Smart Well Pumping Controller

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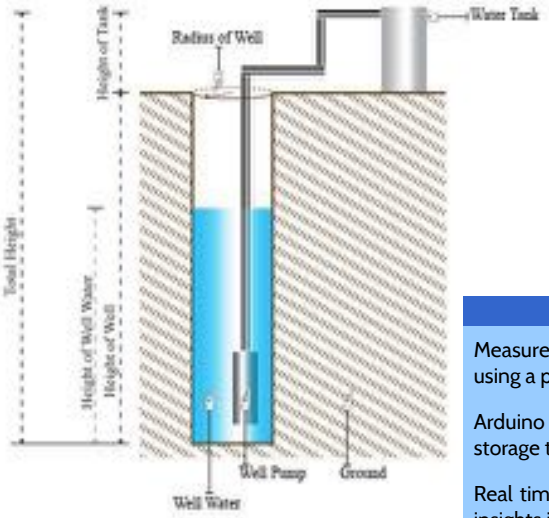
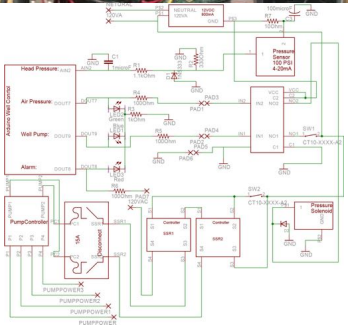
Why optimize a well?

- California is in severe drought
- Approximately 38-46 % of our water comes from groundwater
- Commercial domestic well controllers pump wells extremely inefficiently.
- Our goal was to implement a cheaper and more efficient well controller.

Our Well System



West Well

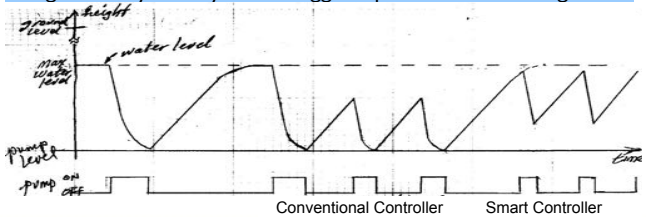


How to control a well

Measure the height of the water (about 500 ft below the surface) using a pressurized air hose.

Arduino microcontroller and Raspberry Pi computer record well and storage tank pressures, and turn on and off the pump.

Real time logging of water system parameters have provided new insights into system dynamics suggest optimal control strategies.



Conventional Controller Smart Controller

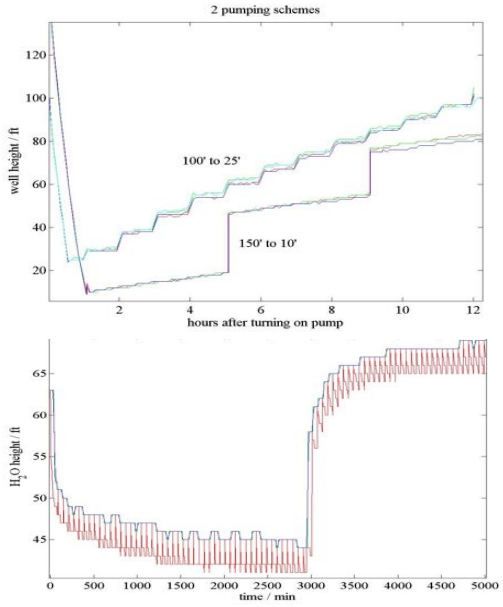
West Well

Using a commercial well controller, this well would be pumped empty, at significantly greater energy cost. Our real-time controller allows the well to be cycled near its full level, achieving greater efficiency.

East Well

This well has never run dry, but exhibits a rapid drop (and recovery) followed by a slower asymptotic drop. An efficient control strategy is to pump this well less frequently but longer.

Recovery Time on a Well



In Conclusion...

We have demonstrated the feasibility of real-time measurement and control of a domestic well system using an air hose and inexpensive surface hardware.

Our measurements on two wells have revealed new insights on their dynamics and suggest new algorithms that achieve more efficient control.

Pumping water off the top of the well requires less energy. Commercial well controllers only detect an empty well condition, thus requiring pumping from the bottom, at greater cost.

Real time monitoring of well and tank height also enables detection of leaks and unexpected losses. With appropriate software the controller could shut off surface pumps before precious water is lost.