Solar Powered Wireless DC Valve Controller

Unintrusive, self powering, automatic watering system built for small hobby farms or gardens.

System Goals

- **Solar Powered** - A solar panel mounted to the system provides power to the system without the need for charging or replacing batteries.

- **Wireless** - Radio and WIFI communication used to send and receive information. Website allows the user to control the watering with precision.

- **DC Valve** - The system should control a valve inside of a pipe using an attached DC solenoid.

- **Controller** - Signals from the system will be used to automatically control the valve solenoid without the need to manually turn the valve on and off.

Figure 1: Custom Designed Solar Charging Boost PCB

System Achievements

- Maximum effective range is 900 feet between nodes.

- The system includes a solenoid that can be controlled by the radio board. Given a running water pipe, it will be able to control the valve inside.

- Custom website allows users to set watering schedules and see status updates throughout the day.

- Solar panel recharges the batteries, which then provide the power for the valve control and communication systems.

SUMMARY

→ Compact, automated method for watering land

→ Website allows users to create and manage watering schedules and read info about the system

→ The Control Node passes signals between blocks and stores system information

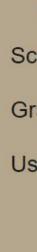→ The Watering Node reads scheduling information and controls the watering valve

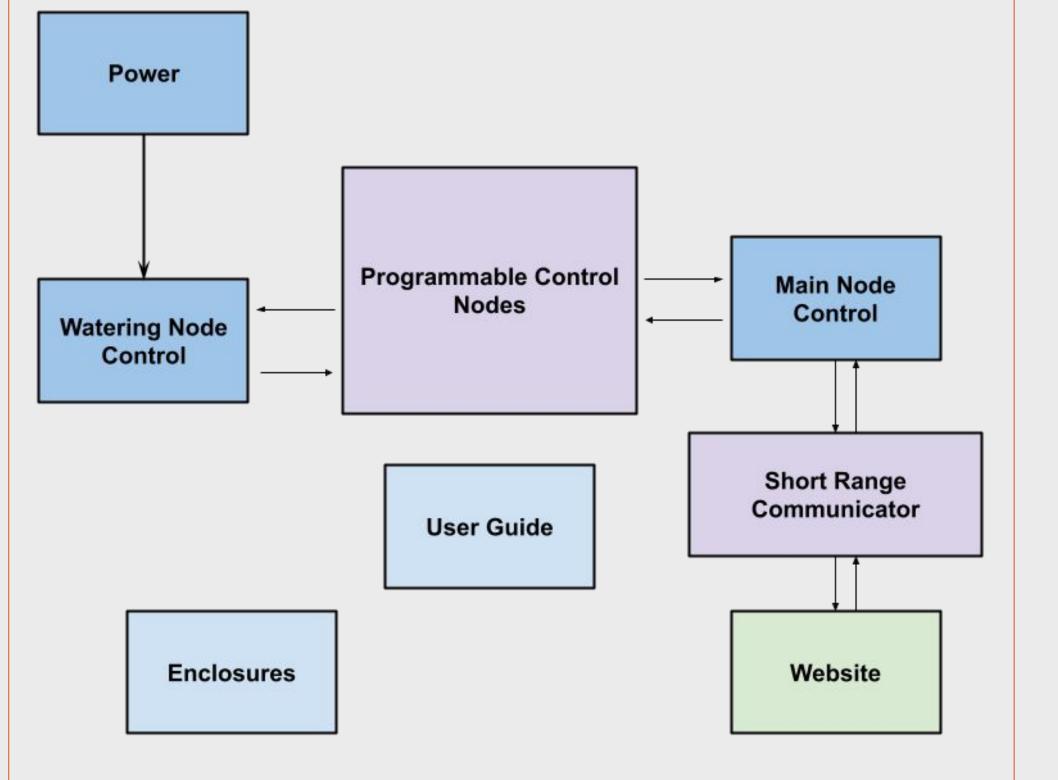Figure 3: Scheduling page for the website, displays the current watering schedule

Figure 2: System Block Diagram. Blue is hardware, green is software, and purple is mixed.

NODE CONSTRUCTION

The watering and control nodes are made of smaller blocks coming together. Both nodes have a radio board, used to communicate with each other.

The control node also has a wireless board, which connects to wifi in order to read schedules from the website, and a control block, which connects the two boards and powers them.

The watering node comes with a solar panel for power and it's own control block, this one has built in systems to allow the board to control the solenoid easily as well as provide power.

COMPONENT BREAKDOWNS

Programmable Control Nodes - Handler for the long range communication between nodes, controls the solenoid, and receives watering schedules.

Power - Powers the system via a battery pack being continually charged by a solar panel.

Watering Node Control - Handles voltage transfer between the power block, solenoid valve, and radio board. Controls the direction that current flows through the solenoid, allowing it to be opened and closed. Capacitors are used to provide the power spike required during valve movement.

Short Range Communicator - Interface between the website and the rest of the system.

Main Node Control - Connects other blocks and provides power. Powers the other blocks using a barrel jack plug and provided DC wall adapter for easy transportation.
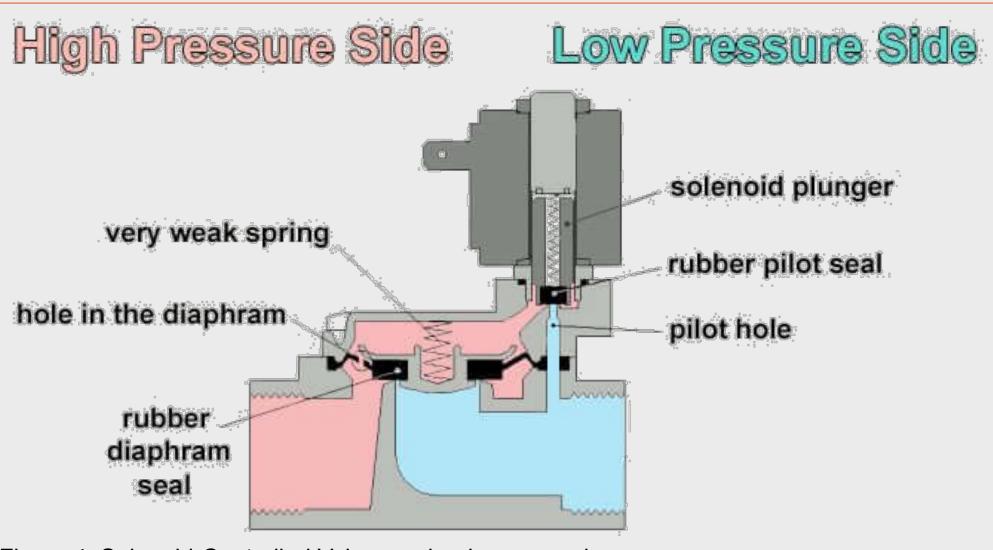

Figure 4: Solenoid-Controlled Valve mechanism example.

Engineering Requirements

1. The system shall be powered directly by batteries and the batteries will be charged via a solar panel.

2. The system can communicate at least 600 ft.

3. The system creates customizable automatic watering schedules through a web interface.

4. The system adjusts the valve within 5 seconds of the scheduled time.

5. The system comes with a user guide.

6. The system sends messages through nodes with wireless communication systems that will successfully transmit 80% of sent messages.

7. The system records messages sent and received by the system to an internal data backup, holding at minimum 1 month of messages.

8. The system circuitry will be protected by an enclosure that is water and dust proof.

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