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Smart Watering System

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[https://www.researchgate.net/profile/Sudheer-Nagothu/publication/316031811\_Weather\_based\_Smart\_watering\_system\_using\_soil\_sensor\_and\_GSM/links/5a3a269f458515889d2bd87f/Weather-based-Smart-watering-system-using-soil-sensor-and-GSM.pdf]

*Abstract* — In this article, a prototype of a Smart Watering System will be explained, along with logic gates to give a greater understanding of the prototype. Additionally, all hardware components will be justified as to how each component works with one another to create a complete system, and potential security risks that come with the usage of listed hardware.

# Introduction

IoT, also known as Internet of Things, is a constantly evolving network of physical devices (such as sensors and vehicles) connected to the internet with the ability to interact with each another. Device communication over the internet is done via protocols, the most common being TCP / IP (Transmission Control Protocol / Internet Protocol). Alongside the introduction of more physical objects into IoT over years (like washing machines and fridges), the hardware itself has gotten more compact and simpler which allows for more possibilities of digitalisation, a major one being agriculture. With these technical developments in mind, there have been multiple benefits to digitalisation in agriculture as it can help optimise the production of crops while keeping the waste and costs as minimal as possible to reduce the negative effects on the farmers themselves and the environment. Finally, with the UN Goals in mind, this product will help in achieving zero hunger, as more healthy crops will be harvested due to their growing conditions being more appropriate and later being produced into food for consumption. Additionally, another goal that is achieved with this product is upkeeping responsible consumption and production, as growing crops utilizes a lot of water and without proper optimisation a lot of water could be wasted (such as watering crops when its raining), effectively having a negative impact on the environment.

# Literature Review

[https://easternpeak.com/blog/iot-in-agriculture-technology-use-cases-for-smart-farming-and-challenges-to-consider/]

# Methodology

This smart watering system will provide the user with necessary features to maintain efficient crop yields while staying the most cost-efficient as possible to increase profitability of the user. The proposed water system is able to utilize profession moisture sensors and temperature sensors to collect data that will be manipulated by the master microcontroller in ways such as; sending a message to the slave microcontroller to activate a sprinkler if the value from the moisture sensor drops below a specified threshold, displaying moisture and temperature values on an LCD (liquid crystal display) screen for the consumer to see accurate measurements of the crop’s conditions. These measurements will be collected at regular set intervals as this will prevent the microcontrollers from overflowing with too much data and causing delays in the system. Also, this will allow for scalability for the system itself as the consumer will be allowed to connect more data collection nodes to cover more area without causing issues for the already existing system.

The communication protocol that is used between the microcontrollers is the I2C (Inter-Integrated Circuit) protocol, the reason why this is the chosen protocol for this prototype is because the amount of data being transferred is small which won’t have a major impact on the processing speeds and won’t disrupt the communication of the two controllers. Also, with future scalability in mind, this communication protocol will be a valid choice as the same methodology can be used when upgrading to wireless by keeping multiple slave and master Arduinos functioning the same way at the cost of a potentially slower data transfer. However, if the product was to include wireless communication, then there would have to be extra security measures put into place as the data transmission would be exposed to noise that could disrupt the message or other potential ways of data being captured.

In Figure 1 below, is a circuit depicting how each component of the system will communicate with each other to demonstrate a prototype of the final product. The circuit consists of:

* 2x Arduino Uno
* 1x LCD screen
* 1x 9v Battery
* 1x DC Motor
* 1x L239D Chip
* 1x Soil Moisture Sensor
* 1x Temperature Sensor
* A diagram of a circuit board

  Description automatically generatedx Wires

Figure

## Implementation of a Moisture Sensor

Moisture Sensors use dielectric-permittivity [1] to calculates the volumetric content of water in soil to fluctuate the resistance value of the sensor using the built-in variable resistor, this resistance value is then constantly communicated to the connected micro-controller. The resistance of the Moisture Sensor decreases as more water is present in the soil. These sensors will be connected in groups, and transmitting data in groups to their corresponding master node over a wireless connection, to allow for more data collection which can then be averaged to provide more accurate results per area.

[1 - <https://gi.copernicus.org/articles/12/45/2023/gi-12-45-2023.pdf>]

[https://www.researchgate.net/profile/Sudheer-Nagothu/publication/316031811\_Weather\_based\_Smart\_watering\_system\_using\_soil\_sensor\_and\_GSM/links/5a3a269f458515889d2bd87f/Weather-based-Smart-watering-system-using-soil-sensor-and-GSM.pdf]

[https://lastminuteengineers.com/soil-moisture-sensor-arduino-tutorial/]

## Implementation of a Temperature Sensor

Temperature sensors are working alongside moisture sensors, they will be feeding information towards the master node at similar intervals to the moisture sensors, the data collected from these sensors will be displayed to the user on an LCD where each group of sensors will have their temperatures displayed, and the user will be able to toggle which group is being displayed on the screen.

## Implementation of an LCD Screen

LCD Screens will be displaying data gathered from the moisture and temperature sensors to the user, the information that is to be displayed will be sent from the slave Arduino directly to the screen for the user to view it.

Using the data collected from both moisture sensors and temperature sensors, the micro-controllers will be able to control an irrigation system (for example a network of sprinklers) to determine when water should be spraying crops to keep them at their most optimal growth conditions. The microcontroller in charge of the irrigation system will receive a command when to water plants and when to stop from the microcontroller handling the sensors’ data. The commands that are to be sent will be based on default presets (of which they will be most commonly farmed crops) or a custom pre-set can be created by the farmers themselves.

With future development in mind,

# Results

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# Discussion

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# Conclusion

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##### References

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