International Journal of Multidisciplinary Engineering in Current Research
ISSN: 2456-4265, Volume 6, Issue 1, January 2022, http://ijmec.com/

MONITORING ENVIRONMENTAL PARAMETERS AND DEVICE CONTROL VIA IOT (INTERNET OF THINGS)

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Abstract: This paper focuses on the functional design and implementation of a Wireless Sensor Network (WSN) platform tailored for long-term environmental monitoring within IoT applications. The platform's specifications take into account various application requirements such as low cost, high quality of service, extended lifespan, minimal maintenance, rapid deployment, and low power consumption. With notable transformations occurring in industrial process control, intelligent building management, and automation technologies, there is mounting pressure to reduce operational expenses while incorporating significant advancements in telecommunications and software. Software has emerged as a critical component in both production and enterprise-wide systems, while internet connectivity has revolutionized monitoring and control arrangements. Moreover, the utilization of open/public standards and personal computing devices (including PCs, tablets, and smartphones) offers substantial benefits to users and manufacturers alike. These developments have paved the way for a new Industrial Revolution, characterized by the integration of the Internet of Things (IoT) into industrial processes.

Keywords. Arduino, NodeMCU, Moisture Sensor, LDR Sensor, Lm35, LCD

1. INTRODUCTION

More than decade ago, the Internet of Things (IoT) was coined in which the computers were able to access data about the objects and environment without human interaction. Two technologies were considered as key enablers for IoT paradigm: Radio Frequency Identification (RFID) and the Wireless Sensor Network (WSN).While the former is well established for low cost identification and tracking, WSN bring IoT applications richer capabilities for both sensing and actuation. In fact, WSN solution already covers a broad range of research and technology advances continuously expand their application field Based on the advantages WSN concepts bring to a vast amount of different applications, interest in the corresponding technology is high. Ideally, the WSN allows for the deployment of large amount of sensor nodes, which configure themselves, depending the network topology and neighborhood situation. After sensing the physical environment and processing the obtained data locally, nodes communicate their data towards a network sink, where data is further processed and made available for readout. As transmitted data should find the best route towards its destination automatically. A Environmental Monitoring Although EM can mean the monitoring of any kind of environment, it is most often defined as the observation and study of natural environment. Scientifically, EM includes the field the of physics, chemistry and biology. The motivation based on the ever increasing the world population, means that environmental monitoring is not limited to the understanding of environments, but also includes the monitoring

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preservation reasons. Typical, application in addition to purely environmental science purposes, include the protection of water supplies, air pollution monitoring, radioactive waste treatment, natural recourse protection, weather forecasting, enumeration and monitoring of species. Environmental monitoring strives to determine the status of changing environment by analyzing representative sample of the environment. The open environmental monitoring is especially challenging because of the typical harsh operating condition and difficulty, cost of physical access to the field for deployment and maintenance .The generic WSN platform can be used a good results in a broad class of IoT environmental monitoring application. However, many IoT applications may have stringent requirements, such as low cost, large number of nodes, ease of deployment, low maintenance which makes the generic WSN platforms less suited.

1.1 ENVIRONMENTAL MONITORING IN IoT

Integrating cloud computing, wireless sensor network, RFID sensor networks, satellite network, and other intelligent transportation technologies, a new generation of IoT-based environmental data clouds can be developed and deployed to bring many benefits, such as include the protection of water supplies, air pollution monitoring, radioactive waste treatment, natural recourse protection, weather forecasting, enumeration and monitoring of species. A IoT Environmental Monitoring Requirements WSN data acquisition for IoT environmental monitoring applications is challenging, especially for open nature fields. In its simplest event-driven form, each sensor node performs periodic measurements of the surrounding air temperature and sends alert surveillance personnel if they exceed a threshold For a fast response time, the coverage of even small areas requires a large number of sensor nodes, making this application representative for cost, networking and deployment issues of the event-driven high- density IoT application class. In the simplest star topology, the sensor nodes connect directly to the gateways, and each gateway autonomously connects to the server. Ideally, the field deployment procedure ensures that each sensor node is received by more than one gateway to avoid single points of failure of the network. Structure of WSN platform The sensor is the size of a matchbox; in its standard form it measures moisture and temperature. All measurements are transmitted wirelessly to a computer, and it is then possible to read and regulate energy consumption in a room or a building over the internet via a web browser, thus basically wherever you might be. The technology is currently used to monitor humidity and heat in around an environment. A sensor that allows to reduce the temperature in rooms at night, turn down the lights when no one is there, all while ensuring that the humidity is correct so that no exhibits are damaged. Several hospitals are equipped to monitor the temperature in labs where sensitive tests are carried out. The battery in the sensor only needs to be changed once every ten years and outdoors the system has a radio range between sensor and computer of 1.6 km. Measurement and regulation of humidity and temperature is one use, but the research group is looking beyond that. In this particular project they will also test the technology for environmental sensors that measure carbon dioxide levels and other environmental data. 96Since these and many related applications typically use fewer sensor nodes, they are less demanding on the communication channels (both in field and with the server) and for sensor node energy and cost.

2. SYSTEM HARDWARE

The device consists of Arduino microcontroller connected with temperature

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sensor, heartbeat sensor, LCD and IoT module. For measuring Temperature, the device makes the use of LM35 IC The device measures Light Intensity, Fire and temperature of the industry and transmits it wirelessly with the help of IOT module and the data is received at the other end using smartphone connected with internet using Blynk App.

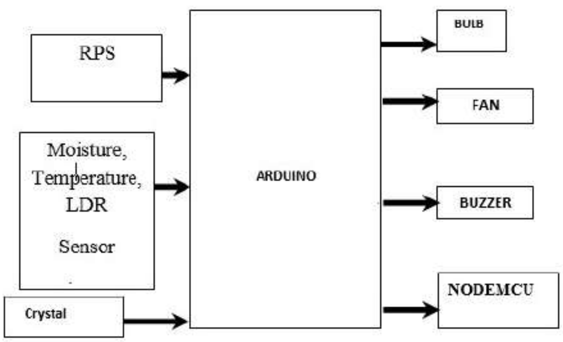
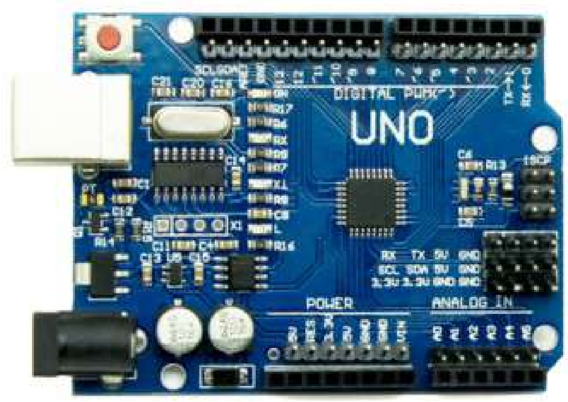


Fig. 1: Block diagram showing industrial IoT system

3. RELATED WORK

A wireless smart sensor platform targeted for instrumentation and predictive maintenance systems is presented. The generic smart sensor platform with „plug-and-play" capability supports hardware interface, payload and communications needs of multiple inertial and position sensors, and actuators, using a RF link for communications, in a point-to-point topology. The design also provides means to update operating and monitoring parameters as well as sensor/RF link specific firmware modules „over-the-air". Sample implementations for industrial applications and system performance are discussed. In this project has used on Zigbee. This cost is too high and the WSN are controlled by remote access. Radio Frequency Identification and Wireless Sensor Network are two important wireless technologies that have wide variety of applications and provide limitless future potentials. However, RFID and sensor networks almost are under development in parallel way. Integration of RFID and wireless sensor networks attracts little attention from research community. This paper first presents a brief introduction on RFID, and then investigates recent research works, new products/patents and applications that integrate RFID with sensor networks. Four types of integration are discussed. They are integrating tags with sensors, integrating tags with wireless sensor nodes, integrating readers with wireless sensor nodes and wireless devices, and mix of RFID and sensors. New challenges and future works are discussed in the end. RFID readers have relatively low range and are quite expensive, we envision that the first applications will not have RFID readers deployed ubiquitously. The applications which allow mobile readers to be attached to person"s hands, cars or robots will be good candidates.

4. ARDUINO



Overview:

The Arduino Uno is a microcontroller board subject to the ATmega328 (datasheet). It has 14 motorized data/yield pins (of which 6 can be utilized as PWM yields), 6 essential wellsprings of information, a 16 MHz artistic resonator, a USB alliance, a power jack, an ICSP header, and a reset catch. It contains everything expected to help the microcontroller; just interface it to a PC with a USB association or power it with an AC-to-DC connector or battery to begin.

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The Uno contrasts from every first board in that it doesn't utilize the FTDI USB-to-back to back driver chip. Or on the other hand possibly, it joins the Atmega16U2 (Atmega8U2 up to change R2) adjusted as a USB-to-successive converter.

The Uno board has a resistor dismantling the 8U2 HWB line to ground, making it less mind boggling to put into DFU mode.

The board has the going with new highlights:

pinout: included SDA and SCL pins that are close to the AREF stick and two other new sticks set close to the RESET stick, the IOREF that engage the shields to adapt to the voltage gave from the board. In future, shields will be extraordinary with both the board that uses the AVR, which works with 5V and with the Arduino Due that works with 3.3V. The resulting one is a not related stick, that is set something aside for future purposes.

- Stronger RESET circuit.
- Atmega 16U2 uproot the 8U2.

"Uno" suggests one in Italian and is named to check the top tier section of Arduino 1.0. The Uno and structure 1.0 will be the reference changes of Arduino, pushing ahead. The Uno is the most recent in a development of USB Arduino sheets, and the reference model for the Arduino compose; for an examination with past structures, see the archive of Arduino sheets.

5 NODEMCU

WI-FI: The WI-FI module used in this project is ESP8266. It follows TCP/IP stack and is a microchip which is less in cost. This microchip allows microcontroller to connect to a WI-FI network, by using Hayes style command connections are done or made through TCP/IP connection. ESP8266 has 1MB of built in flash, single chip devices able to connect WI-FI. Espressif systems are the manufacturers of this module, it is a 32 bit microcontroller. There are 16 GPIO pins in this module. This module follows RISC processor. It has 10 bit DAC. Later Espressif systems released a software development kit(SDK) which is used to programme on the chip, so that another microcontroller is not used. Some of the SDK's are Node MCU, Arduino, Micro Python, Zerynth and Mongoose OS. SPI, I2C, I2S, UART are used for communicating between two sensors or modules.

Figure : Wi-Fi module

6. IoT Technology and Applications

IoT development speedily assist the IoT application that focused on the heap industry and specific users, while networks and devices allow connectivity of physical things. IoT application gives reliable vital device-to-human and device-to-device communication. IoT device applications need to ensure that information is received and properly acted according to a suitable specific way, a simple example is that of logistic application monitoring that has the transported status of goods such as organic products, fresh products, meat and dairy terms. Furthermore, during logistics, quality control of climate change, shock and humidity is regularly monitored and suitable movements are strategically and naturally made to preserve goods spoilage from a long distance when connection is out of courage. To claimed that "some examples of IoT applications in existence can be found in Smart Environment, Smart

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Greenhouse, Smart Cities, Smart Water, Smart Metering, Security and Emergency, Industrial Control, Home Automation and Electronic Health". 'IoT' is therefore stationed on devices that can examine sensed data and then transmit it to the user. K. IoT Challenges As stated in a previous study, there are some challenges that IoT design would face in the coming future generation. All the devices, nodes connected in associate in nursing IoT design needs to have terribly low latency over reliable links. Because of the vast variety of IoT devices and the use of various frequency bands, there would be a crisis in spectrum house. Although IoT devices are expanding on a daily basis that consumes terribly lesser power, still there'll be a big quantity of greenhouse gas emission because of all of these devices. Finally, IoT architecture not solely must be price effective however additionally they have to be capable of supporting heterogeneous applications and devices. As stated above on IoT challenges, IoT applications will have some more basic needs to tackle, for example, Device addressing, Security, Scalability, Mobility, Anchor-less sending and so on. As mentioned, IoT applications contains numerous heterogeneous devices, and however, content security is a key concern that plays a great roles. A previous study has indicated the challenges of both IoT and ICN in their past study, this past study endeavours to combine them where IoT illustrate the different challenges and on the other hand, ICN illustrates the positive solutions. Nonetheless, their study explained initially how different ICN features can address IoT issues and after that, some use cases and contextual investigations are examined

7. LIMITATIONS

The system has following limitations:

1. **Compatibility**: As of now, there is no standard for tagging and monitoring with sensors. A uniform concept like the USB or Bluetooth is required which should not be that difficult to do.

2. **Complexity**: There are several opportunities for failure with complex systems. For example, both you and your spouse may receive messages that the milk is over and both of you may end up buying the same. That leaves you with double the quantity required. Or there is a software bug causing the printer to order ink multiple times when it requires a single cartridge.

3. **Privacy/Security**: Privacy is a big issue with IoT. All the data must be encrypted so that data about your financial status or how much milk you consume isn't common knowledge at the work place or with your friends.

4. **Safety**: There is a chance that the software can be hacked and your personal information misused. The possibilities are endless. Your prescription being changed or your account details being hacked could put you at risk. Hence, all the safety risks become the consumer's responsibility.

8. FUTURE WORKS

1. The device can be connected to PC by using serial output so that measured heartbeat and temperature can be sent to PC for further online or offline analysis.
2. Warning for abnormalities of industrial parameters can be displayed.

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ISSN: 2456-4265, Volume 6, Issue 1, January 2022, http://ijmec.com/

3. Sound can be added to the device so that the device makes a sound each time when the parameters changes to harmful level.

4. The output can be sent to mobile phones by using GSM module or Bluetooth module for further analysis.

5. More parameters (like GAS, Pressure) can be added to the device.

9. CONCLUSION

The lifetime of wireless sensor network for an environmental monitoring has been presented, allowing them to operate as autonomous measurement system for long period of time. The energy consumption of the system has been addressed and methods to reduce the energy consumption have been identified. WSNs are traditionally considered key enablers for Packet delivery ratio has been increased, while transmitting the data using WSN. This paper deal, all phases of the practical development from scratch of a full custom WSN platform for a environment monitoring IOT application. All aspects of the wireless platforms are considered: reusability and flexibility, platform structure, optimization of the sensor node and gateway node, error recovery in communication and node operation, high availability of service, application server reliability and interface with IOT. The particular importance of IOT is low cost, fast deployment, long unattended service time.

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International Journal of Multidisciplinary Engineering in Current Research
ISSN: 2456-4265, Volume 6, Issue 1, January 2022, http://ijmec.com/

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