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Improving Access to Clean Water Through Autonomous Monitoring of Hand Pump Operation

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Improving Access to Clean Water Through Autonomous Monitoring of Hand Pump Operation

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The Need

Millions of households in sub-Saharan Africa rely on hand pumps installed by various non-governmental organizations (NGOs). Studies have shown that more than 35% of these pumps are broken when people come looking for water, with significant delays before maintenance personnel arrive. To facilitate more rapid repair of broken pumps, the Intelligent Water Project (IWP) is working with NGOs such as World Vision to develop a system that automatically not only tracks pump usage, but also monitors metrics indicative of common failure modes and automatically reports pump health to remote maintenance personnel.



OUR SYSTEM



Main System Electronics

Our system consists of a handle movement sensor, water presence sensor, GSM cellphone and PIC microcontroller based electronics, powered by a battery and a solar panel. Sensor data is processed to calculate volume of water pumped, maximum distance water is lifted to prime the pump, and maximum leak rate. Each day this information is sent via text message to a remote database/web reporting system. The raw data in the text message is processed and used to inform client NGO's about the usage and condition of the pump.

In order to accomplish our future goal of creating a sustainable and reliable system for use in the field, we have used the feedback from the previous field installations in Ghana and Burkina Faso to make design and process changes. Looking forward, we will be sending 4 of our current systems to Zimbabwe to begin a field trial starting in the summer of 2022. Following success in Zimbabwe, we hope to send 4 systems to Ghana and 4 systems to Mozambique for similar field trials during the 2022-2023 academic year; gathering performance and reliability data to determine if our system is ready for large volume manufacturing.



PARTNER: **alignedworks**
VENTURE TALENT

ADVISOR - Dr. Randy Fish

STUDENT

TEAM:

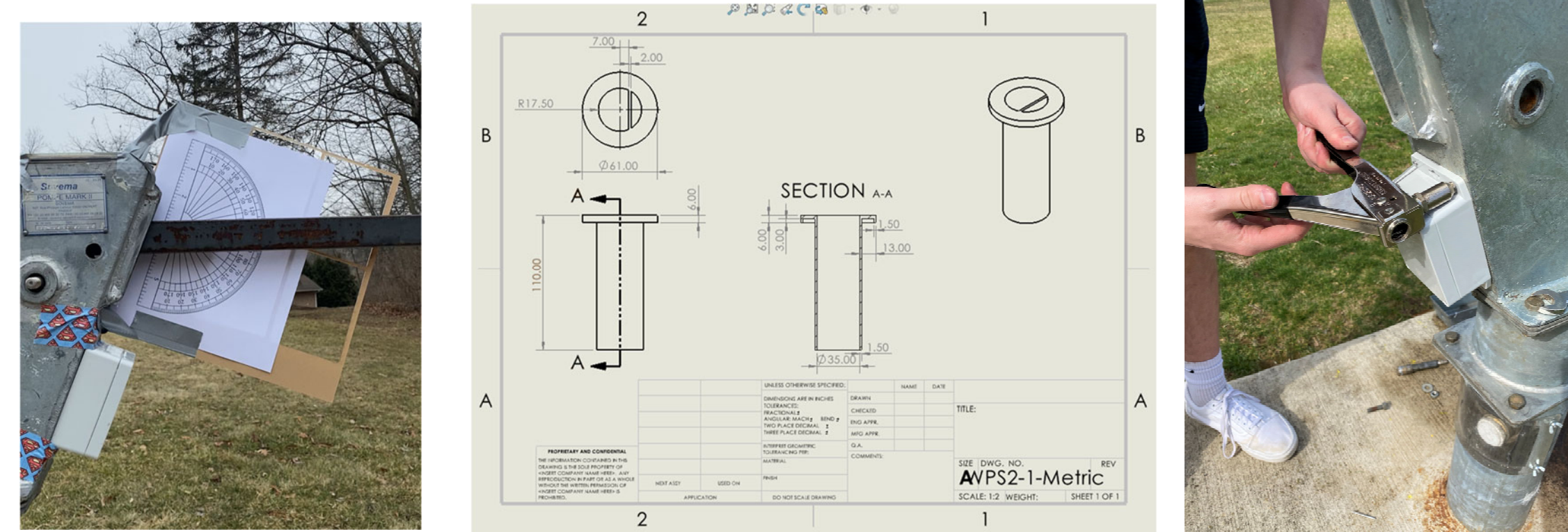
- . Jared Groff
- . Matt Caldwell
- . Josiah McCarthy
- . Lydia Reber



CURRENT WORK

Accomplished Goals: As the Intelligent Water Project approaches extended field testing, it is important to ensure that accurate data is reported, as well as create installation procedures to make the installation as straightforward as possible. The team installed multiple systems on its on-campus pump to verify the ease of installation and used each for a week to identify any short term failures. Additionally, tests were run to verify and determine a new way to calculate how much water was pumped. This new approach improved system accuracy and opened up improvements for the future.

In Process: The team is currently working on implementing a new volume calculation algorithm that will account for different speeds of pumping, as well as determine the number of strokes in a given pumping event. A new water presence sensor is being developed to reduce cost and improve ease of installation.



FUTURE GOALS AND DEVELOPMENT

- . Year long field trials in Mozambique, Ghana, and Zimbabwe
- . Translate Installation Documentation
- . Pilot run of large scale production



CONTACT INFORMATION

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<https://aligned.works>

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DEPARTMENT OF
ENGINEERING



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