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IOT Based Data Logger System for Weather Monitoring

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ABSTRACT

This paper attempts to develop an effective solution for weather monitoring using wireless sensor networks (WSN) on a real time basis. Commercially available sensors are used to sense variable parameters such as temperature, humidity, light intensity and presence of rainfall. The sensors are then integrated with the wireless sensor motes for field deployment at the campus using multi hop data aggregation algorithm. A light weight middleware and a web interface to view the live data in the form of numbers and charts from the test beds was developed and made available from anywhere on the internet.

Keywords : Data Aggregation Algorithm, Light Weight Middleware, Web Interface

I. INTRODUCTION

The weather conditions are required to be monitored to maintain the healthy growth in crops and to ensure the safe working environment in industries, etc. Due to technological growth, the process of reading the environmental parameters became easier compared to the past days. By using the sensors for monitoring the weather conditions, the results will be accurate and the entire system will be faster and less power consuming. The system proposed in this paper describes the implemented flow of the weather monitoring station. It includes the wireless communication technology IEEE 802.11b/g, also familiar as Wi-Fi. The system monitors the weather conditions and updates the information to the web page. The reason behind sending the data to the web page is to maintain the weather conditions of a particular place can be known anywhere in the world. In our application, we have to make the weather condition of a particular place can be informative anywhere worldwide. The World Wide Web (www) needs to have one client – server configuration for communication. It's clients needs to be connected to the server with its IP address which can be universally accessible. The system is equipped with all sensor devices that acts as client to send the data to the web server. For establishing a connection between the sensor network and internet, we have used a Wi-Fi module as an additional communication interface controlled by the microcontroller. The criteria of connecting all the sensors to the internet is Internet of Things (IoT).

II. METHODS AND MATERIAL

EXISTING MODEL

Existing system model uses Zigbee based wireless sensor networks to monitor physical and environmental conditions with thousands of application in different fields. The sensor nodes directly communicated with the moving nodes deployed on the object of interest which avoided the use of complex routing algorithm but local computations are very minimal.

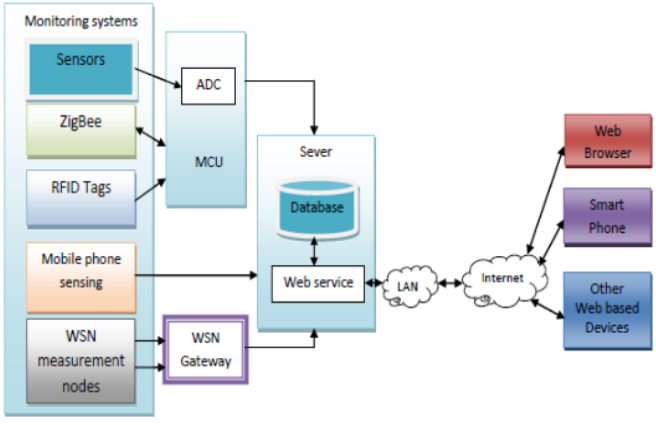

Figure 1. Existing Model

PROPOSED MODEL

The proposed Embedded device is for monitoring Temperature, Humidity, light intensity in the atmosphere to make the environment intelligent or interactive with the objects through wireless communication. The proposed model is more adaptable and distributive in

BLOCK DIAGRAM

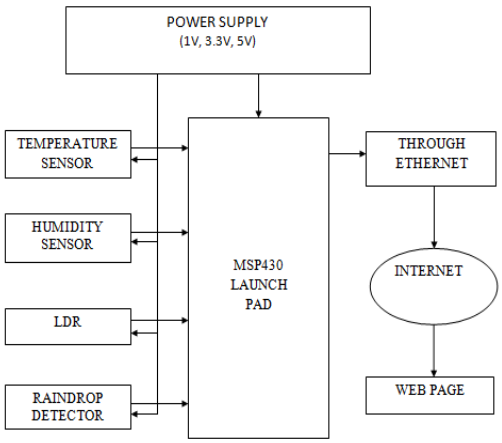

Figure 1. Block Diagram

COMPONENTS

Components required for working of project are:

A) HARDWARE REQUIREMENTS

- MSP430 launch pad
- Power Supply
- Transformer
- Temperature sensor
- Humidity sensor
- LDR
- Rain sensor module
- LCD display
- Tiva C series launch pad

B) SOFTWARE REQUIREMENTS

- Energia IDE

HARDWARE REQUIREMENTS

1. MSP430 LAUNCH PAD

Texas Instruments released the MSP430 Launch pad in July 2010. The MSP430 Launch pad has an onboard flash emulator, USB, 2 programmable LEDs, and 1 programmable push button. As an addition to experimentation with the Launch pad a shield board is available. TI has since provided several new Launch Pads based on the MSP430 platform:

- MSP-EXP430F5529LP features the MSP430F5529 USB device-capable MCU with 128KB flash and 8KB SRAM
- MSP-EXP430FR5969 features the MSP430FR5969 FRAM MCU with 64KB FRAM and 2KB SRAM
- MSP-EXP430FR4133 features the MSP430FR4133 FRAM MCU with 16KB FRAM, 2KB SRAM and on-board LCD

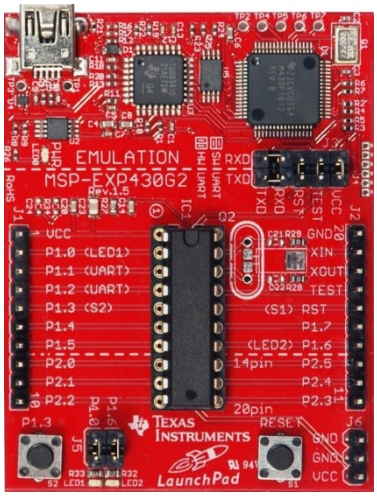

Figure 3. MSP430 Launch pad

All three of these Launch Pads include an Z-FET JTAG debugger with backchannel UART capable of 1Mbit/s speeds. The FRAM Launch Pads (MSP-EXP430FR5969, MSP-EXP430FR4133) include Energy Trace, a feature supported by TI's Code Composer Studio IDE for monitoring and analyzing power consumption.

2. POWER SUPPLY

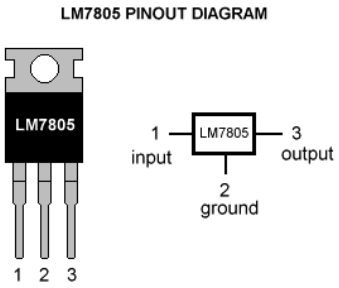

Figure 4. LM7805

The power supply circuits built using filters, rectifiers, and then voltage regulators. Starting with an ac voltage,

a steady dc voltage is obtained by rectifying the ac voltage, then filtering to a dc level, and finally, regulating to obtain a desired fixed dc voltage. The regulation is usually obtained from an IC voltage regulator unit, which takes a dc voltage and provides a somewhat lower dc voltage, which remains the same even if the input dc voltage varies, or the output load connected to the dc voltage changes.

3. TRANSFORMER

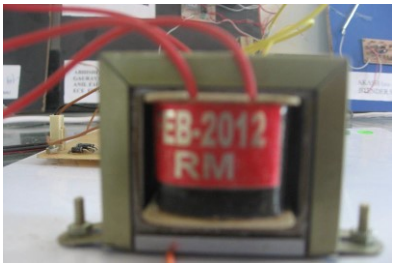

Figure 5. Transformer

The principle parts of a transformer and their functions are:

- The core, which makes a path for the magnetic flux.
- The primary coil, which receives energy from the ac source.
- The secondary coil, which receives energy from the primary winding and delivers it to the load.
- The enclosure, which protects the transformer from dirt, moisture, and mechanical damage.

Generally, the primary winding of a transformer is connected to the input voltage supply and converts or transforms the electrical power into a magnetic field. While the job of the secondary winding is to convert this alternating magnetic field into electrical power producing the required output voltage.

APPLICATIONS OF TRANSFORMER

- Transformers have many applications in power transmission and electronics.
- They may be used to minimize energy losses due to voltage drop in transmitting electricity over long distances.
- They match loads with internal resistance so that there is maximum power transfer.
- They couple signals between electronic stages.

STEP DOWN TRANSFORMER

Step down transformer is one whose secondary voltage is less than its primary voltage. It is designed to reduce the voltage from the primary winding to the secondary winding. This kind of transformer "steps down" the voltage applied to it. As a step-down unit, the transformer converts high-voltage, low-current power into low-voltage, high-current power.

4. TEMPERATURE SENSOR

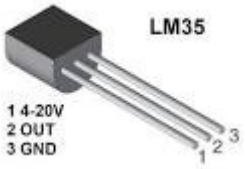

Figure 6. Temperature Sensor

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range. The device is used with single power supplies, or with plus and minus supplies. As the LM35 device draws only 60 μA from the supply, it has very low self-heating of less than 0.1°C in still air.

5. HUMIDITY SENSOR

A humidity sensor senses, measures and reports the relative humidity in the air. It therefore measures both moisture and air temperature. Relative humidity is the ratio of actual moisture in the air to the highest amount of moisture that can be held at that air temperature.

Figure 7. Humidity Sensor

The warmer the air temperature is, the more moisture it can hold. Humidity sensors use capacitive

measurement, which relies on electrical capacitance. Electrical capacity is the ability of two nearby electrical conductors to create an electrical field between them. The sensor is composed of two metal plates and contains a non-conductive polymer film between them. This film collects moisture from the air, which causes the voltage between the two plates to change. These voltage changes are converted into digital readings showing the level of moisture in the air.

6. LDR

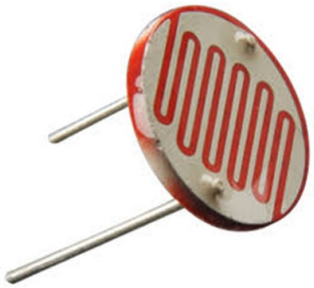

Figure 8. LDR

A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance.

7. RAIN SENSOR MODULE

Figure 9. Rain Sensor Module

The rain sensor module is an easy tool for rain detection. It can be used as a switch when raindrop falls through the raining board and also for measuring rainfall intensity. The module features, a rain board and the control board that is separate for more convenience, power indicator LED and an adjustable sensitivity though a potentiometer. The analog output is used in detection of drops in the amount of rainfall. Connected to 5V power supply, the LED will turn on when induction board has no rain drop, and DO output is high. When dropping a little amount water, DO output is low, the switch indicator will turn on. Brush off the water droplets, and when restored to the initial state, outputs high level.

8. LCD DISPLAY

Figure 10. LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

III. RESULTS AND DISCUSSION

1. TIVA C SERIES LAUNCH PAD

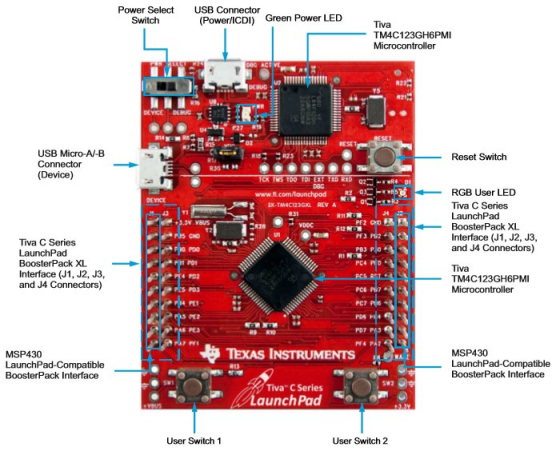

Figure 11. Tiva C Series Launch pad

The Tiva™ C Series TM4C123G Launch Pad Evaluation Board (EK-TM4C123GXL) is a low-cost evaluation platform for ARM® Cortex™-M4F-based microcontrollers. The Tiva C Series Launch Pad design highlights the TM4C123GH6PMI microcontroller USB 2.0 device interface, hibernation module, and motion control pulse-width modulator (MC PWM) module.

The Tiva C Series Launch Pad also features programmable user buttons and an RGB LED for custom applications. The stackable headers of the Tiva C Series TM4C123G Launch Pad Booster Pack XL interface demonstrate how easy it is to expand the functionality of the Tiva C Series Launch Pad when interfacing to other peripherals on many existing Booster Pack add-on boards as well as future products.

SOFTWARE REQUIREMENTS ENERGIA

Figure 12. Symbol of Energia

Energia is an open-source electronics prototyping platform started by Robert Wessels in January of 2012 with the goal to bring the Wiring and Arduino framework to the Texas Instruments MSP430 based Launch Pad. The Energia IDE is cross platform supported on Mac OS, Windows, and Linux. Energia uses the mspgcc compiler by Peter Bigot and is based on the Wiring and Arduino framework. Energia includes an integrated development environment (IDE) that is based on Processing. Energia is also a portable framework/abstraction layer that can be used in other popular IDEs. Community maintained Energia plug-ins and integrations are available for Xcode, Visual Studio, and Code Composer Studio.

IV.CONCLUSION

The above proposed concept is used to collect information on weather in a particular area and helps to monitor it without the need to go directly to the particular area. In this the sensors collect the data on particular parameters for what it has been installed and sends the data to the controller, which then uploads the data to the webpage using the Tiva C series launch pad where the data gets displayed in the form of a graph. The webpage has username and password so that it lets only the authority people to monitor and safeguard the data not letting others to gather their information.

V. ACKNOWLEDGEMENT

The success of a work depends on a team and cooperation. We take this opportunity to express our gratitude and thanks to everyone who helped us in our project. We would like to thank our institution, Sri Eshwar College of Engineering, Coimbatore, India for excellent facilities provided and our project guide Mr. S. Yogeswaran, Assistant Professor for the constant support and guidance provided to complete this project.

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