Energy Efficient Network Protocol for Precision Agriculture using Threshold Sensitive Sensors for Optimal Performance

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Abstract - This paper presents modern agriculture management system using wireless sensor networks using IoT platform. It mainly contributes to perform agriculture management with partial human effect. In this concept we will get real time values of current environment as well it will perform based on those values only. There are four sensors to find the soil moisture and temperature. As well we can find the water resource levels and managing. Precision agriculture is a way to optimize resources and improve cultivation through the collection of relevant information through the deployment of sensor networks, providing government authorities with statistical information to make appropriate decisions based on reliable data Agriculture is backbone of Indian country so we try to do that in current trending methods.

Key Words: IoT, soil moisture, Temperature sensor, wireless sensor networks, Big data, Zigbee, UART.

1.INTRODUCTION

A web service is defined a service offered by an electronic device to another electronic device, communicating with each other via the World Wide Web. Agriculture is one of the most important pillars for the development of society, constituting a fundamental element for the economy of many countries. In precision agriculture technology is applied to increase the production and quality of the crops. Contribution of this project from previous paper we can handle our agriculture land temperature, humidity, soil-moisture and water resource water levels based on those values motor will turn on automatically as well we can handle manually.

1.1 Precision Agriculture

High accuracy is required in terms of weather information which reduces the chances of crop damage. Agriculture IoT ensures timely delivery of real time data in terms of weather forecasting, quality of soil, cost of labor and much more to farmers.

1.2 Crop Water Management

In order to perform agriculture activities in efficient manner, adequate water is essential. Agriculture IoT is integrated with Web Map Service (WMS) and Sensor Observation Service (SOS) to ensure proper water management for irrigation and in turn reduces water wastage.

1.3 Food Production and Safety

Agriculture IoT system accurately monitors various parameters like warehouse temperature, shipping transportation management system and also integrates cloud based recording systems.

1.4 Rain water management

During the rainy season agriculture land water level will increase that we should not keep that much of water. So that time the bundle need to be cut, to release water with human effect. We overcome that problem also humidity level is low at the same time water level is greater than required level that time motor will turn on and remove plates in bundle in that way automatically water will be release.

2. LITRATURE REVIEW

In the reference paper [1], We have witnessed the Fixed Internet emerging with virtually every computer being connected today; we are currently witnessing the emergence of the Mobile Internet with the exponential explosion of smart phones, tablets and net-books. However, both will be dwarfed by the anticipated emergence of the Internet of Things (IoT), in which everyday objects are able to connect to the Internet, tweet or be queried. Whilst the impact onto economies and societies around the world is undisputed, the technologies facilitating such a ubiquitous connectivity have struggled so far and only recently commenced to take shape. To this end, this paper introduces in a timely manner and for the first time the wireless communications stack the industry believes to meet the important criteria of power-efficiency, reliability and Internet connectivity. Industrial applications have been the early adopters of this stack, which has become the de-facto standard, thereby bootstrapping early IoT developments with already thousands of wireless nodes deployed.

The reference paper [2] The emergence of low-cost connected devices is enabling a new wave of sensorization services. These services can be highly leveraged in industrial applications. However, the technologies employed so far for managing this kind of system do not fully cover the strict requirements of industrial networks, especially those regarding energy efficiency. In this article a novel paradigm, called Low-Power Wide Area Networking (LP-WAN), is explored. By means of a cellular-type architecture, LP-WAN-based solutions aim at fulfilling the reliability and efficiency challenges posed by long-term industrial networks. Thus, the most prominent LP-WAN solutions are reviewed, identifying and discussing the pros and cons of each of them. The focus is also on examining the current deployment state of these platforms in Spain. Although LP-WAN systems are at early stages of development, they represent a promising alternative for boosting future industrial IIoT (Industrial Internet of Things) networks and services.

The contribution of the reference paper [3] Ubiquitous sensing enabled by Wireless Sensor Network (WSN) technologies cuts across many areas of modern day living. This offers the ability to measure, infer and understand environmental indicators, from delicate ecologies and natural resources to urban environments. The proliferation of these devices in a communicating–actuating network creates the Internet of Things (IoT), wherein sensors and actuators blend seamlessly with the environment around us, and the information is shared across platforms in order to develop a common operating picture (COP). Fueled by the recent adaptation of a variety of enabling wireless technologies such as RFID tags and embedded sensor and actuator nodes, the IoT has stepped out of its infancy and is the next revolutionary technology in transforming the Internet into a fully integrated Future Internet. As we move from www (static pages web) to web2 (social networking web) to web3 (ubiquitous computing web), the need for data-on-demand using sophisticated intuitive queries increases significantly. This paper presents a Cloud centric vision for worldwide implementation of Internet of Things. The key enabling technologies and application domains that are likely to drive IoT research in the near future are discussed. A Cloud implementation using Aneka, which is based on interaction of private and public Clouds is presented. We conclude our IoT vision by expanding on the need for convergence of WSN, the Internet and distributed computing directed at technological research community.

As in reference [4], Technologies to support the Internet of Things are becoming more important as the need to better understand our environments and make them smart increases. As a result it is predicted that intelligent devices and networks, such as WSNs, will not be isolated, but connected and integrated, composing computer networks. So far, the IP-based Internet is the largest network in the world; therefore, there are great strides to connect WSNs with the Internet. To this end, the IETF has developed a suite of protocols and open standards for accessing applications and services for wireless resource constrained networks. However, many open challenges remain, mostly due to the complex deployment characteristics of such systems and the stringent requirements imposed by various services wishing to make use of such complex systems. Thus, it becomes critically important to study how the current approaches to standardization in this area can be improved, and at the same time better understand the opportunities for the research community to contribute to the IoT field. To this end, this article presents an overview of current standards and research activities in both industry and academia.

3. SYSTEM OVERVIEW

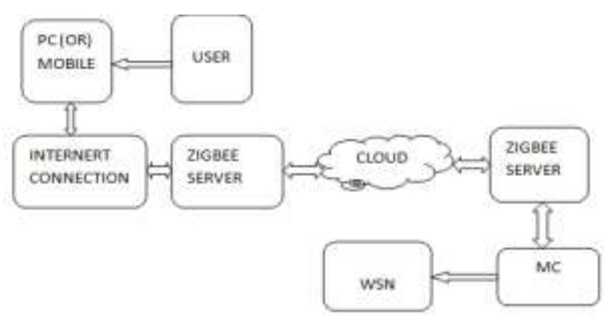

Fig-1: System overview

The paper consist of four sections; zigbee, micro-controller, wireless sensors and PC or mobile app to control system. In the present system, every sensors is integration with different nodes and devices and they are interconnected to one central server via wireless communication modules. The zigbee act as server sends and receives information from user end using internet connectivity. There are two modes of operation of the system; auto mode and manual mode. In auto mode system takes its own decisions and controls the installed devices whereas in manual mode user can control the operations of system using android app or PC commands and that all conditions are applicable for manual mode. One more special concept in this paper these activities will perform depends on water resource level.

3.1 Zigbee

The ZigBee (cc2530) is a true system on chip (SoC) solution for IEEE 802.15.4 applications. It combines the excellent performance of a leading RF transreceiver with an industry-standard enhanced 8051 MCU, in system programmable flash memory, 8 kB RAM, and many other powerful features. Received Signal Strength Indicator (RSSI) is a measurement of power present in a received radio signal. . In an IEEE 802.11 system, RSSI is an indication of the power level being received by the receive radio after the antenna and possible cable loss. Therefore, the higher the RSSI number, the stronger the signal. The CC2530 comes in four different flash versions: CC2530F32/64/128/256, with 32/64/128/256 KB of flash memory, respectively. The CC2530 has various operating modes, making it highly suited for systems where ultralow power consumption is required. Short transition times between operating modes further ensure low energy consumption.

3.2 System Architecture

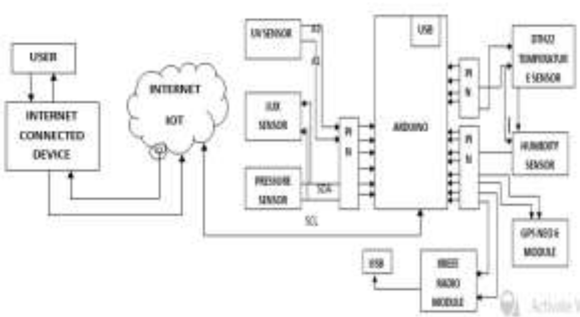

Fig-2: System Architecture

System architecture mainly focused on the modern agriculture using wireless sensor networks using IOT platform arduino board connected with DTH22 temperature/humidity sensor. Temperature detector is used to measure out climate how many days water level is enough for our agriculture. Atmospheric pressure sensor, LUX sensor UV sensors also integrated with this arduino module this modules are used to sense our soil moisture levels and bene water levels. We can switch on our motor using iot operation and we don't know water level in bene that's why we try to implement out project with WSN (Wireless Sensor Networks) it will sense the water level while we turn on our motors it will sense the low level water if water reached specified level it will send message to our mobile please turn off your motor. Otherwise it can measure water level in a land also.

XBEEE radio module is integrated with arduino board it will send modern agriculture and bene monitoring system. Agriculture is one of the most important pillars for the development of society, constituting a fundamental element for the economy of many countries. In [1], precision agriculture technology is applied to increase the production and quality of the crops. In the case of Ecuador, nowadays an important part of the country's productive capacity is linked to products such as bananas, coffee, shrimp, or cocoa. To leverage the available resources efficiently as well as the optimization of agricultural production, it is necessary to implement new methods for monitoring and measuring agriculture parameters focused on preventing economic losses associated with the lack of information and control over crops. Heat and radioactive stress effects are measured in [2] using remote and proximal sensing techniques. Climate change has a certain impact on the quality of crops, which can cause economic volatility and losses for a certain country in the agricultural sector. Most of the crops are not monitored using technological tools. WSN have been implemented to enable efficient irrigation [3]. PA provides the tools to help optimize resources for cultivation through the constant monitoring of specific parameters such as environment and soil temperature, atmospheric pressure, level of luminosity, and UV radiation using wireless sensors networks; the aforementioned sensors can obtain data on a determined geographic area where crops are cultivated and provides farmers with valuable information aimed at making better decisions.

3.3 Wireless Sensors

There are three memory blocks in each of the PIC16F87XA devices. The program memory and data memory have separate buses so that concurrent access can occur and is detailed in this section. The EEPROM data memory block is detailed in Section 3.0"Data EEPROM and Flash Program Memory". Additional information on device memory may be

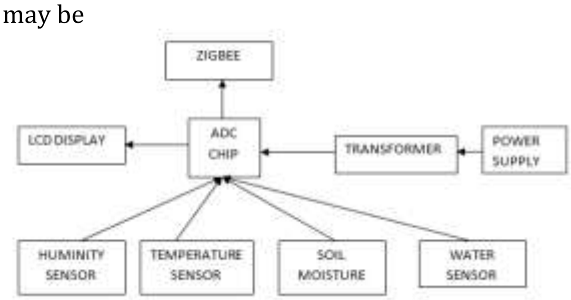

Fig-3: sensors

found in the PIC-micro® Mid-Range MCU Family Reference Manual (DS33023). During the rainy season agriculture land water level will increase that we should not keep that much of water. So that time the bundle need to be cut, to release water with human effect. We overcome that problem also humidity level is low at the same time water level is greater than required level that time motor will turn on and remove plates in bundle in that way automatically water will be release.

Humidity >temperature
And
Current water level>required water level
And
While motor in off mode.

4. REQUIREMENTS

4.1 Hardware Used

a) ADC Microcontroller 40 pins:
This powerful (200 nanosecond instruction execution) yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC® architecture into an 40- or 44-pin package and is upwards compatible with the PIC16C5X, PIC12CXXX and PIC16C7X devices. The PIC16F874A features 128 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I^2C™) bus and a Universal Asynchronous Receiver Transmitter (USART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications.

b) ZigBee Module:
ZigBee is used for achieving wireless communication between Node1 and Node2. The range for Zigbee is roughly 50 meters and it can be increased using high power modules or by using network of modules. It operates on 2.4 GHz frequency. Its power consumption is very low and it is less expensive as compared to other wireless modules like Wi-Fi or Bluetooth. It is usually used to establish wireless local area networks.

c) Temperature Sensor LM35:
The LM35 is precision IC temperature sensor. Output voltage of LM35 is directly proportional to the Centigrade/Celsius of temperature. The LM35 does not need external calibration or trimming to provide accurate temperature range. It is very low cost sensor. It has low output impedance and linear output. The operating temperature range for LM35 is −55˚ to +150˚C. With rise in temperature, the output voltage of the sensor increases linearly and the value of voltage is given to the microcontroller which is multiplied by the conversion factor in order to give the value of actual temperature.

Temperature = ((HighByte <<8) + LowByte) * 0.0625

d) Moisture sensor:
Soil moisture sensor measures the water content in soil. It uses the property of the electrical resistance of the soil. The relationship among the measured property and soil moisture is calibrated and it may vary depending on environmental factors such as temperature, soil type, or electric conductivity. Here, It is used to sense the moisture in field and transfer it to microcontroller in order to take controlling action of switching water pump ON/OFF. Humidity sensor: The DHT11 is a basic, low-cost digital temperature and humidity sensor. It gives out digital value and hence there is no need to use conversion algorithm at ADC of the microcontroller and hence we can give its output directly to data pin instead of ADC. It has a capacitive sensor for measuring humidity. The only real shortcoming of this sensor is that one can only get new data from it only after every 2 seconds.

e)Water Sensor BT901i:
This water Level sensors are used to detect the level of substances that can flow. Such substances include liquids, slurries, granular material and powders. Level measurements can be done inside containers or it can be the level of a river or lake. Such measurements can be used to determine the amount of materials within a closed container or the flow of water in open channels.

4.2 Software Used

This GUI was designed using Visual Studio with embedded C-programming. This interface is divided into various categories depends on multiple sensors values.

5. EXPERIMENTATION AND RESULTS

As shown in the figure 4 experimental setup for displaying temperature and soil moisture values by that sensors with help of ADC controller.

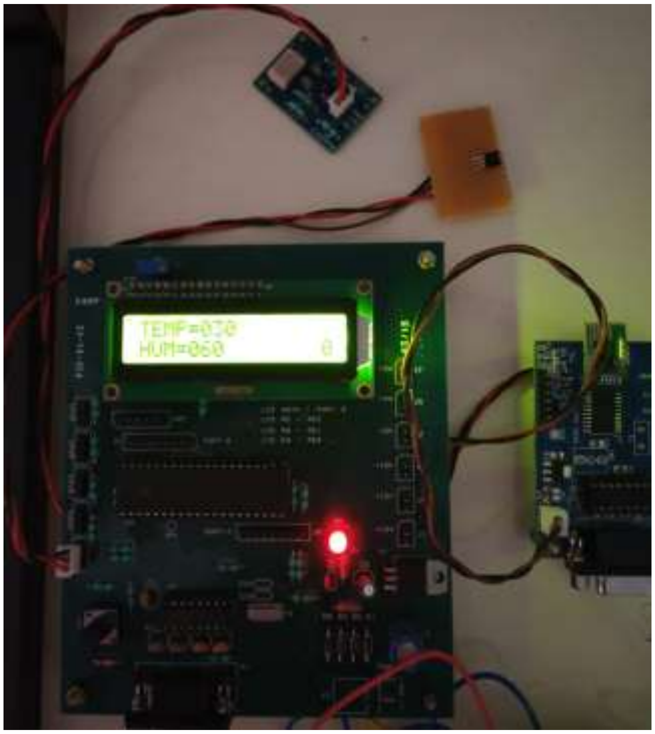

Fig-5: displaying values

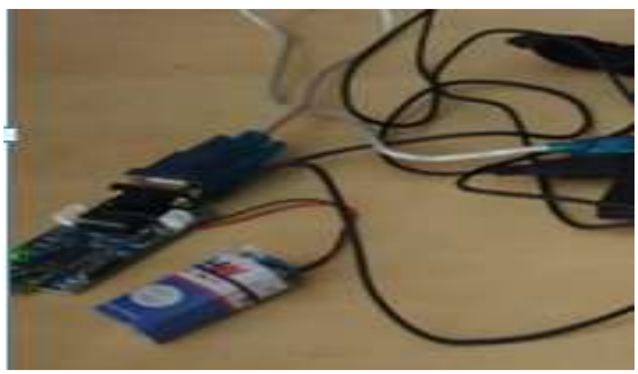

Fig-6: power supply for zigbee

Below we can see out values in analog form in a pc/mobile app. As well we can see it in digital form in a LCD display.

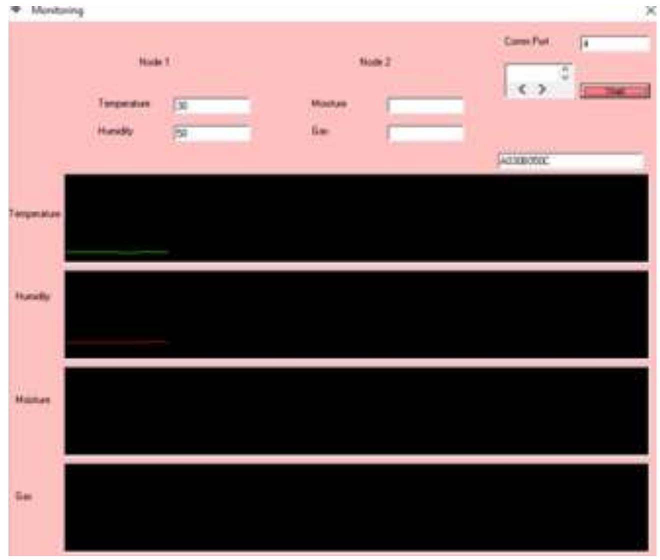

Fig-7:Analog design

Fig-8 connecting all sensors with motor

6. CONCLUSION

The sensors and microcontrollers of all three Nodes are successfully interfaced with raspberry pi and wireless communication is achieved between various Nodes. We did lots of topics like automation motor management, water level identifying in water resource, turn on particular pipe for a particular piece of land, especially rain water manage in field.

7. ACKNOWLEDGMENT

I am sincerely thankful to all my teachers for their guidance for my seminar. Without their help it was tough job for me to accomplish this task. I am especially very thankful to my guide **Mr. D. Kanthasamy** for his consistent guidance, encouragement and motivation throughout the period of this work. I also want to thank our Head of the Department (CSE) **Mr. R. Malar vannan** for providing me all necessary facilities. Very big thanks for my all reference author's and related topic writers.

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