# Data Turbine Android Sensor Pod

# Taiwan Forest Research Institute

By

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**Background:**

This project will assist researchers at the Taiwan Forest Research Institute (TFRI) in developing and testing an environmental monitoring system based on the Android platform and the Data Turbine software.

The usage of sensor data is becoming more popular since researchers and in particular environmental scholars are interested in uncompromised data. Using sensor pods will give them the opportunity to access raw data for long term monitoring. Most monitoring systems are custom built, which creates a learning curve for anyone new to the systems as well as sacrificing other elements such as scalability. DataTurbine is a middleware created as a direct response to this. This open source system, supports real-time data management and allows different types of sensor data to be synchronized in real time, buffered and streamed across a network.

**Method:**

Developed by Dr. Tony Fountain and his team, DataTurbine is an open source real-time streaming engine. It is highly flexible and can stream live data to multiple receivers. Additionally, it is scalable and capable of adapting the network structure of various sizes. As for my part, I will focus on integrating a weather station (Vaisla WXT 520) at the TFRI research station with the DataTurbine Android  Sensor Pod developed and built by Dr. Tony Fountain and his research group at UCSD.

The sensor pod has four sensors in total:

-Built-in Droid camera
-Built-in Droid microphone
-External temperature and Humidity sensors
-External Precision Voltage sensor

My job was to build this sensor pod and assure that enough power was provided to charge the phone and run the Vaisala Weather station.

**Sensor Pod Description:**

The sensor pod includes a Mean Value Voltage regulator, IOIO board, RS232 Shifter and three on board sensors: Precision Voltage sensor, Temperature and Humidity sensor.

*Mean value Voltage regulator*: Would automatically maintain a constant voltage level. For the purpose of this project, the MW SKE 15-05 was used to convert the input power from the solar panels (range of 9-18V) to a DC out put of 5V 3A.

*IOIO board:* The IOIO (pronounced "Yo-Yo") is a board specially designed to work with any Android version 1.5 and later device. The board provides robust connectivity to an Android device via a USB or Bluetooth connection and is fully controllable from an Android application using a simple and intuitive Java API.

*Voltage Sensor*: The voltage sensor measures the potential difference on the input. The input is connected to the batteries and the sensor measures only the voltage of the batteries.

*Temperature sensor*: Measures Relative Humidity from 10% to 95% with a typical error of ±2%RH at 55% RH.

*Humidity sensor*: Measures Ambient temperature in the range of -30°C to +80° C with a typical error of ±0.75°C in the 0°C to 80°C range.

*RS232 Shifter:* This board has one purpose- to convert RS232 to TTL and vice versa (TX and RX). This will allow a microcontroller to communicate with a computer. Shifter SMD is powered from the target application and can run at any voltage! That's right - power the board at

5V and the unit will convert RS232 to 5V TTL. Includes two indicator LEDs for TX and RX.

Runs from 300bps up to 115200bps.

**Power Calculation:**

| **Number of Batteries** | **2** |
|---|---|
| Batterie Voltage (V) | 12 |
| Batterie Current (Ah) | 7.2 |
| Total Amps-hour (Ah) | 14.4 |
| Total Watts-hour (Wh) | 172.8 |
| Time to recharge batteries (hours) | 8.64<br>using the solar panels |
| **Number of Solar Panels** | **2** |
| Total Solar Panels (W) | 20 |
| Total Solar Panels (A) | 1.67 |
| Power Consumed in 24 hr | 148.93 |
| Amp drawn in 24 hr @ 12V | 12.41 |

| **Device** | **Voltage (V)** | **Current Draw (mA)** | **Power consumption (W)** |
|---|---|---|---|
| Android Phone | 5 | 1000 | 5 |
| IOIO Board | 5 | 200 | 1 |
| Voltage sensor | 5 | 3.6 | 0.018 |
| Temperature sensor | 5 | 0.3 | 0.0015 |

| Device | Voltage (V) | Current Draw (mA) | Power consumption (W) |
|---|---|---|---|
| Humidity sensor | 5 | 3.6 | 0.018 |
| Vaisala WS | 12 | 14 | 0.168 |
| | Totals | 6.2055 | 148.932 |

**Conclusion:**

Unfortunately, our system lasted for only a few hours since the phone battery drained. The solar panels were providing enough power to keep the weather station and IOIO-board running properly. However, although the phone could communicate with the IOIO board it was not getting fully charged since the CHG on IOIO was not fully closed. It was a manufacture problem since we could not close the CHG on IOIO at all.

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