Project title

Self Powered Weather Station (**SPWS**).

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For information, questions or more details please contact us.

2. Abstract

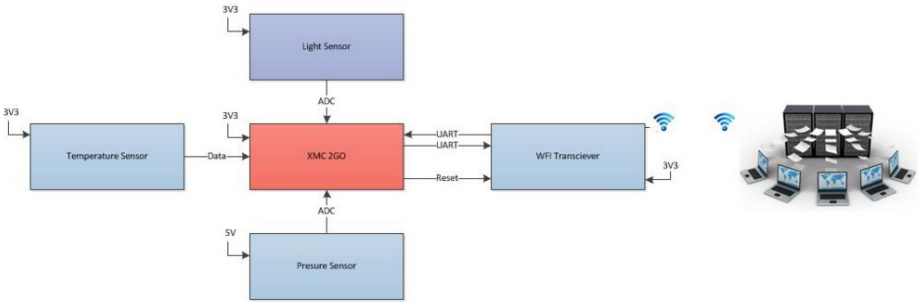
A **weather station** is a facility, either on land or sea, with instruments and equipment for measuring atmospheric conditions to provide information for weather forecasts and to study the weather and climate. The measurements taken include temperature, barometric pressure and light intensity. The main activity of the project is to read data from an Analog Barometric Air Pressure Sensor , a photoresistor and a temperature sensor. All the read data are converted per sensor in pressure/lux/Celsius degrees and transmitted with a WiFi transceiver on a Web Server. The link for **Web Page** is:https://thingspeak.com/channels/73806 .

The link to the **Wiki Page** is : https://bitbucket.org/iradu/ci_project/wiki/Home .

3.Introduction, project aims and objectives

The main purpose of weather station project is to provide real time data read with XMC 2 GO on a web server. Some applicability of the project could be a mini weather station which can provide information regarding the actual temperature, rainfalls and some types of weather conditions such as cloudy or sunny days from different locations , a greenhouse monitoring who can provide real time data and statistics about the weather conditions inside the greenhouses or can be used for making statistics about how many times per years rains in different location on the globe.

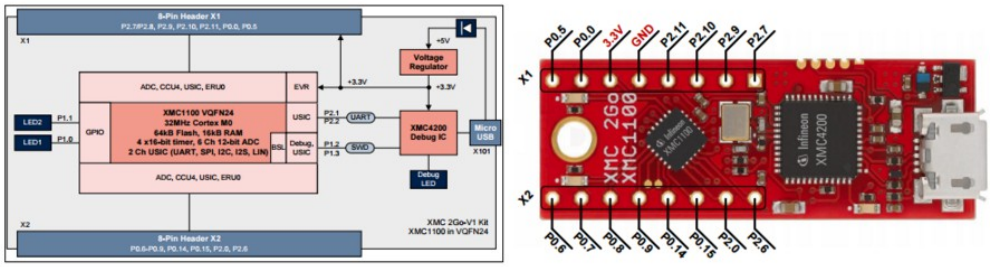
4.System overview



5.Components & Schematics

XMC 2Go Board

The XMC 2Go board is designed to evaluate the capabilities of the XMC1100 Microcontroller beeing equipped with the ARM® Cortex™- M0 based XMC1100 Microcontroller from Infineon Technologies AG. In the next figures it is presented the block diagram of this board with few details about microcontroller and peripherals and board pinout.



For more details about microcontroller, debugger or pinout please access Board User Manual or XMC1100 datasheet.

Light sensor

This sensor is in fact a photoresistor (A photoresistor or light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; - Wikipedia) which it was calibrated using an luxmeter. Feedback provided by this resistor is interpreted by ADC and transformed accordingly to the equation determined during calibration.

Pressure sensor

The KP236N6165 is a miniaturized Analog Barometric Air Pressure Sensor IC based on a capacitive principle. It is surface micromachined with a monolithic integrated signal conditioning circuit implemented in BiCMOS technology. The sensor converts a pressure into an analog output signal. The calibrated transfer function converts a pressure range of 60 kPa to165 kPa into a voltage range of 0.2 V to 4.8 V.

The chip is packaged in a “green” SMD housing. The sensor has been primarily developed for measuring barometric air pressure, but can also be used in other application fields. The high accuracy and the high sensitivity of the device makes it a perfect fit for advanced automotive applications as well as in industrial and consumer applications.

WiFi transciever

The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to aWiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware. The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

Features:

- 802.11 b/g/n
- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLLs, regulators, DCXO and power management units
- +19.5dBm output power in 802.11b mode
- Power down leakage current of <10uA
- 1MB Flash Memory
- Integrated low power 32-bit CPU could be used as application processor
- SDIO 1.1 / 2.0, SPI, UART
- STBC, 1×1 MIMO, 2×1 MIMO
- A-MPDU & A-MSDU aggregation & 0.4ms guard interval
- Wake up and transmit packets in < 2ms
- Standby power consumption of < 1.0mW (DTIM3)

6.Software

XMC2GO Module: represents the principal module who read the data from light sensor, temperature sensor and pressure sensor, converts all the data read in specific format and transmit the information on a web server using the ESP Module.

Temperature Module: The temperature is provided by the ds1b20 sensor who is connected with XMC board . The data is read digitally via an I/O port and is converted in Celsius degrees.

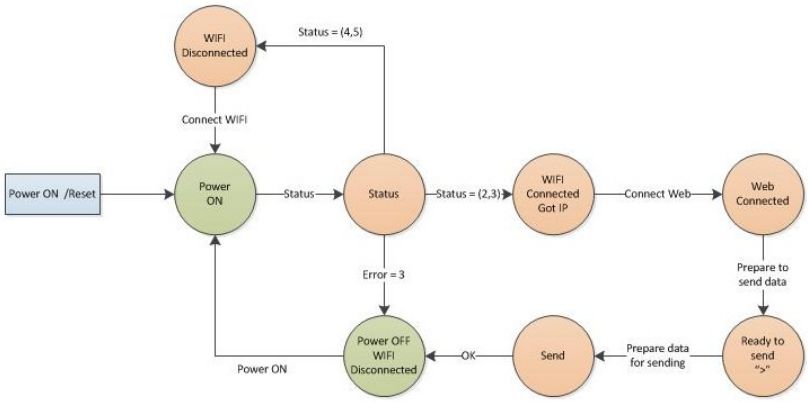
Light Module: provides data from a photoresistor directly connected with the XMC board and convert the information in lux format .

```
/* return value from photoresistor in LUCS */

uint32_t Calculate_SensorLight(void ){


  double LUCS_retVal = 0;

  uint16_t ADC_SensorLight_Avg = 0;


  if(ADC_Sensors_CompleteConversion[ADC_MEASUREMENT_ADC_LightSensor.ch_num] == 1){

     ADC_SensorLight_Avg = ADC_Sensors_AvgValue[ADC_MEASUREMENT_ADC_LightSensor.ch_num];
```

```
    if((ADC_SensorLight_Avg <= 2340) && (ADC_SensorLight_Avg > 1005)){

        LUCS_retVal = 21.4*ADC_SensorLight_Avg -20130;


    }else if((ADC_SensorLight_Avg <= 1005) && (ADC_SensorLight_Avg >= 150)){

        LUCS_retVal = 1.45*ADC_SensorLight_Avg -196.75;

    }


    if(LUCS_retVal <= 0){

        return 0;

    }else if(LUCS_retVal > 30000){

        return 30000;

    }else{

        return (uint32_t)(LUCS_retVal* UART_PRECISION);

    }

  }

  return (uint32_t)(((uint16_t)LUCS_retVal) * UART_PRECISION);
}
```

Pressure Module: provides data from Infineon KP236N6165 sensor and convert the information in mmHg.

Wifi Module: transmit the data provided by the XMC Module on a web server. All the data are transmitted by the ESP8266 module and the functional description graph is described in next figure.

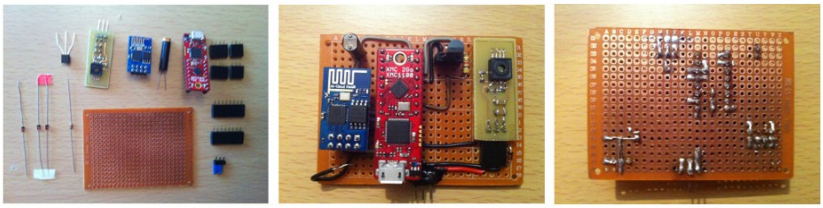


Web server: ThingSpeak is an open data platform and API for the Internet of Things that enables you to collect, store, analyze, visualize, and act on data from sensors or actuators, such as Arduino, Raspberry Pi, BeagleBone Black, and other hardware. For example, with ThingSpeak you can create sensor-logging applications, location-tracking applications, and a social network of things with status updates, so that you could have your home thermostat control itself based on your current location.

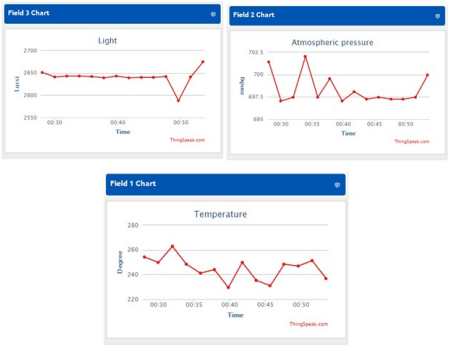
7.Project results & Applications

Considering all described components we have created using a prototype board and DIP sockets an object which represents the hardware implementation of the above presented schematic. All components are connected through sockets, except photoresistor which is enough cheaper to be soldered :). Created module has three wires for power, because it was intended to be powered from solar cells and energy should be very carefully managed.

As can be seen in next three images, prototype board is complete and functional.

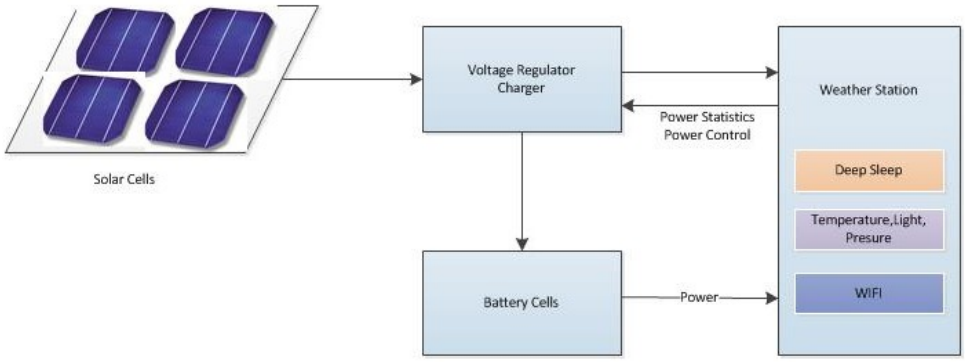


The final data collected and converted by the XMC board are shown on the web server. This three pictures provides information about the last data received from the XMC board.



The figures provides information about the latest data collected from a period of time. The data are represented in a chart which depends on the time and the values received from the board.

Future Improvements



8. Reference - .....

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