# Remote Solar-Powered Water Pump Controller

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## Overview

An automated, solar-powered water pump controller is designed to pump water from a water body to a storage tank at the user's location. Existing systems require the users to manually check the level of water in their tank and turn on/off the motors. Our system limits human intervention and automates the pumping process and hence saves the time of the user. Our system uses solar energy for all the power supplies and hence conserves electricity. It is economical and would require less maintenance and running cost. Since the tank can be about hundred meters from the water source, a 433 MHz RF link is used to communicate the state of the tank to the pump.

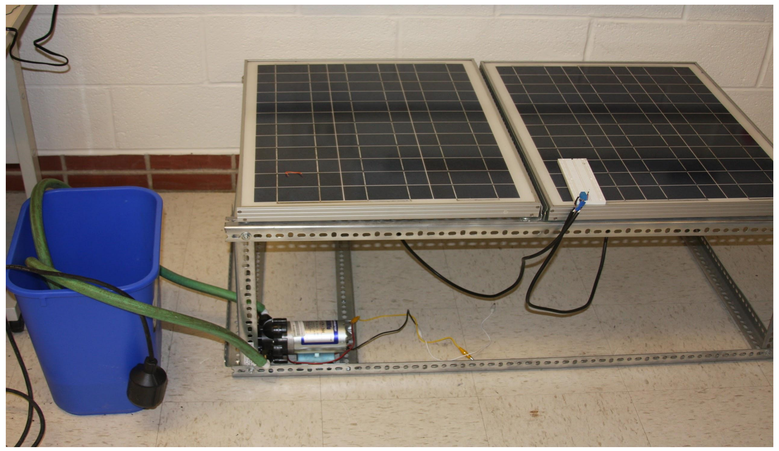

**Fig. 1 : The Solar-powered pump**

## High level Design

The system has two primary units- the transmitter unit and receiver unit. The transmitter unit is located at the user's location. The receiver unit is located near the water body. The transmitter unit consists of a solar panel, a float switch to detect the level of water in the tank, a microcontroller circuit to check the state of the float switch and an RF transmitter unit interfaced with the microcontroller for communicating with the receiver. The receiver unit consists of the solar panels, a steel frame, a microcontroller, an RF receiver and a Shurflo Motor for pumping water.

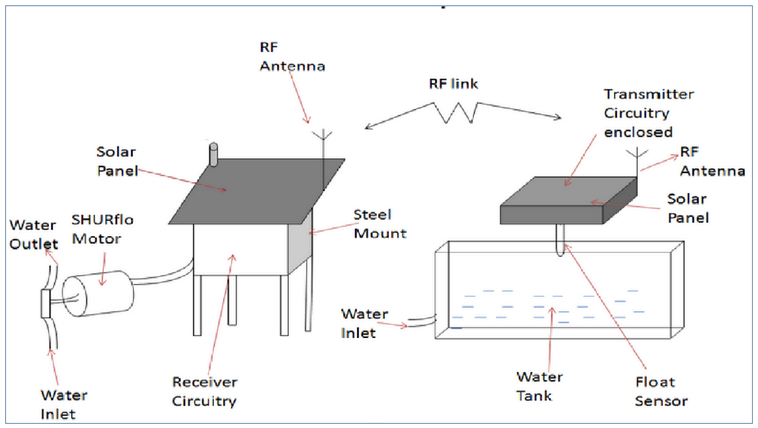


**Fig 2: Block Diagram**

## Transmitter Sub-System

The transmitter section is located at the user's desired location of the tank. The transmitter unit consists of four main parts - a solar panel, float sensor, a 433 Mhz transmitter and the Atmega32 Microcontroller unit. The float sensor is fixed in the side of the water tank around the center, such that it will be on when the water level is below a limit, and it will be off when the tank is full. The float sensor is connected as an input to one of the ports of the microcontroller and when it is high, the microcontroller sends a 'pump' command to the receiver through the RF wireless link.

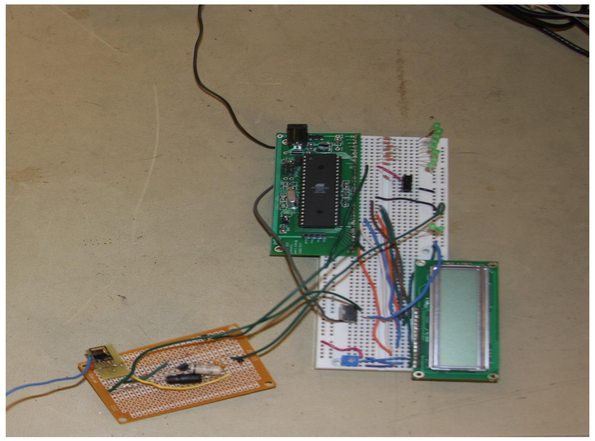

**Fig. 3 : 433 MHz RCT 433 Transmitter and Microcontroller**

## Receiver /Pump Sub-system

The receiver/pump subsystem (Fig. 1), consists of two 40W solar panels, a pump, a microcontroller, and a 433 MHz receiver. Provided that there is enough sunlight, the microcontroller is powered on, and communication resumes between this subsystem and the transmitter subsystem. A voltage regulator ensures that the microcontroller receives 5V irrespective of the output voltage of the solar panels. The pump remains off until an 'pump on' signal is received from the transmitter end. When this happens, the gate voltage on a power transistor is switched high to cause a current to flow to the pump. Thus, water would be drawn from the source of water to the storage container.

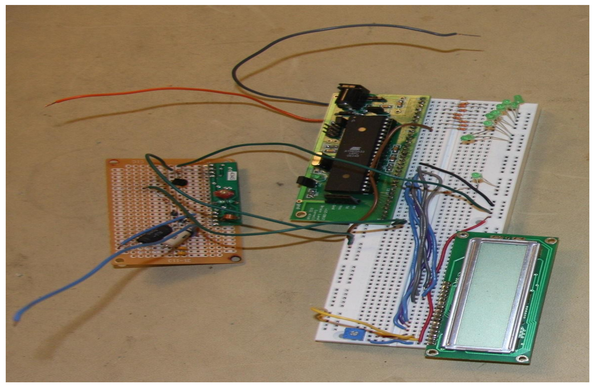

**Fig 4: 433 MHz Receiver and microcontroller**

## Communication Protocol

The protocol used is On-Off Keying (OOK) over a 433 MHz channel. In OOK, a logical 1 corresponds to a transmission at a carrier frequency whereas a logical 0 is the absence of transmission. Thus, a synchronized receiver can detect the symbol a transmitter sent. To deal with synchronization issues, a reserved start symbol is used so the receiver can determine when transmission starts. The transmitter is an RCT433 unit and the receiver is RCR 433 from Radiotronix.

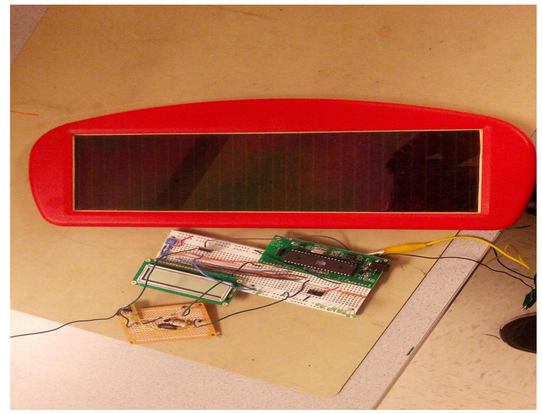

**Fig. 5 : Transmitter unit with solar panel**

## Results and Conclusion

The subsystems of our remote, solar-powered water pump controller have been built successfully. Each subsystem works and all that is required is integration. Preliminary range tests have been performed for the 433 MHz channel and transmission is successful from one end of Duffield hall to the other. This corresponds to a distance of about 80 metres. Further outdoor tests are required to measure the maximum possible range with this setup. Finally, with careful impedance matching and antenna design, the range could be further optimized.


**Fig. 6 : Google Earth view of intended use location**

## Acknowledgement

We would like to acknowledge our advisor Prof.Bruce Land for the constant motivation and inspiration to think beyond the ordinary.