Final Project

ECE - 218: Embedded Microcontroller Projects

DAJ Enterprises

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Problem definition

It is hard to keep a plant alive while on vacation. Some plants have different water and light requirements that you have no control over whilst you are on vacation. The goal is to keep the soil hydrated and give the plant plenty of light to provide the right conditions for your plant to grow.

Problem Conceptual Solution

Based on parameters defined for different plants, the system will track the moisture content of the soil and add water from a storage when necessary. The system will also monitor the light intensity, and use an external light source to improve the conditions for the plant.

Design Solution Alternatives

Our main system functions that have different approaches can be split up into the soil moisture detection, and the watering (we have chosen to omit the light switch-on function as there is only really one way to achieve this). The findings are shown below

Subfunctions	Alternative A	Alternative B	Alternative C
1. Detect soil moisture	**Capactitive moisture sensor**	Water dish w/ weight sensor	Color sensor to check how dark/light the soil is
2. Water Plant	**water bottle w/ solenoid valve and sprinkler head**	Spray mister + string + motor	water dumper

We decided, after considering the above approaches, that approach A to both solutions is the best. For moisture detection, the hardware required for the alternative approaches is undeniably too

complex and would not achieve the same quality of results as using a capacitive moisture sensor. Whilst we considered solution B to be a viable alternative for the plant watering feature,, we believe this would have less of a direct impact on soil moisture and meat lead to excess wastage through evaporation.

Goals and Constraints

Goals

- The system will continuously check the soil moisture and will indicate to the system when the water should be released

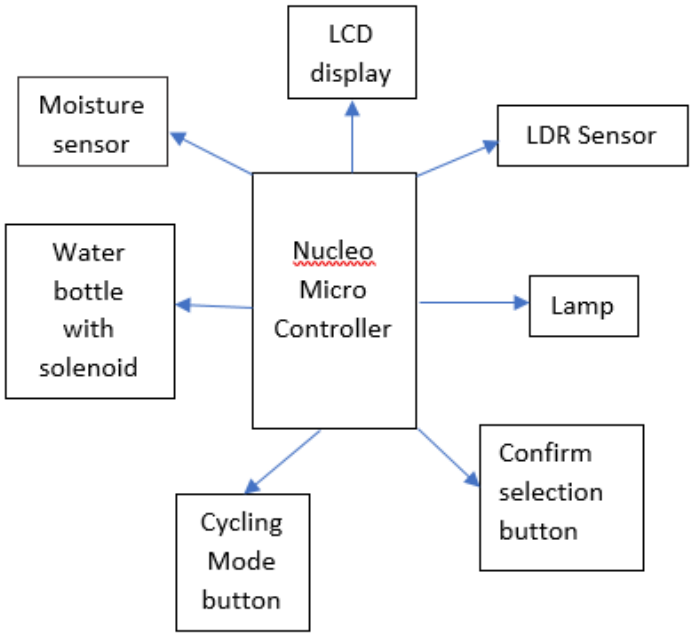
- There should be selectable plant modes that determine how much light/ soil moisture a plant needs to grow in its ideal environment
- The current plant mode should be displayed to the user in some format, and the user should be able to change the plant type easily
- When the light is measured below a certain range, the lamp should turn on to provide light to the plant

Constraints

- The system only works as long as there is water in the reserve therefore a big reserve is needed
- Users should be advised that due to this constraint there is a time limit on how long the system can effectively operate without user interaction
- The system requires constant power, we are researching a way to provide this without having to leave a computer running, or possibly without having to use a wall outlet to make the product more portable

Hardware Overview

The two major new components we would be using are a solenoid valve to open and close the water release system and a moisture sensor. The solenoid has two states, open and closed; however we can choose the amount of time the valve is open for and have other methods at our disposal to ensure the water released is correct. Further, the moisture sensor is analog and has variable output so we can use this data to adjust the solenoid valve accordingly.



The remaining components we have used in our other projects so far. The vital components to the embedded system are the LCD display and the LDR and these will be using the same setup as in our smart home projects from the class. The lamp we have yet to decide on a final implementation for. Should we be unable to source a bright and practical growing light was can simulate this with an LED on the NUCLEO board or an external LED.

Software Overview

Our software breaks down into three driver modules that will be implemented by a system and subsystem - similar to the smart-home system from the textbook.

A module, growing_light will use the data from the LDR to turn a light source on and off. Another main module, water_system will systematically check the soil moisture and turn the solenoid valve on or off accordingly, and our final module LCD_Display will be used to set the current plant and convey this to the user.

Of course, these modules will be called by a loop within our subsystem which will enact the feedback loop that is necessary of such an embedded system.

NOTE: We may choose to decompose our LCD module to have a user interface, that will control the actions of a user button click, and a separate module that just handles the display. However we will decide if this is the best way forward after we begin implementation.