

Environmental Monitoring Using SCK

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ABSTRACT: Environmental studies bring together the principles of sciences, economics and social sciences to solve contemporary environmental problems. It is a broad field of study that includes the natural environment and the built environment, and the relationship between them. Environmental scientists work on subjects like the understanding of earth processes, evaluating alternative energy systems, pollution control, alleviation of natural resources and the effects of global climate change. A key element of an effective environmental scientist includes the ability to relate space, and time relationships as well as quantitative analysis. Present researches and environmental scientists mainly focus on continuous monitoring of environmental data and its analysis. Continuous monitoring has been done using Smart Citizen Kit (SCK) using multiple sensors with Arduino.

KEYWORDS: Environmental Sciences, Global climate change, Natural resources, Smart Citizen Kit

I. INTRODUCTION

Smart Citizen is an open environment monitoring platform to generate participation of people in the cities to collect and monitor their ambient environment data and analyse it. The objective of the platform is to serve as a node to build productive and open indicators, and distributed tools, and encourage the collective construction of the city for its own inhabitants. An Open-Source environmental Monitoring Platform has an Arduino compatible Hardware, data visualization web API, and mobile/computer app. This Smart Citizen kit works on geo location, Internet and hardware and software for data collection and sharing and analysing it (Smart Citizen Kit - SCK, REST full API, App and, the web community), and (in a second phase) the production of objects it connects also the people with their surrounding environment in their city to create more effective relationship between resources available, technology utilized and communities present in the urban environment. The goal of the environmental monitoring is to allow anyone to collect the data, visualize it, and share it with others with very little hassle.

II. LITERATURE SURVEY

Objects can sense, communicate and share information and can be interconnected over public or private Internet Protocol (IP) networks. These interconnected objects collect data regularly, analyse it and provide immediate action for decision making. It also allows for analysing the data and helps in taking preventive measures to protect the environment. This is the world of the Internet of Things (IOT). It refers to the idea of things, especially everyday readable, recognizable, locatable, addressable objects, which can be controlled via the Internet, irrespective of the kind of communication (RFID, wireless LAN, WAN, or other means). Every day with more smart devices connected in the IOT landscape, the impact and value that IOT brings to our daily lives become more prevalent. People make better decisions. IOT uses technologies to connect physical devices to the Internet available. The size and cost of electronic components that are needed to support sensing, tracking and control mechanisms play a critical role in the widespread adoption of IOT for various industry applications. In order to support these applications, a reliable platform is essential. Cloud computing is one of the developing platforms to support IOT. Cloud computing is an architecture that allows various technology capabilities such as multi-tenancy and usage accounting while relying on the Internet and other connectivity technologies.

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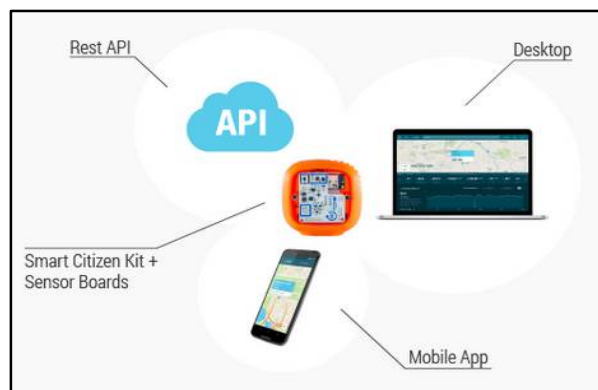


Fig 1 Smart Citizen Platform

The lowest layer of IOT is made up of smart devices which are integrated with sensors. The sensors enable the inter connection of the physical and digital worlds allowing real-time information to be collected and processed. Most sensors require connectivity to the sensor gateways. This can be in the form of a Local Area Network (LAN) such as Ethernet and WiFi connections or Personal Area Network (PAN) such as ZigBee, Bluetooth and Ultra- Wideband (UWB).

As the adoption of IOT becomes pervasive, data that is captured and stored becomes huge. One of the main concerns that the IOT has to address is privacy.

III. THEORITICAL APPROACH

A complete study has been done on Smart Citizen Kit (SCK) and analysis of the environmental data with SCK. A proto type SCK has been designed and identifying the further developments. Monitoring system is designed for proto type SCK for the data to be conveyed to the server (or) operating from some other location. The environmental data collected from SCK sensors are taken and plotted using MS Excel.

The Smart Citizen Kit is a piece of hardware comprised of a sensor and a data-processing board, a battery and an enclosure. The first board carries sensors that measure air composition (CO and NO₂), ambient temperature, and humidity of air, light intensity and sound or noise levels. Once it's set up, the device will stream data measured by the sensors over WiFi using the wireless module available on the data-processing board. The device's low power consumption allows for placing it on balconies and windowsills.

Power to the device can be provided by a solar panel or battery. The Kit is Arduino compatible and all the design files are open source files.

The main aim is to monitoring of environmental data using SCK and design of prototype SCK.

1. Monitoring of environmental data and analysis using SCK
2. Designing a system for detecting the environmental data using Arduino UNO R3
3. Hardware board, Sensors and GPRS.
4. Designing a monitoring section for retrieving the environmental data and posting the data.

The preparation of prototype of the smart citizen kit using Arduino UNO R3 Hardware board with DIP ATmega328, Sensors and GPRS can be done.

In which the hardware consists of the following modules:

1. Arduino UNO R3 Hardware board
2. Sensors (Light, Noise, Temperature, Humidity & Gas sensor)
3. WiFi Module
4. Power Supply
5. Monitoring Section



Fig 2 Smart Citizen Monitoring

1. Arduino UNO R3 Hardware board

Both versions of the SCK (1.0 and 1.1) are using the same CPU, ATMEGA32U4. Only difference that the 1.0 works at 5V and 16MHZ while 1.1 works at 3.3V and 8MHZ. We've improved the power consumption in version 1.1. The sensor board contains the sensors for measuring all the parameters like NO₂ and CO gases, sunlight, noise pollution, temperature, humidity. Also, the sensor board has an I²C bus, which allows expanding the SCK to other kind of sensors also.

2. Sensors

To measure the CO and NO₂ we chose E2V sensors which are based on oxide semiconductors. Their electrical conductivity is due to the reaction between the semiconductor and the gases in the atmosphere.

The light sensor is a basic element to know the light pollution. In version 1.0, was used a LDR (light-dependent resistor) whose voltage varies on the light conditions present, while for 1.1 version a photodiode BH1730FVC is used. This sensor contains an I²C bus that gives us directly the amount of light in ambient and infrared light.

The noise sensor is based on an electret microphone. For the version 1.0 WM-61A was used as the microphone, the captured audio signal is passed through an operational amplifier configured as band pass filter.

To measure temperature and humidity a module that integrates both sensors was used. For version 1.0 the RHT22 was used, it has one wire digital interface. But for version 1.1 the SHT21 was used, it has I²C protocol and faster response between measures than the RHT22.

3. WiFi Module

The SCK, like most Arduino chips, has the ability to communicate through serial protocol (when plugged with a proper USB cable). The SCK uses the WiFly module to communicate with your WiFi router. Anyway, through serial communication you will be able to send the commands directly with this module to set your WiFi settings and extract the MAC address used by our server to verify your identity. The RN-131 module is a standalone, embedded wireless 802.11 b/g networking module. With its small form factor and extremely low power consumption, the RN-131 fits perfectly for the SCK wireless communication requirements and it works as 2.4-GHz IEEE 802.11b/g transceiver. The important features of this Wi-Fi module are

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1. Ultra-low power: 4 uA sleep, 40 mA Rx, 210 mA Tx
2. High throughput, 1 Mbps sustained data rate with TCP/IP and WPA2
3. 8 analog sensor interfaces
4. Accepts 3.3-V regulated or 2 to 3 V battery
5. Wi-Fi Alliance certified for WPA2-PSK

4. Power Supply

For charging the battery there are two ways, USB or solar panel. To carry out the charging we are using MCP73831 IC. For charging the battery in 1.0 version the solar panels have to be 12v and 500mA. In 1.1 version, the solar panel can be more versatile in terms of amperage. For solar panel charging, depending on the sunlight conditions the solar panel produces up to 12v, we have to reduce the voltage to 5v to feed up the V_{in} of the MCP73831 charger IC. To carry out this task we are using the LM2674 IC, a very efficient IC, with a rate of 91% of performance.

IV. IMPLEMENTATION AND ANALYSIS

In the website smartcitizen.com, a step by step process to join the Smart Citizen family is available to add the smart citizen kit (SCK) the platform. Currently only Google Chrome in Win, Mac and Linux is supported for the SCK configuration process. In order to have your kit connected to the Smart Citizen platform, we need a few steps involving the connection of your kit to your computer. The guidelines will help to register the kit to the platform, setup your kit's Wi-Fi settings and update its firmware. Once you've added your SCK to the platform and then by capturing and sending data correctly, you can interact with the platform in several ways. Through the website we can visualize the data, download the data and interact with the data through the API.

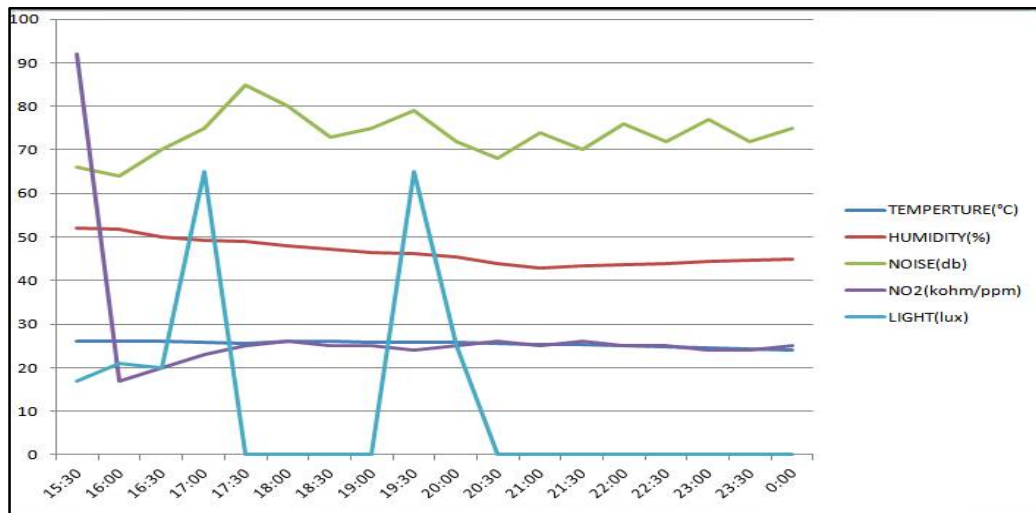


Fig 3 SCK reading on 13 April 2016

The above figure 3 shows the reading on 13 April 2016 in Vishakapatnam. As we can see the plotting is for environmental parameters like Temperature, Humidity, Noise, NO₂ and light. There is more fluctuation for noise and light but for remaining parameters light fluctuation is seen.

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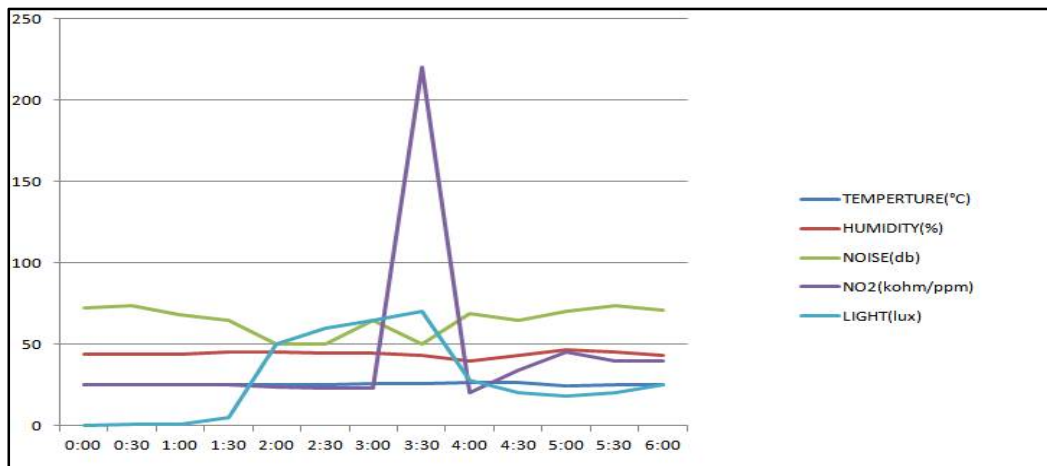


Fig 4 SCK reading on 16 April 2016

The above graph 4 shows the reading for the same environmental parameters as mentioned above. All the reading of the parameters show slight fluctuation but the light parameter shows more fluctuation. These reading were also taken in Visakhapatnam.

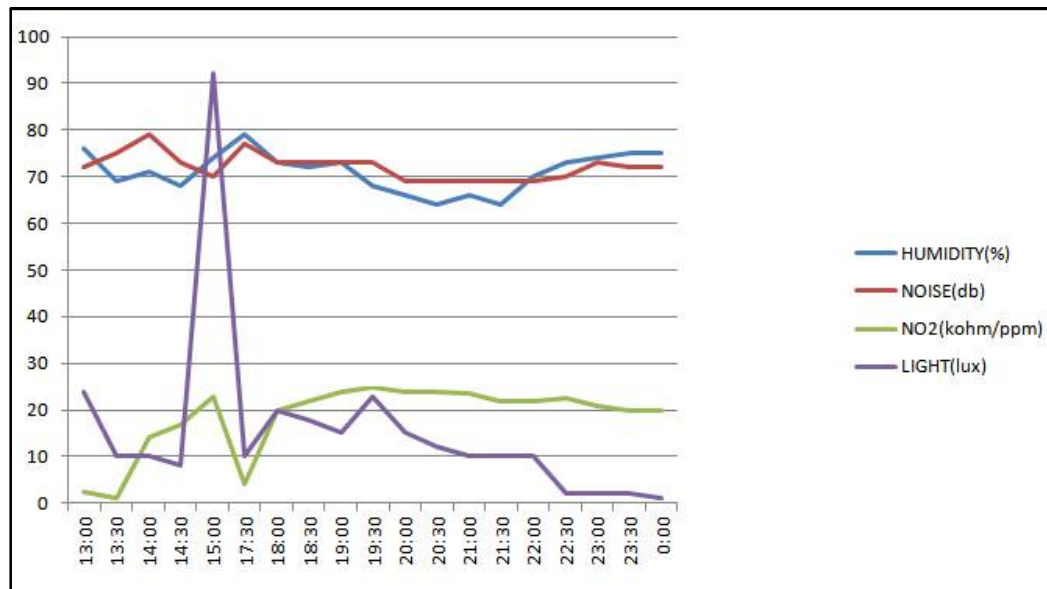


Fig 5 SCK reading on 18 April 2016

The above graph 5 shows the same parameter reading. As the light sensor is very sensitive fluctuations are seen. The remaining parameters reading are analyzed and observed from the smart citizen kit in visakhapatnam.

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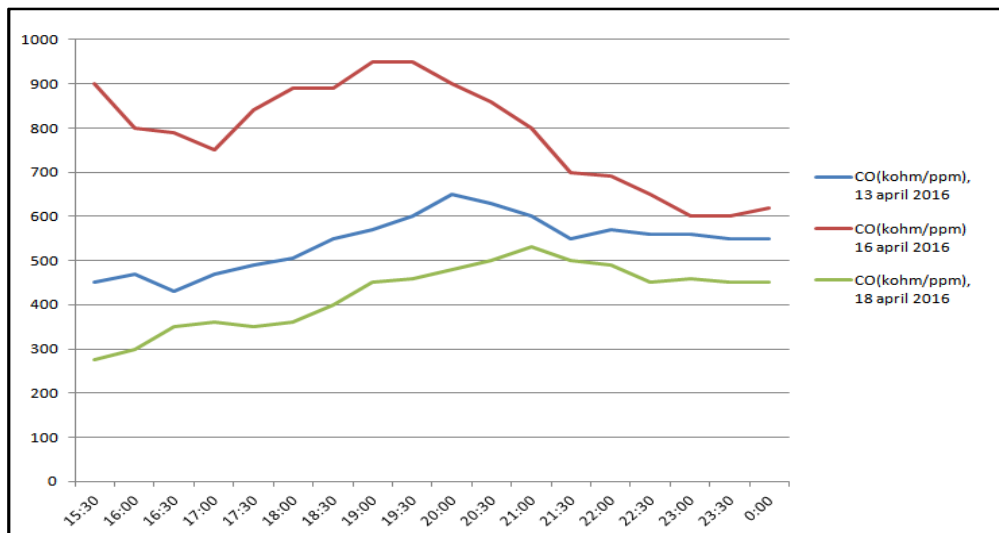


Fig 6 SCK reading for CO gas

The above graph 6 shows the readings for CO gas on various days like 13 April, 16 April, 18 April 2016 in. It can be seen that the gas levels are different on different on all days. This environmental parameter can be analyzed

V. CONCLUSION

Using SCK continuous monitoring can be done accurately. The SCK kit cost is very high as it is imported one. A proto type SCK which is of lost cost has also been introduced and designed to monitor the environmental data. Further developments are needed in the proto type SCK in view of accuracy and continuous monitoring as this prototype SCK will not monitor a continuous environmental data.

REFERENCES

- [1] Smart sensing technology: Opportunities and challenges, B.F. Spencer, Jr., Manuel E. Ruiz-Sandova, and Narito kurata.
- [2] Pines D. J. and Lovell Philip A. (1998). "Conceptual framework of a remote wireless health Monitoring system for large civil structures." Smart materials and Structures. 7:5: 627-636.
- [3] Krantz, D.; Belk, J.; Biermann, P. J.; Dubow, J.; Gause, L. W.; Harjani, R.; Mantell, S.; Polla, D. and Troyk, P. (1999) "Project update: applied research on remotely-queried embedded micro sensors" Proceedings of SPIE- The International Society for Optical Engineering. 3673.
- [4] Lemke, J. (2000). "A remote vibration monitoring system using wireless internet data transfer." Proceedings - SPIE, International Society for Optical Engineering. 3995:436-445. Lemke, J. (2000). "A remote vibration monitoring system using wireless internet data transfer." Proceedings - SPIE, International Society for Optical Engineering. 3995:436-445.
- [5] Dayashankar Dubey, Anjaneyulu T. (2002). "Smart Sensors".
- [6] F.L. Lewis (2004). "Wireless sensor network".
- [7] The Internet of Things: How the Next Evolution of the Internet Is Changing Everything. [Online] Available from: <http://postscapec.com/cisco-internet-of-things-white-Paper-how-the-next-evolution-of-theinternet-is-changing-everything%20>
- [8] Stephane gervais-Ducouret (2011). Next smart sensors generation.
- [9] <https://www.arduino.cc/en/Guide/Environment>
- [10] docs.smartcitizen.me.
- [11] <https://smartcitizen.me/about#hardware>
- [12] <http://www.microchip.com/wwwproducts/en/RN131>