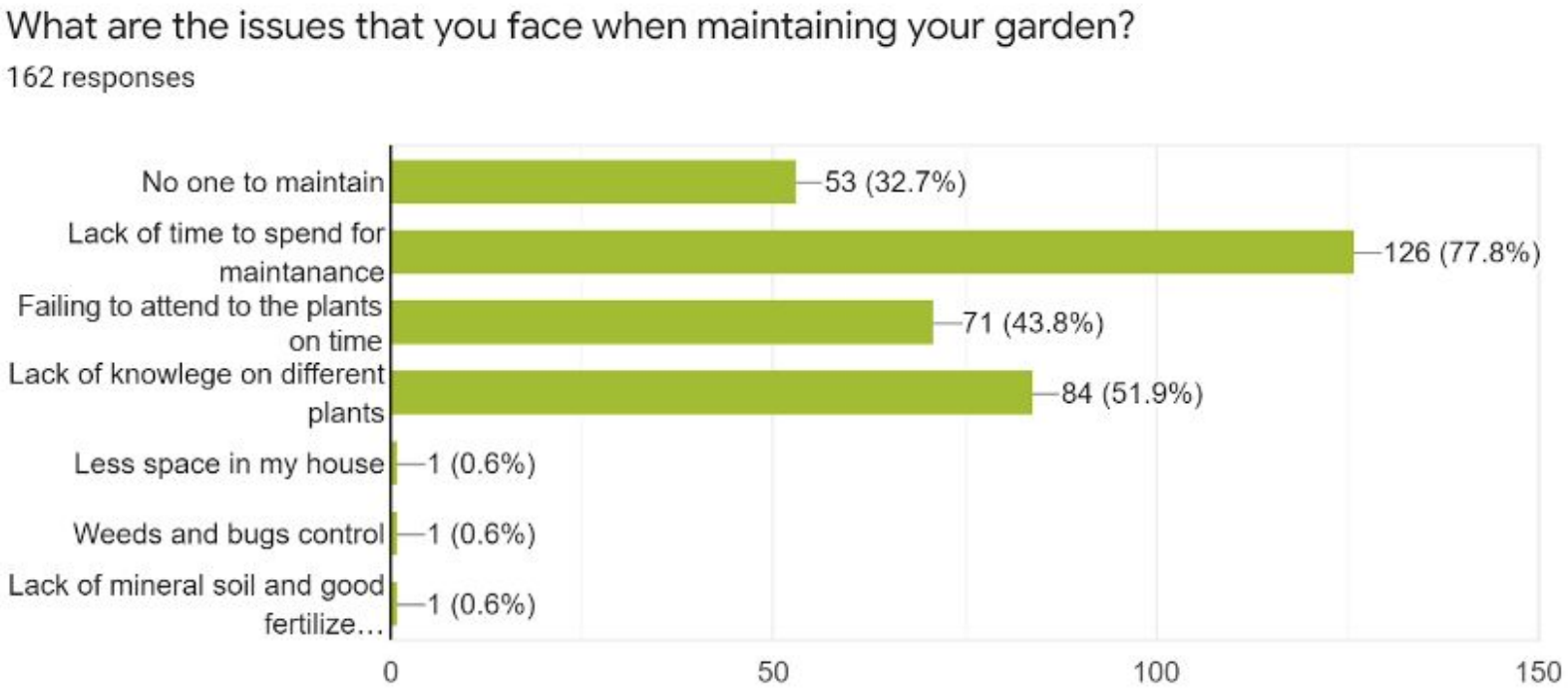
7. Feasibility Study

Operational feasibility

We have surveyed over 100 people from different areas of the island who have started farming in their home gardens after the pandemic started. We let them know about the idea of this system and asked whether they think it would be useful for them in their field. Over 85% of the participants of this survey gave positive feedback saying they are interested in such an idea and it would solve most of their problems.

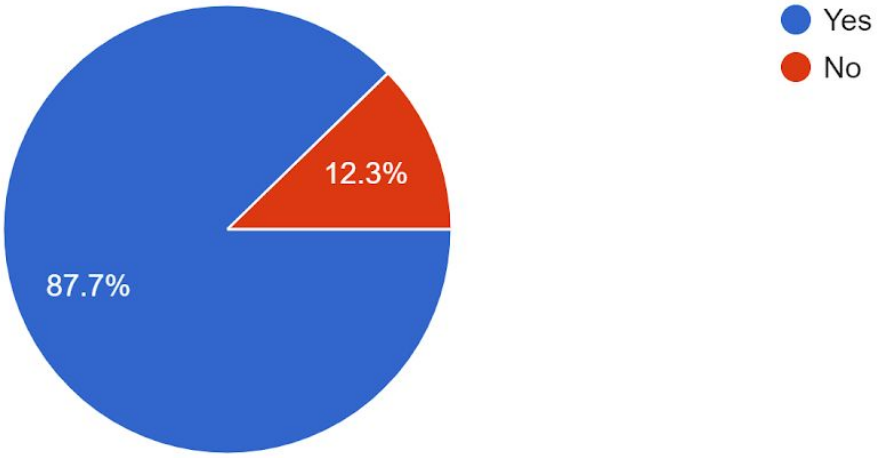
As most of the fruits and vegetables we buy from the markets are heavily treated with pesticides and various types of chemicals, people are much willing to grow their own food. But the real issue occurs when it comes to time. As this system solves the time issue more people are willing to use this kind of solution.

Results of the survey



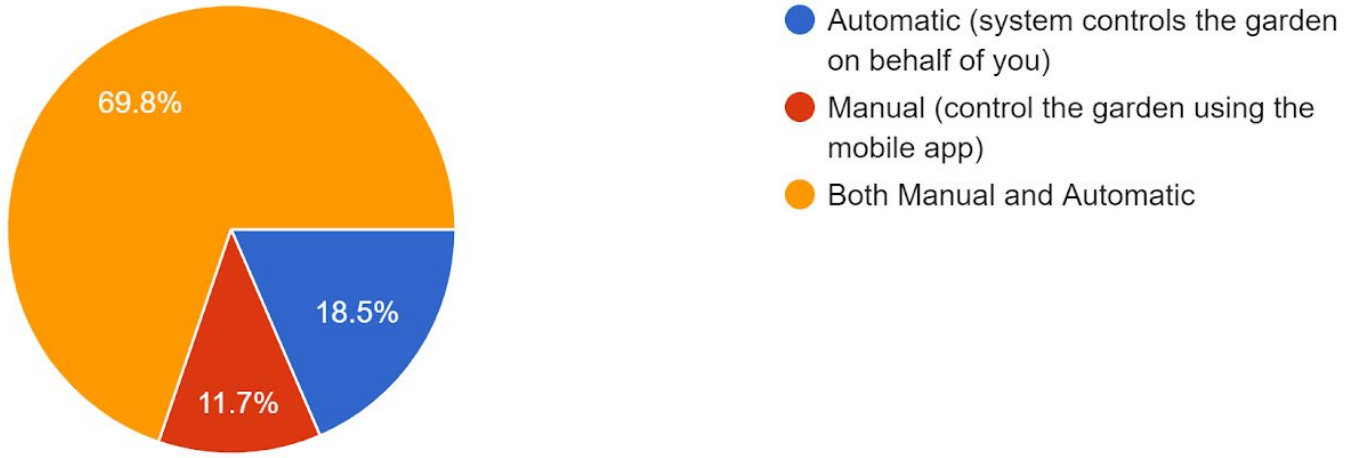
Do you prefer to use an IoT device and a mobile app to control your garden?

163 responses



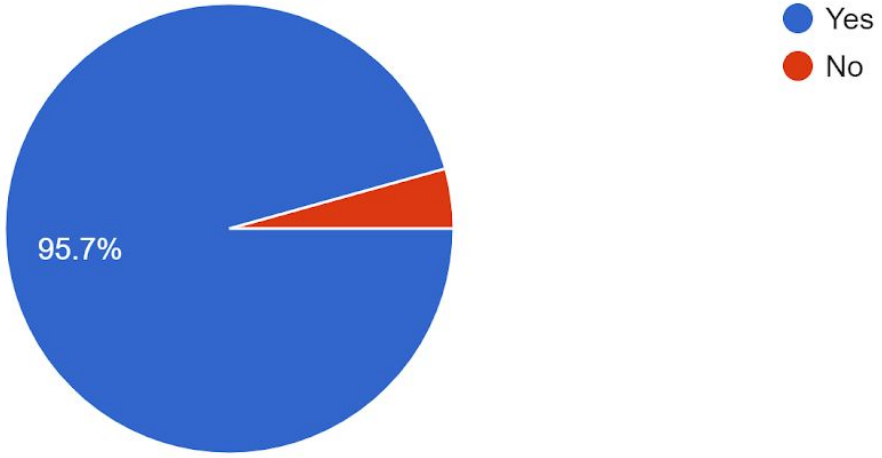
Which type of system do you prefer?

162 responses



Is it comfortable for you to get the service of this type of application with the facilities you already have?(WiFi, Mobile devices etc)

163 responses



Technical Feasibility

The main product of Green Core is an IoT device built using Nodemcu and an Arduino and a mobile application developed by using React Native, JSX, and CSS and for the backend, we will be using Node js and for the database, we will be using MongoDB. Most of these technologies are freely available or could be bought for a low cost.

For the administration, we are using another web app. It is hosted using a dedicated AWS server which is also available for free for a year. After a year we will have to pay and upgrade or look for another server to host our application. The dedicated hardware of 1GB RAM and 1 core CPU will be sufficient at the start. But as the user base grows, we will have to opt for a more powerful server. But for development purposes, these technologies are certainly sufficient.

Schedule Feasibility

Green Core should finish development by the end of August. And since we are following agile methodology for development, requirement gathering also happens continuously parallel to development.

It means more and more features may get added from time to time. But in the current context, considering the number of features that we have to implement as at now it will be possible. Also, it is worth noting that since we are using MERN stack, Arduino, node MCU, and AWS it makes development much easier and hassle-free which accelerates the development time to make it possible to be done by the deadlines.

Economic feasibility

As we are developing this project with profitable motive the production cost should be much lower

- The web application is hosted in the AWS free-tier server, which is provided by AWS for free for one year and this bears zero cost for the first year of operation.
- As we use MongoDB for our database which is free and there are 25Million database operations provided for the free tier
- The web application should have a domain and we will have to pay a small annual subscription for the domain. ($12 per year)

- The development tools like visual studio code Arduino IDE can be used free of charge for the project.
- As we use NodeMcu and Arduino for the IoT units the cost will be around 15$ per unit
- Publishing an Android app requires a developer account which we will have to make a one-time payment for the account. ($25 one-off payment)
- Since it is developed only by a team of university students, development cost also can be factored as none

Therefore in the short-run, the development takes a very small cost ($37 + costs for units) (if we didn't factor the developers cost). But in the long-run, as the system grows, we may have to bare a moderate cost for hosting fee in AWS as well as to allow more capacity in the MongoDB

With all these four feasibilities in check, we can safely assume that this is a feasible project in both the long and short run, thus we should proceed further with the development of this system.

8. Main deliverables of the system

1. Complete working Mobile Application and Web Application and source code
2. Complete Software Requirement Specification for both Mobile app and the Web app
3. User manual for the IoT device
4. License of the software
   - React JS - standard MIT License
   - Node Js - MIT license
   - ExpressJs - MIT License
   - Arduino Mega - Licensed under a Creative Commons Attribution Share-Alike license
   - ESP8266 - GNU Lesser General Public License v2.1
   - MongoDB - Server Side Public License (SSPL) v1.0

9. The Project Plan

Start Date : 21/04/2020
End Date : 30/08/2020

Main 5 milestones,

1. System Design (both Mobile and Web)
2. Mobile Application
3. Web Application
4. IoT Device
5. Deployment

and will be completed parallelly. A milestone will consist of several sprints

Task	April				May				June				July				August			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Project Identification																				
Requirement Identification																				
Concept Paper																				
Feasibility Study																				
Project Proposal																				
Requirement Analysis																				
System Design																				
Proposal Defence																				
UI Design																				
SRS																				
Development																				
Interim Report																				
Interim presentation																				
Testing																				
Deployment																				
Final Product																				

10. References

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- Jeffrey L Whitten and Lonnie D Bentley, “Feasibility Analysis and the System Proposal,” in System Analysis and Design Methods, Pard Duchont, NY, USA, 2007, ch. 11, sec. x, pp. 412–437.
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11. Declaration

We as members of the project titled Green Core, certify that we will carry out this project according to guidelines provided by the coordinators and supervisors of the course as well as we will not incorporate, without acknowledgment, any material previously submitted for a degree or diploma in any university. To the best of our knowledge and belief, the project work will not contain any material previously published or written by another person or ourselves except where due reference is made in the text of appropriate places.

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