Centre for Renewable Energy Systems Technology, Wolfson School of Manufacturing, Electrical and Manufacturing Engineering.

Developing a Low Cost Solar Powered Water Pump for Deployment in Developing Nations for Agricultural Purposes.

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1. Introduction

- A major problem in developing nations is water security. This includes the amount of water available for drinking, agriculture and sanitation, along with labour intensive methods required to withdraw and carry water.
- It is suggested a low cost solar powered water pump could assist people with irrigation and mitigate the dependence on rain-fed agriculture, if an affordable system could be developed.
- Here we present an experimental system for proof-of-concept for the design of a small-scale solar water pump that can lift water up to 7m.

2. Objectives

- Develop a low cost solar powered water pump system, see figure 1.
- Design a sub-system to record the flow rate of the water in liters/hour. Determine the efficiencies of the 12V DC submersible pump and 12V 20W polycrystalline PV panel.
- Extend the capabilities of the system by implementing a mobile phone charger device.

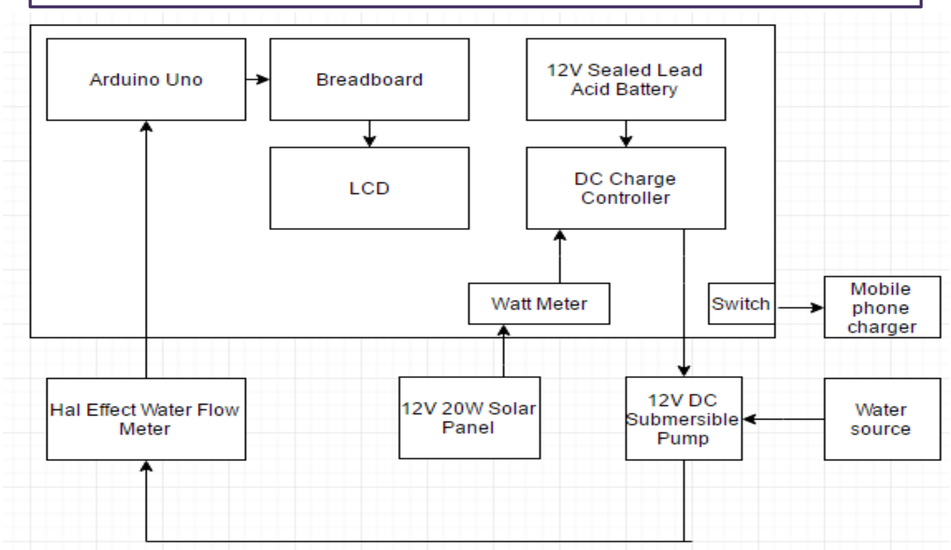

Figure 1, system diagram

3. Methodology

- Calculate the power requirements to lift water and size components.
- $P_{hyd} = \rho g H a Q / 3.6\text{x}10^6$
- Construct solar water pump and test monitoring systems. See figure 2.
- Test the device recording water flow rate, current, voltage, and irradiance received by the PV panel in 1 minute intervals during a 60 minute period.
- Perform replicated tests for head heights of 1m, 3m, 5m and 7m.

4. Results

- The device was successfully built and tested.The measurements taken at a head height of 3m yielded the most desirable results 100l/h, see Figure 3.
- The pump produced an operating efficiency of 44% including the frictional factor of the PVC pipe.
- The efficiency of the solar panel was 12%.
- The effect of irradiance was linearly proportional to current to support the research. Similarly water flow had a linear effect on the current.
- Off the shelf components; PV module, water pump, charge controller and tubing cost of approximately £60.

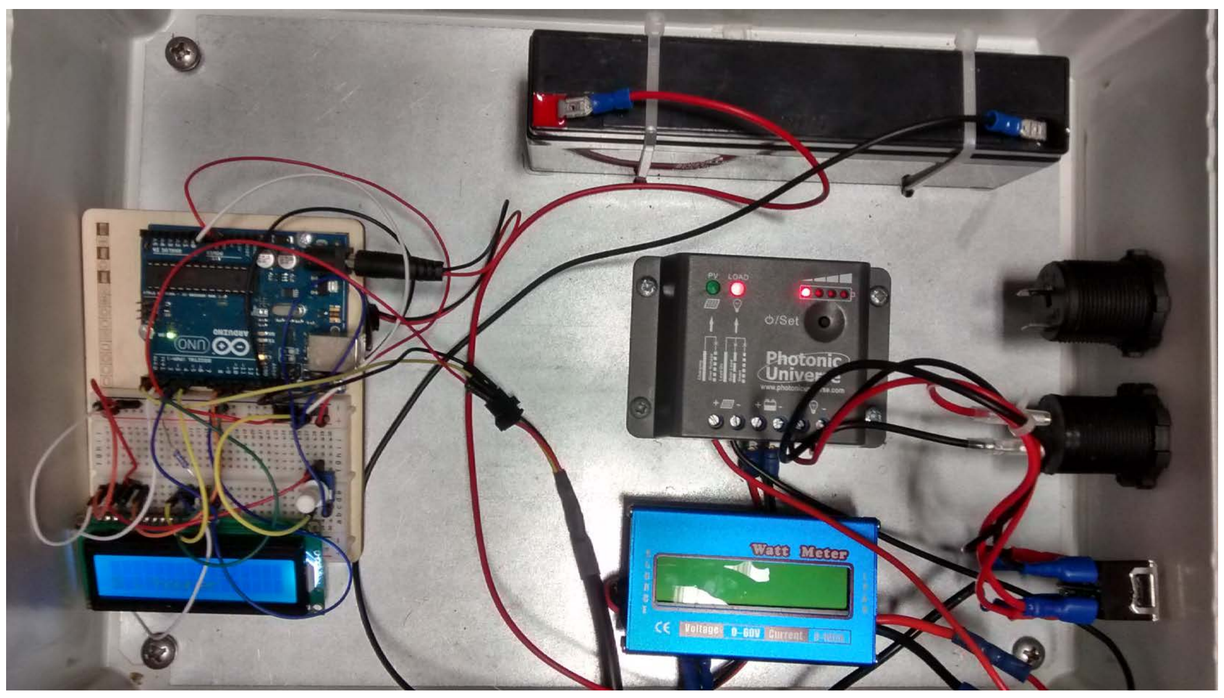

Figure 2, solar water pump monitoring prototype

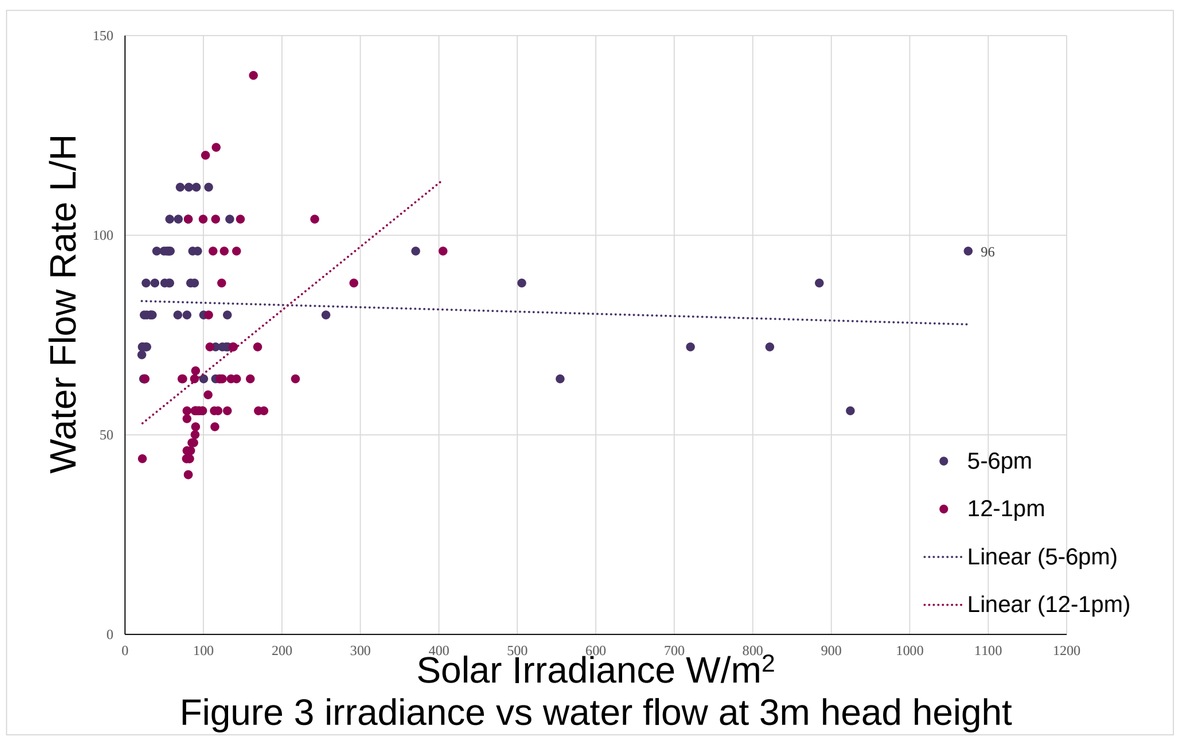

Figure 3 irradiance vs water flow at 3m head height

5. Conclusions

- A solar water pump was developed and tested that gave replicable results.
- Monitoring enables water flow rates and power to be measured and efficiencies for the main components to be calculated.
- The addition of a usb charger for phones or lights could make the device more useful but adds costs to the device.
- Future work could see further product development and field testing.

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