report

Environmental Monitoring Guide

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Precision Temperature
We were measuring a precision temperature today with the Air Sensor *MCP9808.*
Why is it important to measure temperature?
It is important to measure the temperature because it is one of the major influences of climate change. It affects the entire ecosystem and the biodiversity drastically. It is a determining factor for climate change thus it is a major concern for the conservation and preservation of our dushi Aruba and our awesome world. Measuring the temperature helps us to keep track of the changes and alterations that occur. It gives us a sense of understanding of our surrounding and our current climate. And it helps us to be proactive and preventive against substantial and eventual repercussions.

Precision Temperature Sensor *MCP9808.*
The MCP9808 digital temperature sensor converts temperatures between -20°C and +100°C to a digital word with ±0.5°C (max.) accuracy. It works great with any microcontroller using standard i2c. There are 3 address pins so you can connect up to 8 to a single I2C bus without address collisions. A wide voltage range makes is usable with 2.7V to 5.5V. This small sensor comes on a breakout board PCB for easy use. The PCB includes mounting holes, and pull down resistors for the 3 address pins. (https://www.adafruit.com/product/1782) In order for sensor to measure we had an Arduino program set up on the computer. After the sensor was connected to the computer through USB port some settings were changed: the board was set on “Arduino Nano” and the port to a port through which the sensor was connected. Finally when Serial Monitor button was clicked we started getting the data.
The code used to program the sensor:

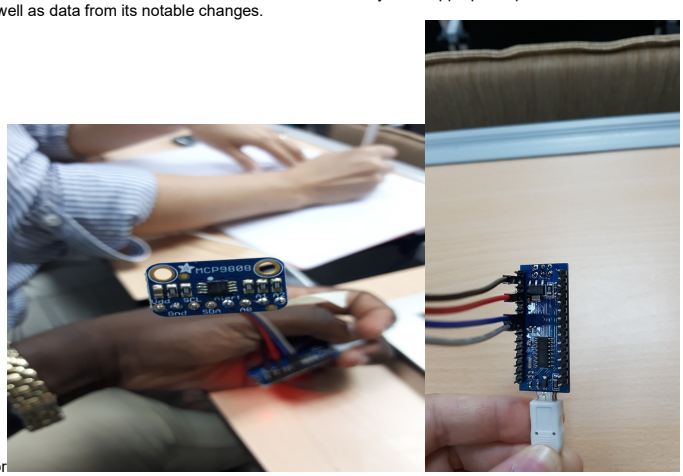
```
/**************************************************************************/
/*!
    @file     Adafruit_MCP9808.h
    @author   K. Townsend (Adafruit Industries)
    @license  BSD (see license.txt)
    This is a library for the Adafruit MCP9808 Temp Sensor breakout board
    ----> http://www.adafruit.com/products/1782
    Adafruit invests time and resources providing this open source code,
    please support Adafruit and open-source hardware by purchasing
    products from Adafruit!
    @section  HISTORY
    v1.0  - First reléase
*/
/**************************************************************************/
#ifndef _ADAFRUIT_MCP9808_H
#define _ADAFRUIT_MCP9808_H
#if ARDUINO >= 100
 #include "Arduino.h"
#else
 #include "WProgram.h"
#endif
#include <Wire.h>
#define MCP9808_I2CADDR_DEFAULT          0x18
#define MCP9808_REG_CONFIG               0x01
#define MCP9808_REG_CONFIG_SHUTDOWN      0x0100
#define MCP9808_REG_CONFIG_CRITLOCKED    0x0080
#define MCP9808_REG_CONFIG_WINLOCKED     0x0040
#define MCP9808_REG_CONFIG_INTCLR        0x0020
#define MCP9808_REG_CONFIG_ALERTSTAT     0x0010
#define MCP9808_REG_CONFIG_ALERTCTRL     0x0008
#define MCP9808_REG_CONFIG_ALERTSEL      0x0004
#define MCP9808_REG_CONFIG_ALERTPOL      0x0002
#define MCP9808_REG_CONFIG_ALERTMODE     0x0001
#define MCP9808_REG_UPPER_TEMP           0x02
#define MCP9808_REG_LOWER_TEMP           0x03
#define MCP9808_REG_CRIT_TEMP            0x04
#define MCP9808_REG_AMBIENT_TEMP         0x05
#define MCP9808_REG_MANUF_ID             0x06
#define MCP9808_REG_DEVICE_ID            0x07
class Adafruit_MCP9808 {
 public:
  Adafruit_MCP9808();
  boolean begin(uint8_t a = MCP9808_I2CADDR_DEFAULT);
  float readTempF( void );
  float readTempC( void );
  void shutdown_wake( uint8_t sw_ID );
  void shutdown(void);
  void wake(void);
  void write16(uint8_t reg, uint16_t val);
  uint16_t read16(uint8_t reg);
 private:
  uint8_t _i2caddr;
};
#endif
```

Place	**Time**	**Degrees Celsius**	**Observations**
At the courtyard of University of Aruba	11:30am - 12:00pm	32ºC & 33ºC	The data was collected while being under the shadow of a tree.
In the premises of the University of Aruba close to the classroom D2	12:00pm - 12:30pm	32ºC & 34ºC 31ºC & 33ºC	At first we moved to another location where the sun rays impacted a little more. But eventually became a little cloudy and the temperature decreased
At the courtyard of University of Aruba	12:35pm - 12:40pm	32ºC & 34ºC	The temperature went back to its past state; but only that

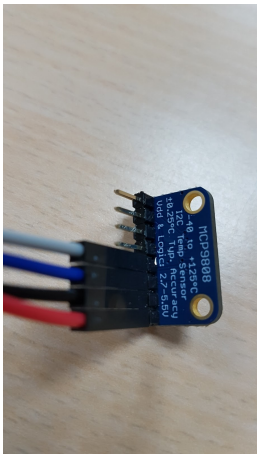
			this time due to the humidity and the lack of breeze the temperature was felt with much more intensity.

What the numbers indicate. The Data collected on October 23, 2017 outside the premises of the University of Aruba which shows an average of 32ºC and 33ºC between 11:30am and 12:00pm; an average of 32ºC and 34ºC between 12:00pm and 12:30pm. But for a moment that it became a little cloudy, the temperature decreased to 31ºC and 33ºC. But then it went back to 32ºC and 34ºC between 12:35pm and 12:40pm. Data taken from internet source (https://www.accuweather.com/en/aw/oranjestad/12007/weather-forecast/12007) for the same day states 31ºC and close to the measurement taken with Air Sensor. The average temperature from Aruba during the month of October is minimum 26ºC and maximum 31ºC (http://www.holiday-weather.com/aruba/averages/october/). Our measurements show that the temperature taken today are exceeding the maximum average rate of the month of October.

Process: We went to an open place at the premises of the University of Aruba; to get the real effect of the temperature change and record viable data. We took our Sensor, plugged it to our computer and started running the software so that we could start getting our temperature data. We lifted the sensor and holded it steadily at an appropriate position that would allow the data to be precise and exact. As a result giving us viable and exact data of the temperature as well as data from its notable changes.



Pictures: Left - Microcontroller Arduino Nano, Right - Temperature sensor



Simulation of the Precision Temperature of Sensor MCP9809
https://docs.google.com/document/d/123jq65zZ3ydiv50sBNEoqrSHuRhsk3WRxHVywoM4ssE/edit?usp=sharing

Field Work Report

Parkietenbos landfill: Parkietenbos Landfill & Containerpark has been Aruba's official public dumping-site since the 1960s. Located in the middle of the island on the south side, you will find it driving on the barcadera road from the West to East, before the airport, you won't be able to miss it, the size of the landfill is visible from land and sea and approximately over 190,000 square meters. The waste is approximately risen 40 meters from the sea level, and the waste received is about 12000 tons Annually, according to the current Manager. Parkietenbos is organized in two main deposit sections, the Container park and the Landfill. These two sections are subdivided according to designated waste materials . The container park is designed for household waste and the Landfill section should be used by public, private and non profit organization. They are open from Mon – Fri: 6.00 am – 7.00 pm, Sat: 7.00 am – 6.00 pm, Sun: 8.00 am – 3.30 pm.

Weather: Sunny weather with slight chance of clouds and rain. At the entrance was almost no wind, while on top of the field was light breeze from sea side (noted that usually the breeze is coming from lands side). The surface-ground was wet from the rain that passed a day ago. There was no visible smoking on the landfill except the one where they burn trees and branches.

Forecast for October 30, 2017 taken from online source is 26ºC-31ºC (https://www.accuweather.com/en/aw/oranjestad/12007/month/12007?monyr=10/01/2017). The measurements were taken between 11:00am and 12:00pm.

Point of Measurement	Temperature range	PH	Observations	Notes
1.By the road on top of the field	33ºC - 35ºC	6.7	The road is muddy and broken from Serlimar waste trucks and private pickups going back and forth every five minutes	At this point it was really warm.
2.Close to the edge of the field from the sea side	34ºC - 36ºC	6.3	Around you can see all kind of trash: plastics, paper, wood, metal pieces mixed up with the soil.	Here, we could feel the breeze from the sea side. But the heat could still be felt
3.Next to the burning pile	36ºC - 39ºC	6.2	The burning smell is almost unbearable	It gives evidence of how high the temperature would be when there is lots smoking and if there was no precipitation.

4.In the middle of the field	35ºC - 37ºC	6.7	The same mixture of waste and soil can be seen around. Street dogs are walking across.	
5.Close to the trucks	30ºC	6.8	Excavators are organizing the field by spreading the piles of waste over the land, making it leveled horizontally	At this point it started raining
6.At the entrance of the field	30ºC - 31ºC	8.7		Rain continues

What do the numbers indicate. The temperature measurements taken in the area of the landfill are much higher than a maximum indicated for that day (except for the ones when it started raining). The maximum temperature for the area was 39ºC and it was taken by the burning pile. In the middle of the field the temperature was also very high (37ºC), that we can think of some burning processes are going deep beneath the surface that resulting in such numbers. At the last two points it started raining and the temperature dropped significantly.

Compare to measurements taken outside the University. The data received from the premises outside the university was a week difference from the one taken on the landfill. The time is approximately same, around midday. However, there is a big difference in numbers (not taken in consideration measurements while it was raining since it was not raining on the day when measurements were taken at the university). If we take an average temperature on the landfill as 36ºC, it is 3 degree higher than an average temperature outside the university, which is 33ºC. Therefore, it is obviously true that the comparison could be higher for the dumping-site was not humide.

pH
Soil pH is a measure of the acidity and alkalinity in soils.The “p” stands for potential, and the “H” stands for hydrogen. pH levels range from 0 to 14, with 7 being neutral, below 7 acidic and above 7 alkaline. The optimal pH range for most plants is between 5.5 and 7.0; however, many plants have adapted to thrive at pH values outside this range. The pH meter that was used is the Rapitest Digital pH Meter. pH measurements were taken at the same locations that are indicated in the data table.

What do the numbers indicate.
The pH levels at the dump where taken at the same locations as where the temperature readings were done. The numbers indicate that the soil is below the average pH of 7.0 which is neutral. This means that the area at the dump is acidic in pH level. The level of acidity is not as severe as initially thought as many plants grow around an pH level of 5.4 to 7.0. This might be a good indication that the dump is not as acidic in form, yet one does not know what the reading of pH might be deeper in the soil, as the dump gets covered over often by a layer of rather seemingly pH neutral dirt.

Compare to measurements taken outside the University.
Unfortunately no measurements were taken outside the school, due to the rain at the dump, it was decided to head home as going to school wasn't mandatory at the time. I had then handed in the pH meter resulting in no data collected at the school. This however could still be done if necessary.