ISSN (online): 2349-784X

IoT Based Environmental Monitoring System using Arduino UNO and Thingspeak

Mr. R. Deekshath
UG Student
Department of Electronics & Communication Engineering
Dr. NGP Institute of Technology, Coimbatore

Ms. P. Dharanya
UG Student
Department of Electronics & Communication Engineering
Dr. NGP Institute of Technology, Coimbatore

Ms. K. R. Dimpil Kabadia
UG Student
Department of Electronics & Communication Engineering
Dr. NGP Institute of Technology, Coimbatore

Mr. G. Deepak Dinakaran
UG Student
Department of Electronics & Communication Engineering
Dr. NGP Institute of Technology, Coimbatore

Mrs. S. Shanthini
Assistant Professor
Department of Electronics & Communication Engineering
Dr. NGP Institute of Technology, Coimbatore

Abstract

The changes in climate led to the increased importance of environmental monitoring. In order to determine the quality of the environment, continuous tracking of the environmental parameter is needed. .As the IoT is the most emerging technology, it plays an important role in collecting the information from the sensing unit. Generally sensing unit is composed of different sensors like temperature, humidity, moisture etc., the paper uses an Arduino UNO, Wi-Fi module that helps in processing and transferring the sensed data to the Thingspeak cloud. Thus the parameters received is stored in the cloud platform (Thing speak). The changes in the environment is updated in the form of a database through the cloud computing method. Thing speak also provide a feature to create a public based channel to analyze and estimate it through the public. An Android application is created for the direct access of the measured parameters.
Keywords: Sensors, Thingspeak, Arduino UNO, Wi-Fi, Internet of Things

I. INTRODUCTION

The demand of service over the internet necessitated the data collection and exchange in an efficient manner. Internet of Things refers to the rapidly growing network of connected objects that are able to collect and exchange data using embedded sensors. It is nowadays finding profound use in each and every sector and plays a key role in the proposed environmental monitoring system too. IoT converging with cloud computing offers a novel technique for better management of data coming from different sensors, collected and transmitted by low power, low cost microcontroller "Arduino UNO". An open source website, Thingspeak is used where the measurement of the parameters are updated. Thingspeak is an open source Internet of Things application and API to store and retrieve data from the sensors using the HTTP Protocol over the Internet. Thingspeak is an IoT analytics platform service that allows you to aggregate, visualize, and analyze live data streams in the cloud. The cloud utilizes the operations of Graphical visualization and available in the form of virtual server for the users and the objects are communicated with the cloud via possible 'wireless internet connections' available to the users and the majority objects uses the sensors to tell regarding the environmental analogue data. The IoT helps bring all things together and permits us to communicate with our very own things. The measurements thus received can be viewed in these scripts such as JSON, XML and CSV. In the proposed system, the environmental parameters can directly be accessed by the user, thus eliminating the need for third parties.

II. EXISTING SYSTEM

Recently climatic change and environmental monitoring and management has received much attention. The paper introduces three different IoT based wireless sensors for environmental and ambient monitoring: one employing User Datagram Protocol (UDP)-based Wi-Fi communication, one communicating through Wi-Fi and Hypertext Transfer Protocol(HTTP) and third one using Bluetooth Smart. The above presented systems help in recording data at remote locations and viewing it from every device with an Internet connection. Here Zigbee is used to monitor and control application where wireless connectivity is required. UDP based cyber physical system monitors the temperature and relative humidity. Here the losses are caused by the network itself. The Wi-Fi sends the UDP or HTTP packets to a Cloud Platform which makes it available only to the administrator who decides whether the data must be public or private. BLE consist of sensors placed at various areas at which they produce a beacon when data is received and the server takes the information from the sensors whenever the beacon is produced. The available Environmental Monitoring System (EMS) uses UDP protocol which requires the establishment of connection and IP matching every time. Direct access of the geographical information is not available since the information is sent to a centralized platform and admin plays a major role.

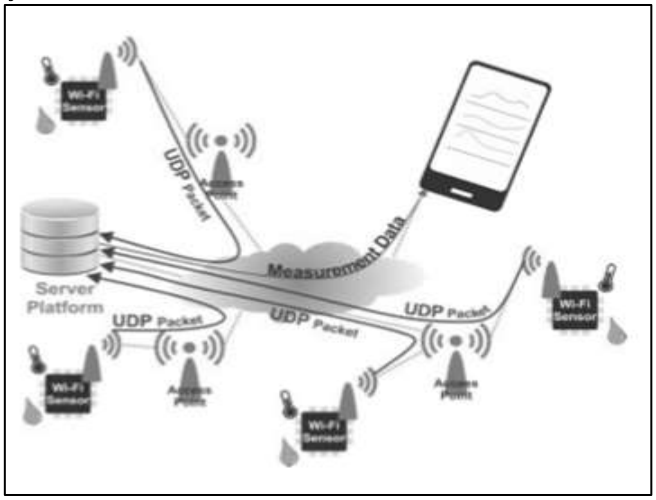


Fig. 1: EMS with communication based on UDP

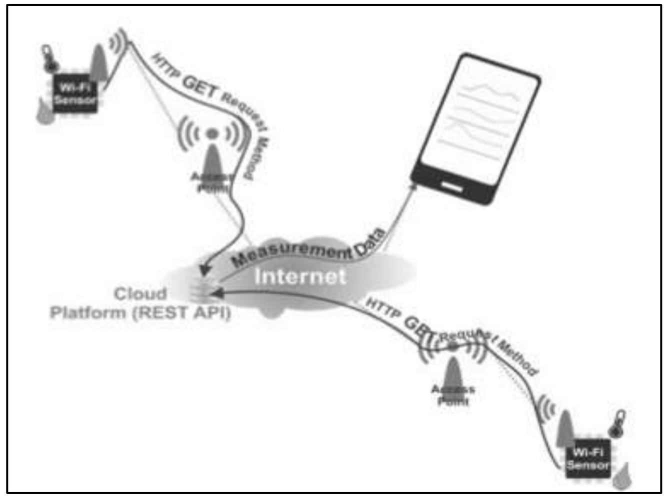


Fig. 2: EMS with communication based on HTTP requests

III. THINGSPEAK

Thingspeak is an open source Internet of Things application and API to store and retrieve data from the sensors using HTTP Protocol over the internet. It is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud.

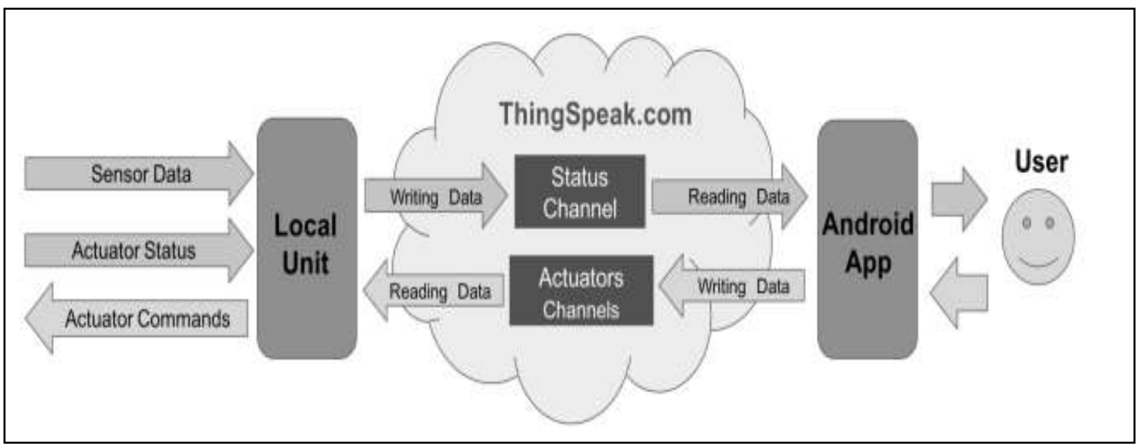


Fig. 3: Working of Thingspeak

The main role of updating data continuously is done by Thingspeak, which has APIs for collecting data produced by sensors and APIs for reading that data from applications. The paper is divided into two parts. One part of the paper is where one has to program a thing to send data. And, the second part is where the other has to see the data. Thingspeak sits in the middle and makes it handy to do both. The paper uses easily accessible hardware to build a proof-of-concept IoT system to monitor air temperature, humidity, soil moisture, soil humidity etc. Further this can be modified with different sensors or actuators for building something for individual purposes. Thus a direct access to all the environmental parameters is given to the user after the above stated procedure is completed.

IV. INTERNET OF THINGS

Internet of Things refers to the rapidly growing network of connected objects that are able to collect and exchange data using embedded sensors. It is nowadays finding profound use in each and every sector and plays a key role in the proposed environmental monitoring system too. IoT converging with cloud computing offers a novel technique for better management of data coming and stores it. The working process of the Internet of Things is shown below.

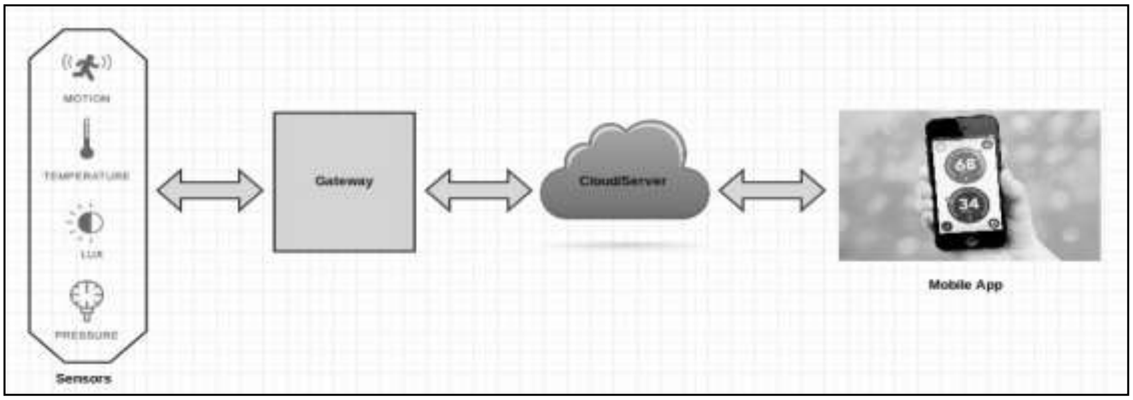


Fig. 4: Working of Internet of Things

V. PROPOSED SYSTEM

The proposed system keeps track on the parameters such as moisture, temperature, humidity, rainfall, gas content and earthquake intimation with the help of the real time sensors. These parameters are continuously monitored by an open source platform called Thingspeak for an interval of every 2 minutes. The data can be viewed in any one of the three formats such as JSON, XML and CSV. The sensors in the proposed system collect the data such as the temperature, humidity, soil moisture, pollution level, rain water level and movement in the earth surface. The Wi-Fi network helps in the process of sending the collected data to the open source platform, Thingspeak. Alternate to that, an app is made for the purpose of viewing the collected data in even more easier manner. Through the application/Thingspeak, the user will be able to know about the status of his/her own agricultural land and counter-measures can be taken after the keen observation of the parameters of the land.

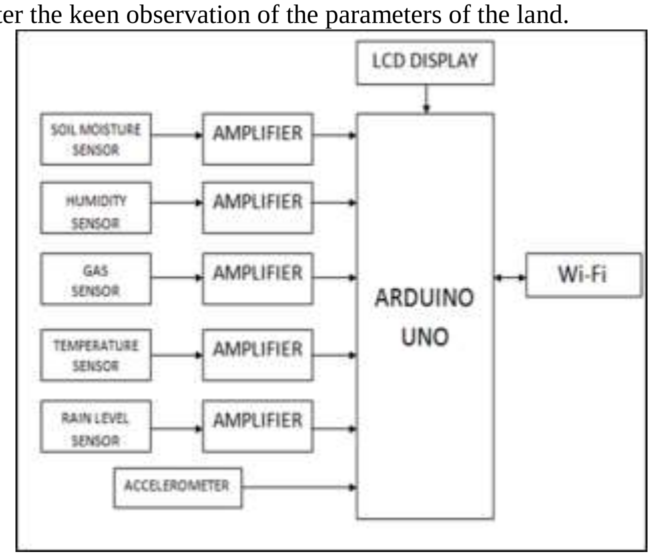


Fig. 5: Block Diagram of the proposed system

VI. SENSORS USED

A. *Soil Moisture Sensor:*

Soil Moisture Sensor is used to measure the water content in the soil. The soil moisture sensors typically refer to sensors that estimate volumetric water content.

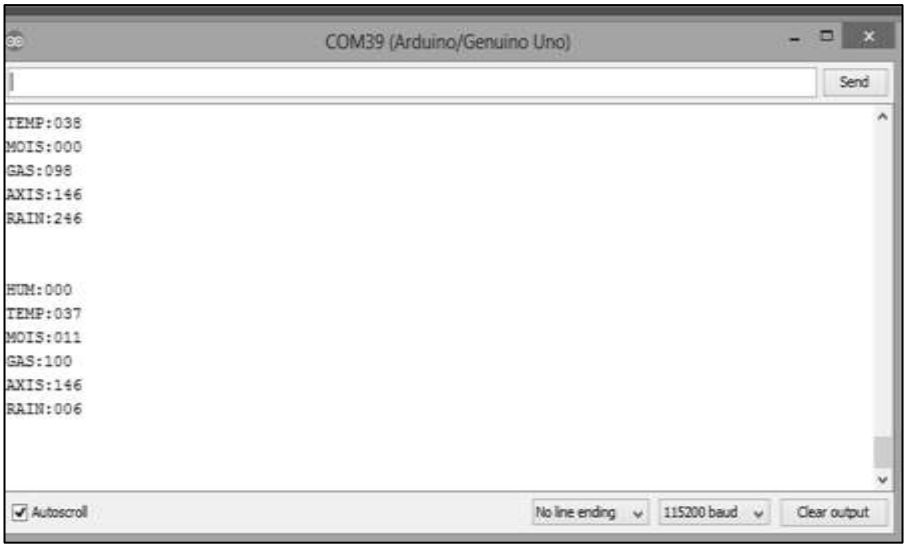
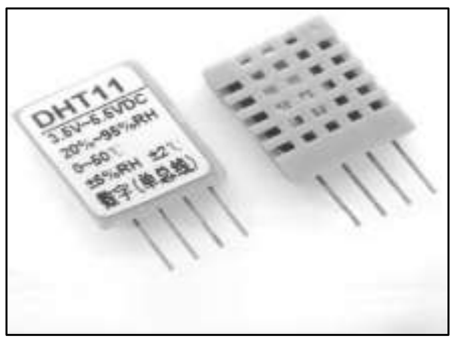


Fig. 6: Result of Soil Moisture Sensor

B. Humidity Sensor:



Humidity sensor (DHT11) is used to measure the water content in the atmosphere. Voltage signal is given to the inverting input terminal of the comparator. The reference voltage is given to non-inverting input terminal.

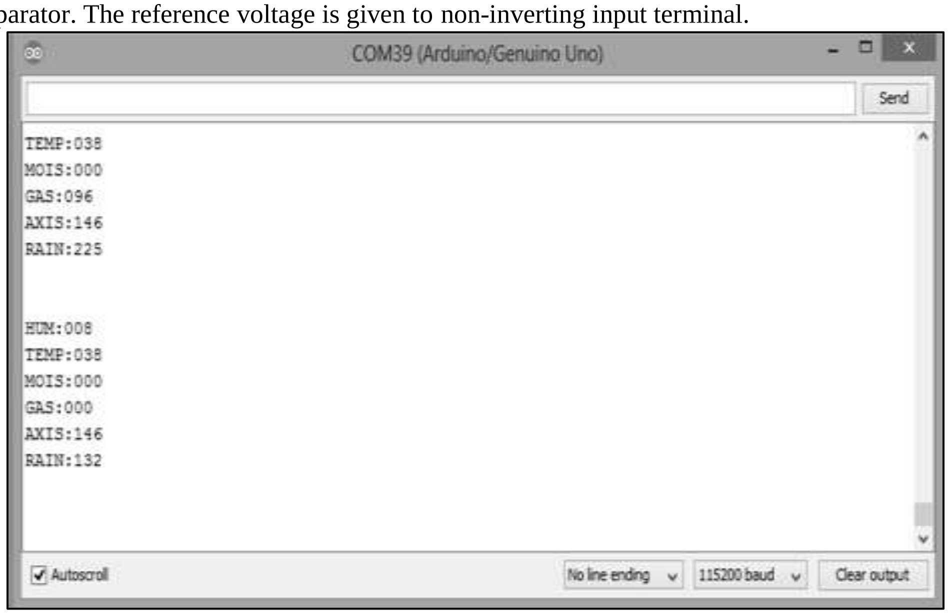
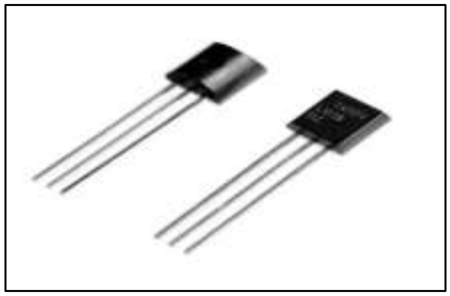


Fig. 7: Result of Humidity Sensor

C. Temperature Sensor:



Temperature sensor is used to measure the temperature with an electrical output proportional to the temperature. The LM 35 device does the function of measuring the surrounding temperature.

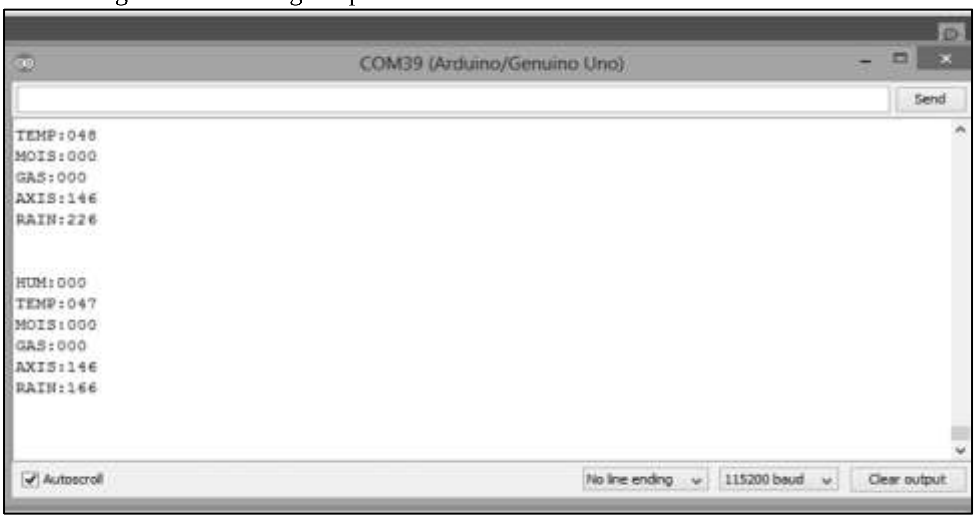
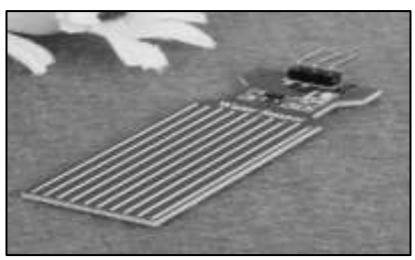


Fig. 8: Result of Temperature Sensor

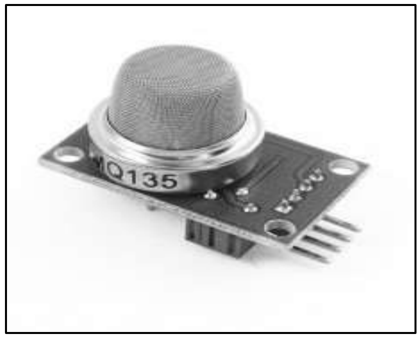
D. Rain Water Level Detector:



Rain water level detector is used to measure the rain or water levels. It detects water that completes the circuits on its sensor board's printed leads.

Fig. 9: Result of Water Level Detector

E. Gas Sensor:



Gas sensor is a device used to detect the presence of gases in an area, often as part of a safety system. MQ 135 sensor is highly sensitive to Ammonia, Sulphide and benzene steam.

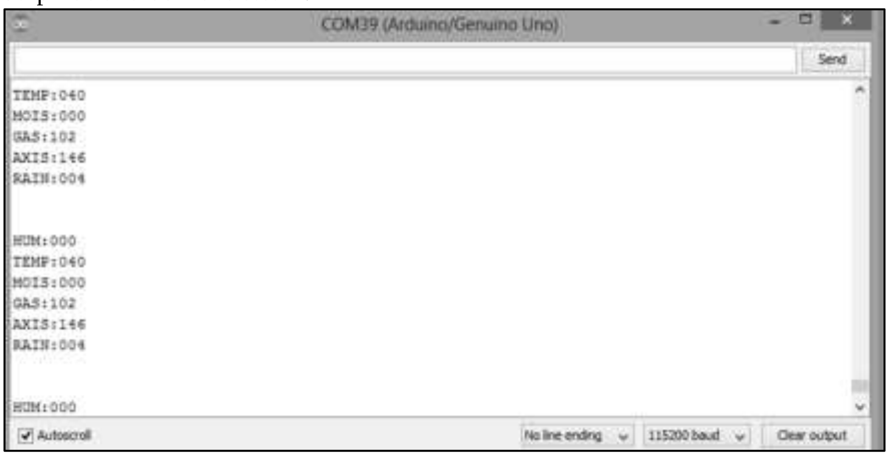


Fig. 10: Result of Gas Sensor

F. Accelerometer

Accelerometer is used to measure the acceleration in all three axis. The output is in the form of analog values. So the interface with a microcontroller is extremely easy.

Fig. 11: Result of Accelerometer

VII. CONCLUSION

The measured parameters from the sensors are continuously updated and is thus viewed by the user using the EMS(Environmental Monitoring System) application. Thus the data is directly accessed and is purely independent of third parties.

Fig. 12: Final Result in Android Application

REFERENCES

[1] Sean Dieter Tebje Kelly, Nagender Kumar Suryadevara et al., "Towards the Implementation of IoT for Environmental Condition Monitoring in Homes", IEEE Sensors Journal, Vol, 13, No. 10, October 2013.
[2] Shifeng Fang, Li Da Xu et al., "An Integrated System for Regional Environmental Monitoring and Management Based on Internet of Things", IEEE Transactions on Industrial Informatics, Vol. 10, No.2, May 2014.
[3] LIU Dan, Cao Xin et al., "Intelligent Agriculture Greenhouse Environment Monitoring System Based on IOT Technology" 2015 International Conference on Intelligent Transportation, Big Data & Smart City.
[4] Abdullah Na, William Isaac et al., "An IoT Based System for Remote Monitoring of Soil Characteristics", 2016 International Conference on Information Technology(InCITE)-The Next Generation IT Summit.
[5] DivyavaniPalle, ArunaKommu, "Design and Development of CC3200-based Cloud IoT for measuring Humidity and Temperature", International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT)-2016.
[6] George Mois, TeodoraSanislav et al., "A Cyber-Physical System for Environmental Monitoring", IEEE Transactions on Instrumentation and Measurement 2016.
[7] Nick Harris, Andy Cranny et al."Application of Distributed Wireless Chloride Sensors to Environmental Monitoring: Initial Results", IEEE Transactions on Instrumentation and Measurement 2016.
[8] Ravi Kishore Kodali and ArchanaSahu, "An IoT based Weather Information Prototype Using WeMos", 2016 2nd International Conference on Contemporary Computing and Informatics.
[9] George Mois, SilviuFolea, et al., "Analysis of Three IoT-Based Wireless Sensors for Environmental Monitoring", IEEE Transaction on Instrumentation and Measurement 2017.
[10] Shiny Abraham and Joshua Beard, "Remote Environmental Monitoring Using Internet of Things" IEEE Transaction on Instrumentation and Measurement 2017.
[11] Somansh Kumar, "Air Quality Monitoring System Based on IoT using Raspberry Pi", International Conference on Computing, Communication and Automation (ICCCA 2017).
[12] Cho ZinMyint, Lenin Gopal et al., "WSN-based Reconfigurable Water Quality Monitoring System in IoT Environment", 2017 14th International Conference on Electrical Engineering or Electronics, Computer, Telecommunication and Information Technology.
[13] SanketSalvi, Pramod Jain et al., "Cloud Based Data Analysis and Monitoring of Smart Multi-level Irrigation System Using IoT" International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud), 2017.
[14] Alif Akbar Pranata, Jae Min Lee et al., "Towards an IoT-based Water Quality Monitoring System with Brokerless Pub/Sub Architecture" IEEE Transaction on Instrumentation and Measurement 2017.
[15] HakanUcgun, et al., "Arduino Based Weather Forecasting Station", 2nd International Conference on Computer Science and Engineering 2017.
[16] J.Cabra, D.Castro et al., "An IoT approach for Wireless Sensor Networks applied to e-health environmental monitoring", 2017 IEEE International Conference on Internet of Things and IEEE Green Computing and Communications and IEEE Cyber, Physical and Social computing and IEEE Smart Data.
[17] Pablo Velasquez, et al., "A low-cost IoT based Environmental Monitoring System. A citizen approach to pollution awareness", 2017 CHILEAN Conference on Electrical, Electronics Engineering, Information and Communication Technologies (CHILECON).
[18] Nikolas Vidakis et al., "Environmental Monitoring through Embedded System and Sensors", 52nd International conference on Power Engineering Universities, 2017.

[19] Roselle B. Anire et al., “Environmental Wireless Sensor Network using Raspberry Pi 3 for Greenhouse Monitoring System”, IEEE 9th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management (HNICEM), 2017.
[20] KonstantinosTzortzakis, et al., “Wireless Self Powered Environmental Monitoring System for Smart Cities based on LoRa”, Panhellic Conference on Electronics and Telecommunications (PACET), 2017.
[21] Munsyi et al., “An Implementation of Data Exchange Using Authenticated Attribute-Based Encryption for Environmental Monitoring”, 2017 International Electronics Symposium on Knowledge Creation and Intelligent Computing (IES-KCIC).