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Environment Monitoring and Device Control using Arduino Based Embedded Controlled Sensor Network

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Abstract: Environmental pollution is an international serious, acute, health and social problem that humans are responsible for. Rapid technology evolution could provide us solutions to predict and monitor environmental parameters and thus minimize or even eliminate environmental pollution. Using a wireless sensor network (WSN) and an Internet of Things (IoT) implementation, we can create an eco-friendly and controlled environment. This paper presents an embedded and standalone system that can monitor, store and analyse environmental data as well as calculate energy consumption in specific settings. Information is available via a web application with central management abilities. Embedded controlled sensor network is the technology used to implement environmental solutions effectively. Many researchers have been making attempts to develop the embedded controlled sensor network. The existing systems are bulky, very costly and difficult to maintain. The proposed system is cost effective and controlled by user friendly embedded systems. In the proposed system Arduino based microcontroller and wireless sensors are used to control the various devices and to monitor the information regarding the environment using wifi technologies.

Keywords: WMANET, Wireless Sensor Network (WSN), ECSN, Internet of Things (IoT).

I. INTRODUCTION

Embedded controlled sensing element networks (ECSN) are mainly designed to be application specific so that the energy consumption is minimum as the battery-powered nodes demand life-time of several months or even a few years. Zigbee is the name for a short-range and having low-power, low-cost, and low-data-rate wireless multi-hop networking technology. The obtainable technologies area unit Bluetooth, Wi-Fi, WiMax, wireless mobile Ad-hoc network (WMANET), UMB, wireless HART, Bluetooth and ZigBee Embedded sensing element networks square measure fashioned by human action.

II. METHODOLOGY

Environment observation and device management allows new level of comfort in homes and it can also manage the energy consumption efficiently which in turns promotes the saving. Remote controlling of the devices offers many advantages to senior citizens and people with disabilities which helps them in being more autonomous and increasing quality of life. Researchers have worked on home automation and environmental monitoring system in the past but in the existing systems cost is high, size is troublesome and that they square measure difficult to keep up. The projected system is price effective and controlled by user friendly embedded systems. In this projected system, we have designed one master modulewhich consists of microcontroller and Zigbee module.

III. TEMPERATURE SENSOR

Temperature sensor LM35 is a precision IC temperature sensor with its output proportional to the temperature (in ^{o}C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With LM35, temperature can be measured more accurately than with a thermistor as shown in Fig1. It also possesses low self heating and does not cause more than 0. 1^{o}C temperature rise in still air. The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every oC rise/fall in ambient temperature, i.e., its scale factor is 0.01V/ ^{o}C.

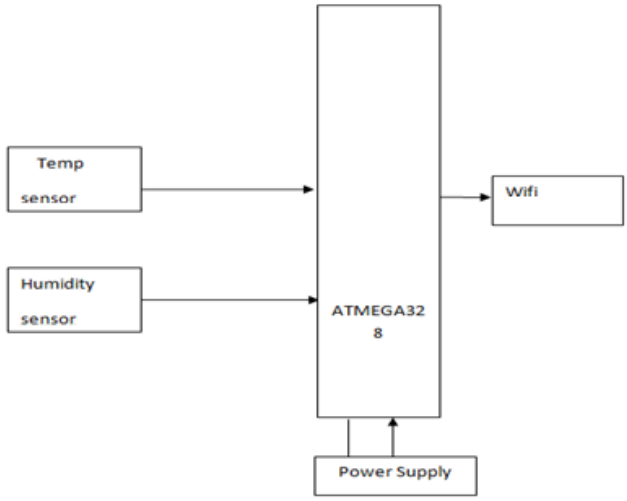

Fig.1. circuit diagram.

A. Arduino Microcontroler

Here we are using ARDUINO microcontroller advantage of arduino in compare to other microcontroller it is an open source prototype platform based on easy to use hardware and software. The ARDUINO Nano is a small, complete, and breadboard-friendly board based on the ATmega328

(Arduino Nano 3.x) or ATmega168 (Arduino Nano 2.x). It has more or less the same functionality of the ARDUINO Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. The Nano was designed and is being produced by Gravitech. Schematic and Design Arduino Nano 3.0 (ATmega328): schematic, Eagle files. Arduino Nano 2.3 (ATmega168): manual (pdf), Eagle files as shown in Fig.2. Note: since the free version of Eagle does not handle more than 2 layers, and this version of the Nano is 4 layers, it is published here unrouted, so users can open and use it in the free version of Eagle.

Specifications:

- Microcontroller Atmel ATmega168 or ATmega328
- Operating Voltage (logic level) 5 V
- Input Voltage (recommended) 7-12 V
- Input Voltage (limits) 6-20 V
- Digital I/O Pins 14 (of which 6 provide PWM output)
- Analog Input Pins 8
- DC Current per I/O Pin 40 mA
- Flash Memory 16 KB (ATmega168) or 32 KB (ATmega328) of which 2 KB used by boot loader
- SRAM 1KB (ATmega168) or 2 KB (ATmega328) EEPROM 512 bytes(ATmega168) or 1KB (ATmega328)
- Clock Speed 16 MHz
- Dimensions 0.73" x 1.70"
- Length 45 mm
- Width 18 mm
- Weigth 5g

Fig.2. ARDUINO microtroller.

Power: The ARDUINO Nano can be powered via the Mini B USB connection, 6-20V unregulated external power supply (pin 30), or 5V regulated external power supply (pin 27). The power source is automatically selected to the highest voltage source. Here we are using ARDUINO microcontroller advantage of arduino in compare to other microcontroller it is an open source prototype platform based on easy to use hardware and software. The ARDUINO Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x) or ATmega168 (Arduino Nano 2.x). It has more or less the same functionality of the ARDUINO Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. The Nano was designed and is being produced by Gravitech. Schematic and Design Arduino Nano 3.0 (ATmega328): schematic, Eagle files. Arduino Nano 2.3 (ATmega168): manual (pdf), Eagle files. Note: since the free version of Eagle does not handle more than 2 layers, and this version of the Nano is 4 layers, it is published here unrouted, so users can open and use it in the free version of Eagle.

B. GSM Module

GSM provides recommendations, not requirements. The GSM specifications define the functions and interface requirements in detail but do not address the hardware as shown in Fig.3. The reason for this is to limit the designers as little as possible but still to make it possible for the operators to buy equipment from different suppliers. The GSM network is divided into three major systems: the switching system (SS), the base station system (BSS), and the operation and support system (OSS).

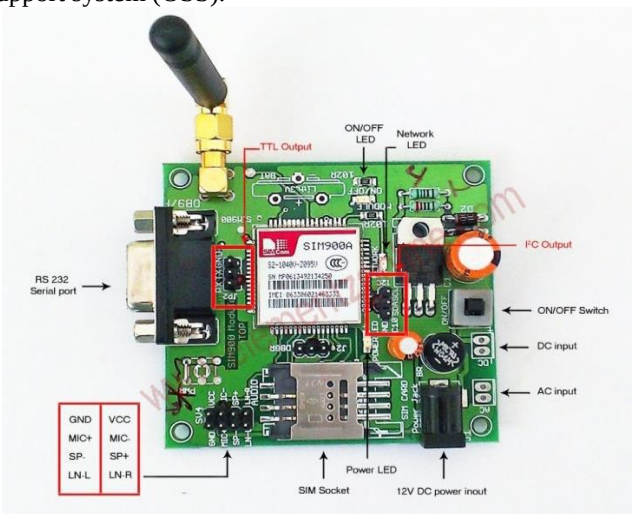

Fig.3. GSM module kit.

Here we are using GSM module to communicate with farmer's authorized mobile number.

C. Transformer

The function of the transformer is to step down the available ac source of 230 volts. The transformer selected is a 0-12v transformer. The current rating of the transformer is 1 A on the low voltage side. Since we require +5V DC sources with a common ground. The 230 AC voltages are stepped down using this step down transformer. At the secondary the 230v AC it is reduced to 12V RMS outputs measured with respect to ground.

D. Rectifier Unit

Using a full wave bridge rectifier then rectifies the reduced AC source of 12 volts RMS and it is converted into pulsating DC available in three outputs. The three outputs are the positive, negative and the ground. This DC is pulsating and it needs filtering. This unregulated DC is applied to the 7805 IC voltage regulator and at the output we can obtain +5V regulated output.

E. Filter Capacitors

The positive and the negative DC outputs have ripple in them and they are called pulsating DC. The ripple coming along the DC has to be removed. The ripple being the combined effect of the high frequency components has to be removed and this is done by the two capacitors. These two capacitors are essential for the positive and the negative bus. The capacitors selected are of the electrolytic type and are rated 25 volts 2200 MFD. Once the filtering is done the bus bar voltage is steady DC and is now not pulsating and it is free from ripples. However the capacitor gets charged to the peak value and therefore the voltage across the capacitor will be 9 * 1.414 volts. From this filtered pure DC source we have to get the operating 7805-voltage regulator IC.

F. Voltage Regulator Units

The function of the voltage regulator units are that when the output of the filters provide DC of a higher value than that is required the output of the regulator r is constant of say + 5 volts. In spite of the variations in the supply voltage the output remains constant at the stipulated level.

G. DC Motors

DC motor is used to drive a mechanical load. In this lab, a separately excited DC generator provides the load. The load on the motor is adjusted by varying the generator field current. By increasing the field current of the DC generator, the load on the DC motor increases and thus the armature current increases. In general, DC motors are characterized by their torque-speed curves as shown in Figure Since the measuring equipment for shaft torque is not available in the lab it is necessary to use alternative means of characterizing the DC motor.

IV. CONCLUSION

Our research has presented an embedded and standalone system that can monitor, store and analyzes environmental data as well as calculates energy consumption in specific settings. The implemented WSN system and the supporting software can work standalone as well as part of a smart ICT grid of appliances and offers the following services: monitor a biotic elements and store data, perform energy profiling of spaces, partially intervene in the operating state of the interconnected. This paper demonstrates designing of embedded controlled sensor networks used for controlling the home devices as well as monitoring the environmental parameters. The features of real time esp8266 are explored to design the system for long distance as well as short distance. Embedded controlled sensor networks have proven themselves to be a reliable solution in providing remote control and sensing for indoor environmental monitoring systems. Three commercial sensors had been integrated with the system to monitor and compute the level of existence of CO gas, temperature and humidity in atmosphere using information and communication technologies.

V. FUTURE SCOPE

The future of this project is to save the time and effort of farmer's, who works continuously day and night in all season By the help of this project they can save full expenses.

VI. REFERENCES

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