Zeus Industrial Automated Irrigation System

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BACKGROUND

A well-managed irrigation system is important for any scale of crops, whether it be a small backyard garden or a large-scale produce company. It can be challenging to water crops with the correct quantity of water. According to the EPA "Irrigation control technologies can significantly reduce overwatering by applying water only when plants need it [1]." Zeus is designed to tackle these issues by allowing the user to setup a watering schedule and by monitoring the current moisture level of the soil.

PROPOSED SOLUTION

Our proposed solution (Fig 2) consists of four components:

1. Programmable Logic Controller (PLC)
2. Human Machine Interface (HMI)
3. Watermark Moisture Sensor
4. Water Control Valve

The components work together to monitor soil moisture and give the user control and information through the interface on the HMI

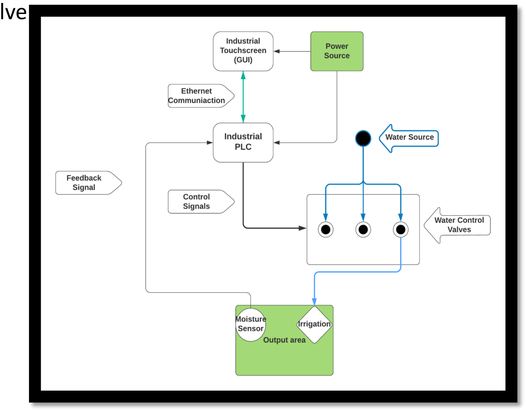

Figure 1

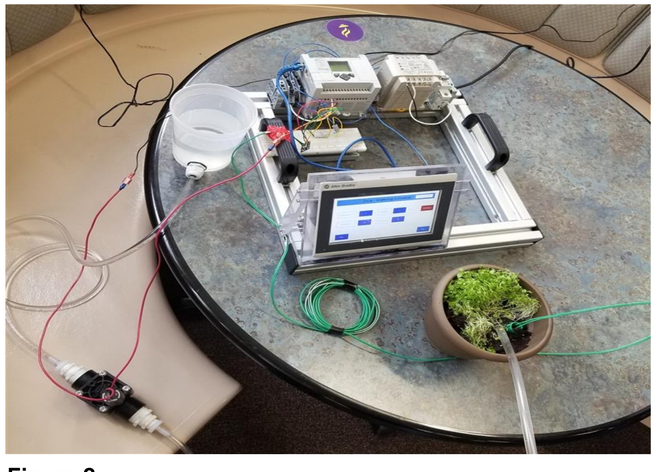

Figure 2

SYSTEM DESIGN

Power

Three power supplies are used:
24VAC for the Water Control Valve
24VDC for PLC power
12VDC for the Moistures Sensor

Ethernet/IP Transmission

Communication between the PLC and HMI over a CAT5e cable.

Human Machine Interface (HMI)

The GUI on the HMI interfaces with the PLC

Allen Bradley 1100 PLC

The PLC uses ladder logic programming to scan inputs and turn on outputs

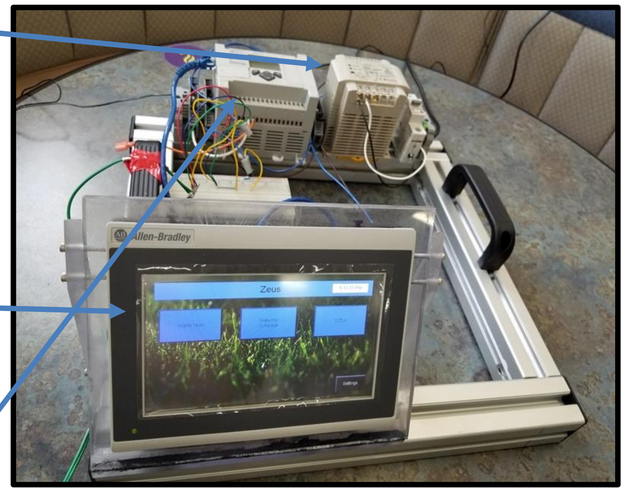

Figure 3

Moisture Sensor

The moisture sensor used in the system is resistive and its value changes depending on the soil's current moisture level. The sensor is connected to an amplifier which is connected to the PLC.

Status Screen (Fig 4)

Shows the user when a plant was last watered and the current moisture level of the soil in Centibars. This feature also lets the user setup the max moisture level.

Water Now Screen (Fig 5)

Shows the user when a plant was last watered and the current moisture level of the soil in Centibars. This feature also lets the user setup the max moisture level.

Schedule Screen (Fig 6)

(Lets user set up a time of the day and the duration of watering for any watering destination.

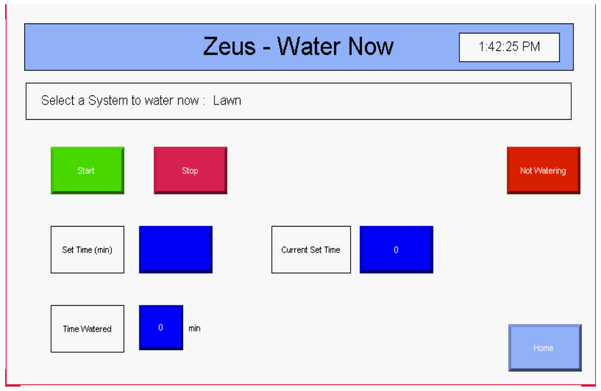

Figure 4

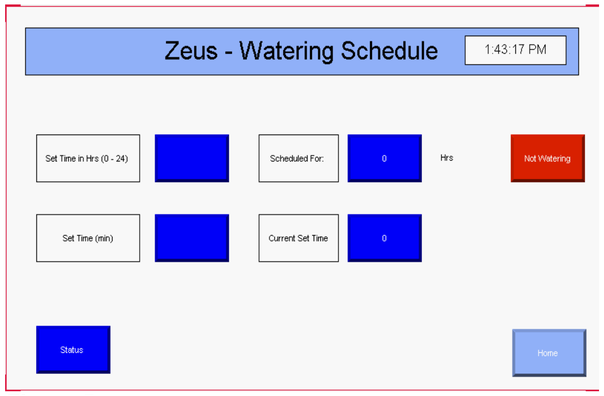

Figure 5

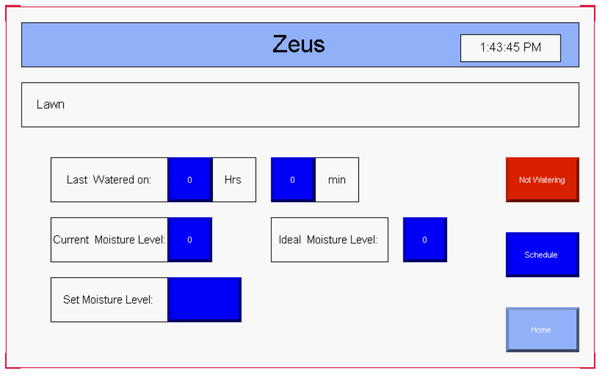

Figure 6

ACKNOWLEDGEMENTS

We would like to thank Dr. Hamari for guiding us through this design project and Doug Laven from South Central College for letting us borrow the HMI

FUTURE DIRECTION

- Create a PCB for incorporating the moisture sensor amplifier and add connectors for attaching and detaching the sensor
- Explore remote I/O options to see if the sensor could be located further from the PLC.
- Look into logging options so moisture over time could be plotted for the user

REFERENCES

[1] EPA. Irrigation Controllers, Available: https://www.epa.gov/watersense/irrigation-controllers

CONTACT INFORMATION

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