








Project Statement

The RainCatcher Clinic Team will design, build, and test a device to monitor and report the performance of rain catchment tanks in Kenya, Uganda, and the Navajo Nation.






Motivation

RainCatcher is a non-profit organization working to tackle the global issue of clean water access through installing rainwater catchment systems. These systems make water accessible to people who would otherwise have to spend hours walking to retrieve water from other sources. The data that our device provides will allow RainCatcher to improve the reliability of their systems and better survey the impact of their work.

Goals

-  Measure tank water volume
-  Transmit data
-  Locally store data
-  Allow retrieval of stored data
-  Process and visualize the data

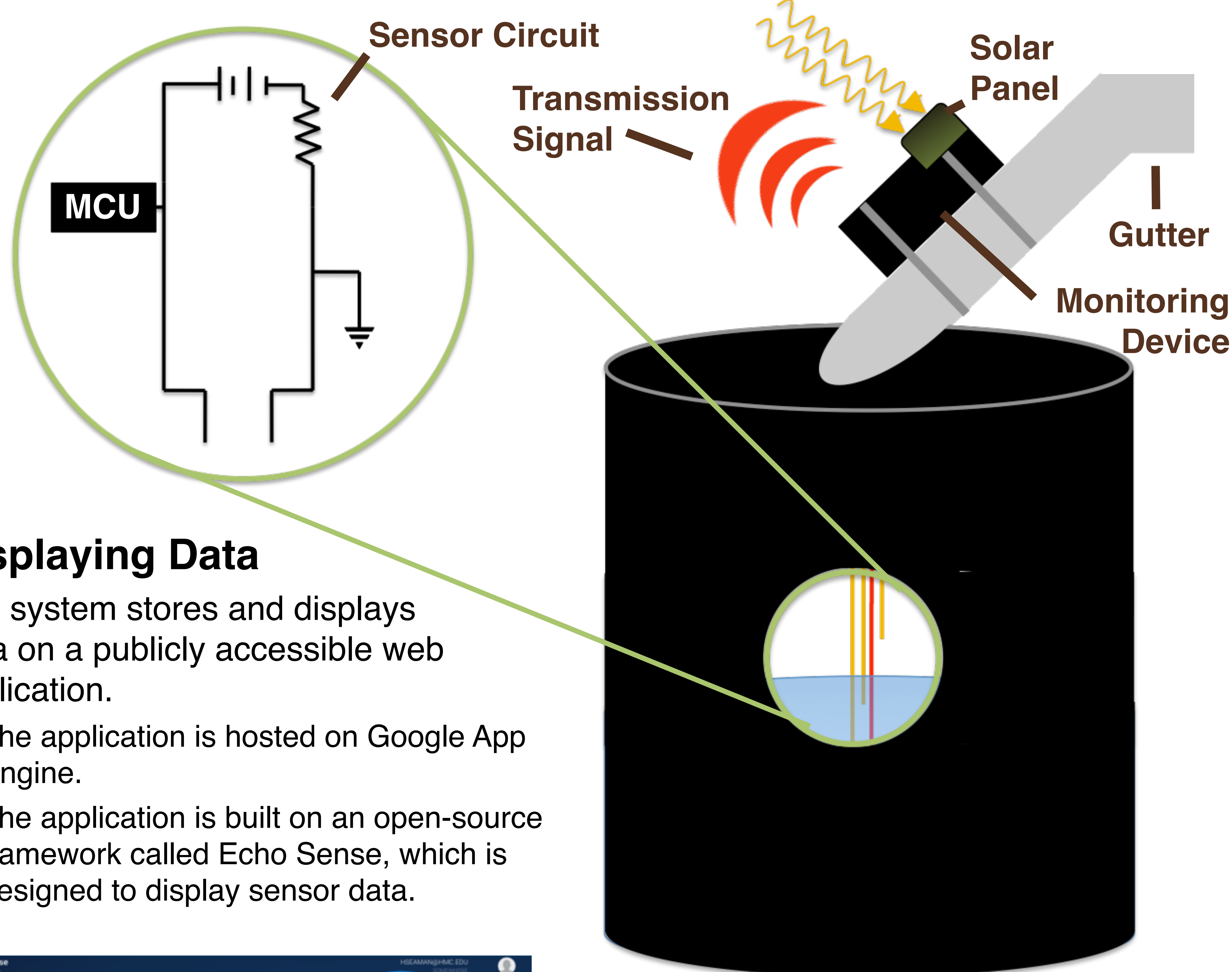
Constraints

-  Minimize cost
-  Minimize possibility of theft
-  Operate under adverse weather conditions
-  Operate on self-sustaining power system
-  Operate for the lifetime of the tank

Measuring Water Level

The system determines the volume of water in the tank using a waterproof sensor.

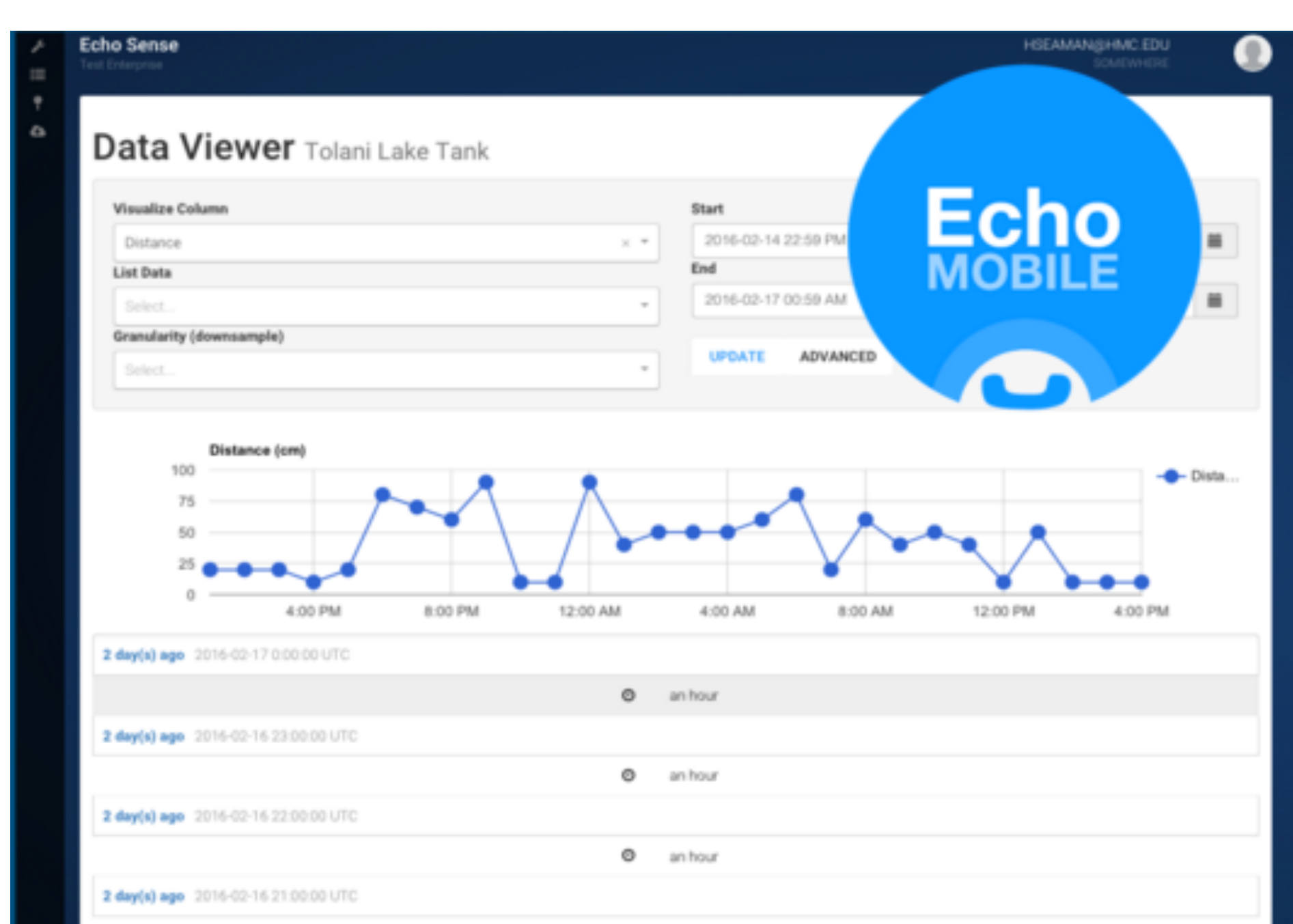
- A collection of wires is connected to a microcontroller and extends into the tank at different heights.
- The software on the microcontroller calculates the height of the water in the tank based on which circuits are closed and which are open.



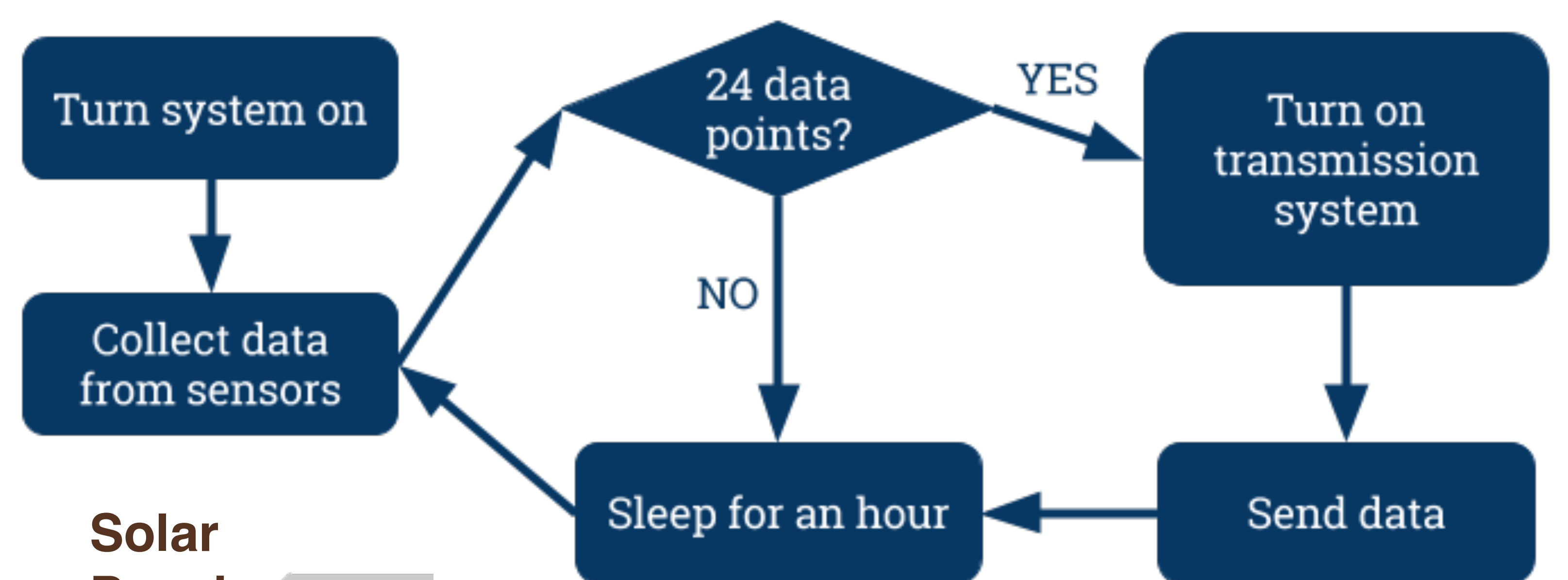
Displaying Data

The system stores and displays data on a publicly accessible web application.

- The application is hosted on Google App Engine.
- The application is built on an open-source framework called Echo Sense, which is designed to display sensor data.



System Operation to Minimize Power Consumption



Communicating Data

The system is designed to send data from remote tank locations to RainCatcher using the following steps:

- A GSM module sends SMS messages via locally available cell networks to a mobile phone.
- An Internet-connected mobile phone relays data to the web.
- A web application receives, parses, and stores collected data.

Storing & Retrieving Data

The system is designed to store data for local access in case of unexpected power down or lack of cellular service.

- Data is stored locally at the tank site on an Electrically Erasable Programmable Read-Only Memory (EEPROM).
- Each device is equipped with an infrared transceiver for manual data retrieval.

Protecting the System

The system is protected from adverse weather conditions and theft.

- A sealed PVC pipe protects the electronic components and deters theft.
- The housing system is clamped to the downspout.

Powering the System

The system operates on self-sustaining and renewable energy.

- Solar panels collect solar energy and recharge supercapacitors each day.
- Supercapacitors store and deliver energy to the system using a switch-mode power system.