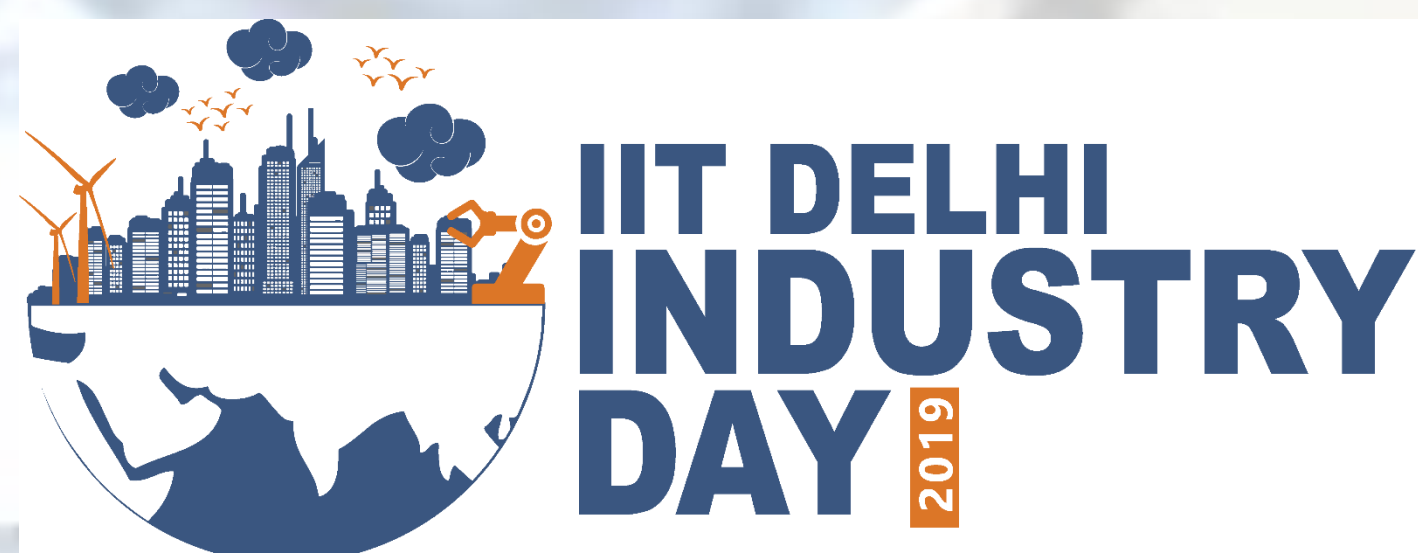


# CLEAN ENERGY FOR SUSTAINABLE ECONOMY & ENVIRONMENT

## Energy Harvesting Wireless Sensor Network

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### Abstract

We have designed a prototype for a 5G-capable environmental air pollution monitoring system. The system measures concentrations of NO<sub>2</sub>, ozone, CO and SO<sub>2</sub> using semiconductor sensors. Further, the system gathers other environmental parameters like temperature, humidity, PM<sub>1</sub>, PM<sub>2.5</sub> and PM<sub>10</sub>. The prototype is equipped with a GPS sub-system for accurate geo-tagging. The board communicates through WiFi and NB-IoT. The board is also equipped with energy harvesting power management, and is powered through solar energy and battery backup.

### Introduction

- Global air pollution is one of the major concerns of our era. Improved monitoring systems are needed, which will be having superior precision, high sensitivity, and require less laboratory analysis. Also it should be less power consuming and energy efficient one.
- Furthermore, air quality data can be used to predict future air quality index (AQI) levels.

### Hardware Architecture

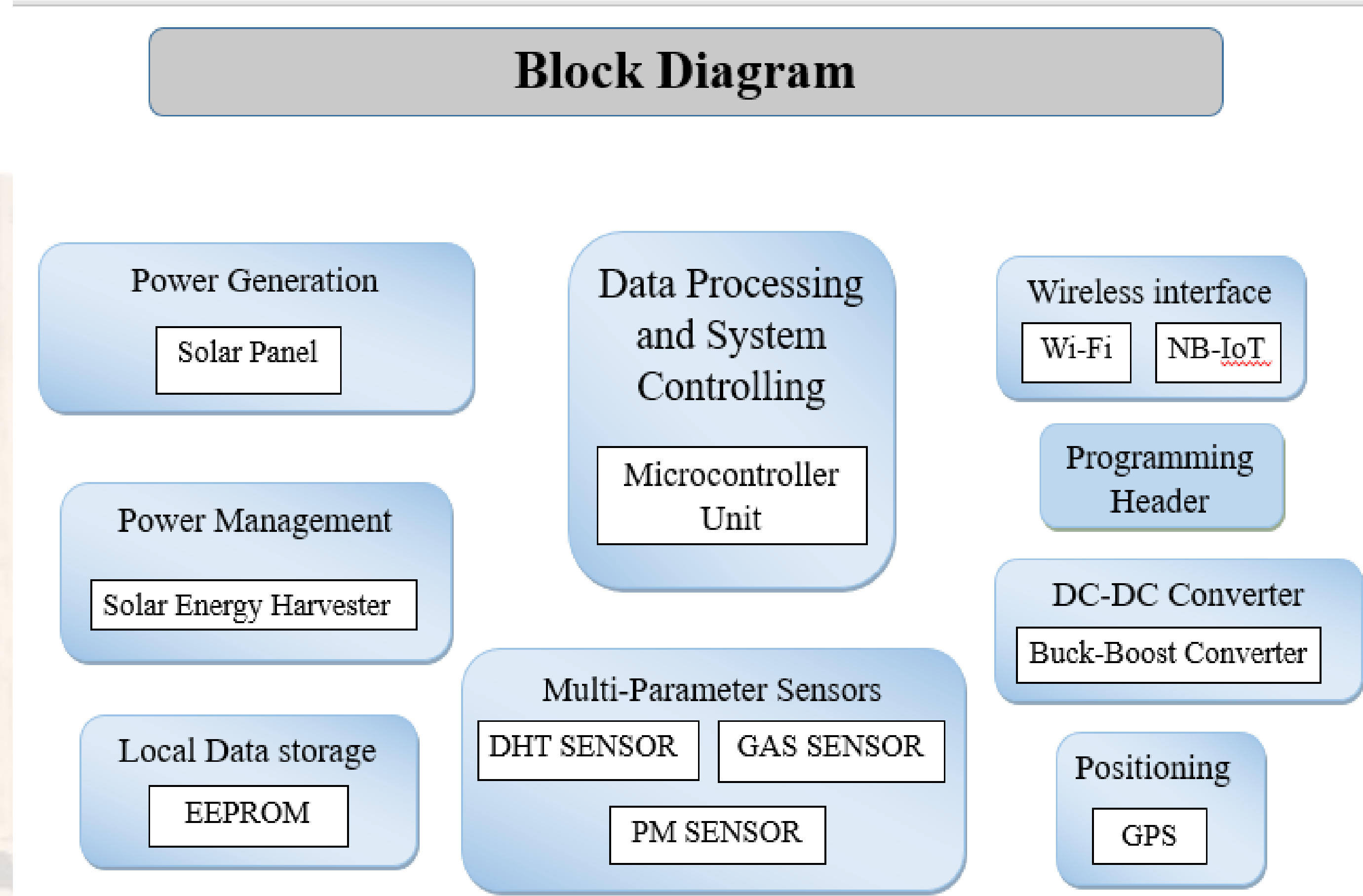


Fig.1 Block Diagram Sensor Board

### Conclusions

As of now we have tested the sensors and collected data at breadboard level. A first prototype with energy harvesting, GPS, the PM sensor, the temperature sensor and Bluetooth communications has been tested. A second prototype with the full array of sensors, NB-IoT, Wi-Fi is being fabricated. The future focus of the work would be to improve power efficiency and optimize the prototype.

### Industrial Significance

The fundamental aspect of proposed work is to provide low cost infrastructure to enable the data collection and dissemination to all stakeholders. As it is using renewable energy (solar) with energy harvester which will increase the battery life time.

### Device Information

**Energy Harvester (BQ25504)** :- This is an energy harvester used for efficiently acquire and manage the microwatts ( $\mu$ W) to milliwatts (mW) of power generated from a variety of DC sources like photovoltaic (solar). BQ25504 is also used to recharge the Li-ion rechargeable battery plane.

**Microcontroller (ATMEGA 328P)** :- High Performance, Low Power AVR 8-Bit Microcontroller used for data processing and system controlling.

**Memory (24LC512)** :- This is a 64K x 8 (512 Kbit) Serial Electrically Erasable PROM used to store the data.

**Wi-Fi (ESP8266)** :- ESP8266 module is used to store data in cloud platform.

**NB-IoT (BC66)** :- BC66 is high-performance, multi-band LTE Cat NB1 module with extreme low power which works in B8 and B20 bands.

**GPS (FGPMMOPA6H)** :- Used for precise positioning and tracking.

**DC-DC Converter** :- Maxim 856- used as a Boost converter to convert 3.3V to 5V.

**TPS62200** :- Used as a Buck converter for converting 3.3V to 1.8V.

**CH340G** :- CH340 is a series of USB bus adapters, that provides serial, parallel interfaces over the USB bus.

### Results

Below are the graphs for temperature and humidity which we have collected and stored in cloud platform.

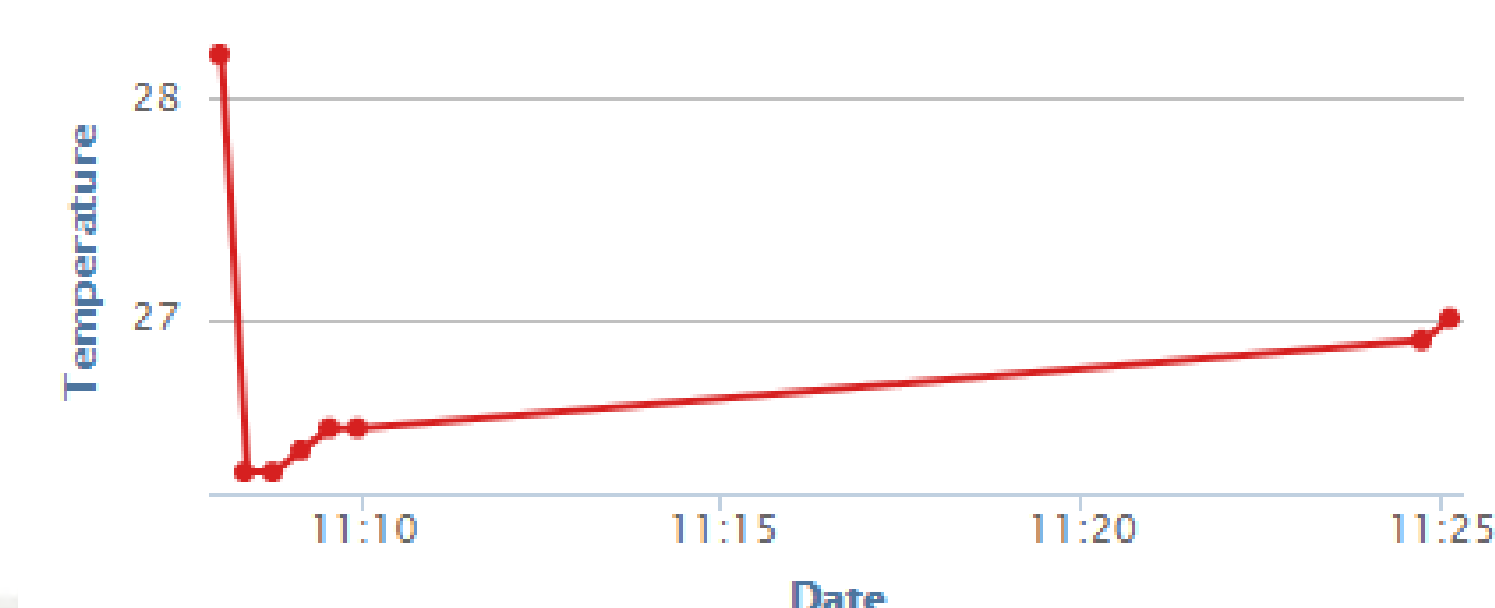


Fig2. Temperature Graph

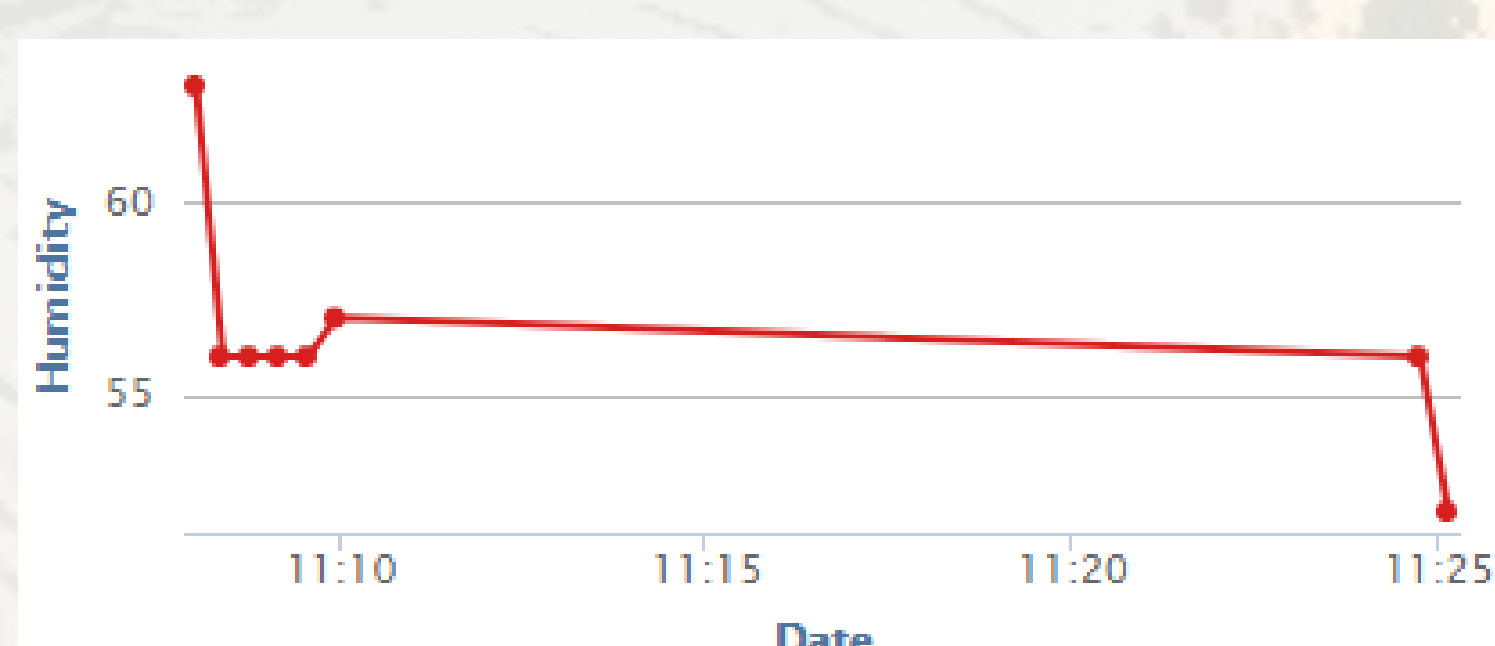


Fig3. Humidity Graph

### References

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