Features of the project:

* This project is a **smart planter** system. [1]
* The project is a **miniature version** of a **vertical farming** system and a **smart farming** system.
* Using the planter, the user can **monitor specific variables** that affect the growth of the plants inside. These variables are **light timing** and **soil moisture**.
* An **Arduino Uno** in the planter **automatically controls** the **light timing** and **soil moisture** through a timer and a soil moisture sensor.
* The **user can control the light timing**, choosing when the light bulb operates in the planter. This simulates the day-night cycle. The Arduino automatically turns the light bulb on and off.
* The **user can control the minimum soil moisture** value. If the soil moisture drops below this value, the plant will be watered. The Arduino automatically pumps water into the soil based on this setting.
* Through a **small display**, **Arduino tells the user** the soil moisture and if the water reservoir needs refilling.

Ambitions vs. the final product:

* The project was **planned** to have **2 additional sensors**: **air humidity** and **planter temperature**. Due to **time constraints**, these two sensors were **not included** in the final product. **Air humidity** and **temperature** determine **plant transpiration** (release of water vapor and oxygen, intake of carbon dioxide) [2].
* One **concept** for the planter was a **mobile app**. The user would **connect their phone** to the Arduino through Wi-Fi, and the **Arduino would regularly send the user** the **conditions** in the planter through the app. It would also tell the user to refill the planter’s water reservoir.
* The project was **originally** going to be a “**climate in a box**”. The **combination** of **soil moisture**, **air temperature**, **relative humidity**, and **lighting** could **replicate** farm **environment conditions** in other parts of the world.
* A **dome** would have been added to **isolate the planter interior** from the outside to **retain** the specified **growing environment**.

Practical uses:

* Since the **Arduino takes care** of the planter **automatically**, the planter **requires very little attention** from the user.
* The user **does not have to water** their plant themselves as the **Arduino does it**.
* If the user **must leave their home** for a long time, the user can **rely on the Arduino** to keep their plant healthy, not having to worry about, say, a housekeeper.
* Since the planter uses a **light bulb**, the plant can **receive light in any weather**. A conventional planter would be placed beside the window for the plant to receive light, and it can not if the weather is cloudy.

Relation to smart farming: [3]

* Smart farming is a concept where a farmer uses data generated by Internet of Things technology to increase the quality and quantity of crop yield.
* A cycle is created with the use of smart farming technology.
* First, sensors connected to a network and installed around a farm collect data. Second, the data is processed through a server, which identifies problems and needs. Third, the data is sent to a farmer, who decides how to treat these problems. Then this cycle repeats.
* Smart farming can make farming more accurate. Data provided can tell a farmer which one plant or animal needs treatment, and which treatment to give them. Additionally, pesticide and fertilizer use can be optimized, applied to specific areas of the farm based on generated data.
* This project relates to smart farming through generated data. The planter generated data and shows it to the user, who decides what happens next. Although with smart farming, the scale is much more massive, much more data is generated and sent, and more decisions can be made.

Relation to controlled-environment agriculture: [4]

* Controlled-environment agriculture is the method of growing plants in an enclosed environment controlled by technology to optimize growing conditions.
* This method of food production can be done in any enclosed area because the conditions of the outside world (weather, pollution, landscape) do not affect the conditions of the enclosed area.
* Technology optimizes growing conditions by controlling certain factors of plant growth: temperature, humidity, carbon dioxide, light, nutrient concentration, and nutrient acidity.
* This technology includes sensors, which measure the growing environment, machines (like heaters and LED lights), which regulate the environment, and computers, which control the sensors and machines.
* This project is an example of controlled-environment agriculture. Sensors (timer, soil moisture sensor) measure the growing environment, machines (light bulb and pump) regulate the environment, and computers (Arduino) control the sensors and machines.

Related topics, strongest to weakest:

1. Controlled-environment agriculture
2. Smart farming
3. Automated farming
4. Vertical farming/indoor farming

Links:

[1] “Build your own Smart Planter”

<https://www.instructables.com/id/Grove-Smart-Plant-Care-Kit-Assembly/>

[2] “How Humidity Affects the Growth of Plants”

<https://www.polygongroup.com/en-US/blog/how-humidity-affects-the-growth-of-plants/>

[3] “Learn more about Smart Farming”

<https://www.iotforall.com/smart-farming-future-of-agriculture/>

[4] “Learn more about Controlled-Environment Agriculture”

<https://medium.com/@FreshBoxFarms/controlled-environment-agriculture-cea-more-than-hydroponics-9611aeed0529>