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Zigbee based weather monitoring system

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ABSTRACT
To develop Sensor Networking and Weather Station Monitoring System without human intervention using Wireless ZigBee Technology. The project is mainly targeted towards the reliability of the Pollution Monitoring system. A WMS keeps track of temperature, humidity, wind speed and direction, rainfall amount etc. The system displays these readings in real time on a display. It also keeps track of historical information on an hourly and daily basis. This data can be display on LCD. Various techniques are used to monitor the weather like satellites, radars, microcontrollers and many other simple instruments. Weather can also be monitored by using remote wireless sensors. Zigbee is the latest wireless weather monitoring technique. The existing monitoring systems of Weather Monitoring System are manual. We need human support for so. There are limitations for human to know about exceeding hazardous parameters of Environment. There are chances of human errors. Like human calculations may not be precise sometimes. Or human may not cover larger area. We need some smart system which will automatically measures the parameters. In this application, Wireless sensor network can solve the problem, where parameters calculations and controlling will be precise even over the larger area.

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I. INTRODUCTION

Sensing the winds and weather has been important to man over the centuries. Athenians built the eight sided Tower of the Winds in the first century B.C. in honor of the eight gods of the winds. The Tower of the Winds stands to this day in the ancient agora, or market, in Athens. Many significant weather events have affected mankind over the years. Today, the winds and other weather variables are of equal concern and can have an even greater impact on our modern, high-tech life style. Weather affects a wide range of man's activities, including agriculture, transportation and leisure time. Often the affects involve the movement of gases and particulates through the atmosphere. Modern weather monitoring systems and networks are designed to make the measurements necessary to track these movements in a cost effective manner. In weather monitoring systems, different parameters like time and date, temperature, relative humidity, dew point, wind direction and speed, rainfall amount, and weather forecast are all shown on the LCD display. Temperature and humidity are indicated for both indoor and outdoor locations. Programmable alarms are also available in the monitoring systems which indicate out-of-range conditions. Thermometer, barometer, and dew point functions have min/max memories. Barometer also features sea level reference, pressure trend indicator and weather forecasting symbols (sunny, cloudy, and rainy). Serial port permits linking to a PC or laptop for data transfer. System is supplied with sensors, an AC adapter, and four AA backup batteries. The conventional weather monitoring system consisted of individual sensors to measure one meteorological variable, each connected to a data collection device or recorder. Modern technology has allowed the combination of several sensors into one integrated weather station that can be permanently located at one site, or transported to a site where localized weather is needed.

II. LITERATURE REVIEW

After the research in the agriculture field researches found the yield of agriculture goes on decreasing day by day. Use of technology in the field of agriculture plays important role in increasing the production as well as in reducing the extra man power efforts, some of the researches tried for betterment of farmers and provides the systems that use technologies which are helpful for increasing the agriculture yield. Some of such researches carried out in field of agriculture are summarized

- The survey was made by visiting different sites and found some following point in the legacy systems.
- Have required a great effort to connect and distribute all the sensors and data acquisition systems.
- These installations need many data and power wires to be distributed along the larger area making the system complex and expensive.

III. PROPOSED SYSTEM DESIGN

The Proposed System design consists of transmitter as well as receiver. The Proposed block diagram of transmitter and receiver is shown in fig.1. Transmitter section consist of different type of sensing unit such as temperature, humidity, rain quantity measurement, wind direction, wind flow as well as the sun intensiy. Microcontroller for time domain multiplexing i.e. multiplexing the data obtained from different type of sensor as well as for converting the analog data into digital one.

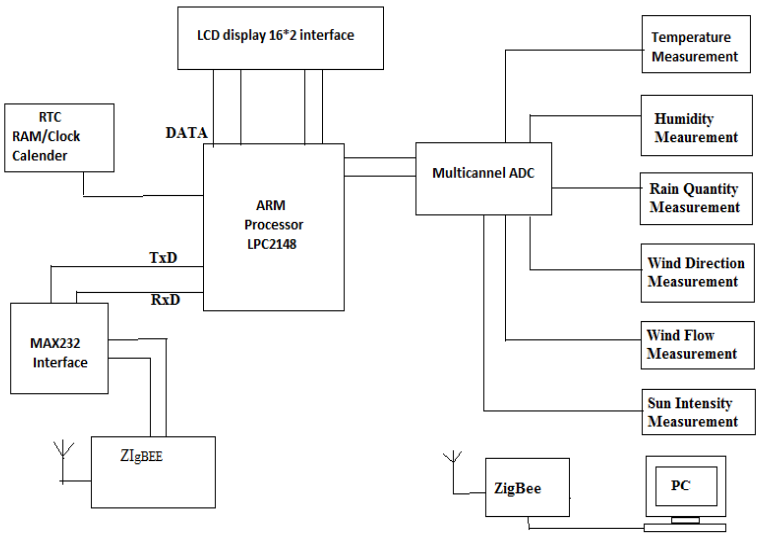


Fig 1: Block diagram

IV. SYSTEM ARCHITECTURE

The proposed hardware of this system includes LPC2148, Temperature, humidity, wind direction, wind flow, rain drop and Sun intensity measurement sensors, LCD. The system is low cost &low power consuming so that anybody can afford it. The data monitored is collected at the server. It can be used in precision farming. The system should be designed in such a way that even illiterate villagers can operate it. During irrigation period they have to monitor their distant pump house throughout the night as the electricity supply is not consistent.

The system can be installed at the pump house located remotely from the village, it is interfaced with the pump starter & sensors are plugged at different location in the field for data acquisition. Using this system they can switch on their pump from their home whenever they want.

ARM7-LPC2148

LPC2148 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontroller with embedded high speed flash memory ranging from 32kB to 512kB. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30% with minimal performance penalty. Due to their tiny size and low power consumption, LPC2141/42/44/46/48 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8kB up to 40kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems.

ZIGBEE MODULE

The XBee RF Modules are designed to operate within the ZigBee protocol and support the unique needs of low-cost, low-power wireless sensor networks. The modules require minimal power and provide reliable delivery of data between remote devices. The modules operate within the ISM 2.4 GHz frequency band. It operates over a range of 100-200 meters [7]. Fig.2 shows the zigbee module. **Figure 2 Zigbee series 2 module** The receiver block diagram is shown in Fig.5. The receiver module consists of an Xbee RF module which is connected to computer system through MAX232.Thus the monitoring data received by Zigbee module is directly transferred to computer system.

Fig 2 : Zigbee series 2 module

The receiver block diagram is shown in Fig.3. The receiver module consists of an Xbee RF module which is connected to computer system through MAX232.Thus the monitoring data received by Zigbee module is directly transferred to computer system.

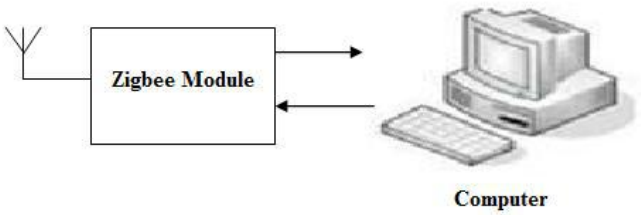


Fig 3: Receiver block diagram

TEMPERATURE SENSOR

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in ^{o}C). It is used to measure temperature more accurately than a using a thermistor. The sensor circuitry is sealed and not subject to oxidation. The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified. This sensor is used to monitor surrounding temperature. It gives the idea about the increase or decrease in the temperature of surrounding. If the temperature changes it is observed on LCD.

ACCERELOMETER –ADXL355

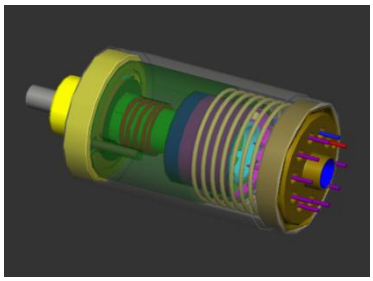
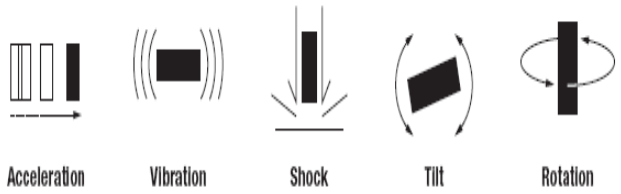


Fig 3: Accelerometer

The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 *g*. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

The user selects the bandwidth of the accelerometer using the CX, CY, and CZ capacitors at the XOUT, YOUT, and ZOUT pins. Bandwidths can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for the X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis. The ADXL335 is available in a small, low profile, 4 mm × 4 mm × 1.45 mm, 16-lead, plastic lead frame chip scale package (LFCSP_LQ).

- An accelerometer is a sensing element
- Measured in units of *g*.
- Measures: vibrations, shocks, tilt, impacts and motion of an object.



LIGHT DEPENDENT RESISTOR

Materials used as the semiconductor substrate include, lead Sulphide (PbS), Lead Selenide (PbSe), indium antimony(InSb) which detect light in the infra-red range with the most commonly used of all photoresistive light sensors being Cadmium Sulphide (Cds). Cadmium sulphide is used in the manufacture of photoconductive cells because its spectral response curve closely matches that of the human eye and can even be controlled using a simple torch as a light source. Typically then, it has a peak sensitivity wavelength (λp) of about 560nm to 600nm in the visible spectral range. The net effect is an improvement in its conductivity with a decrease in resistance for an increase in illumination. Also, photoresistive cells have a long response time requiring many seconds to respond to a change in the light intensity.

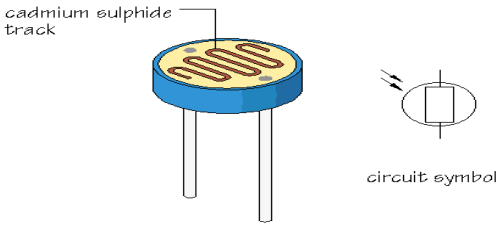


Fig 4: Light sensor

HUMIDITY SENSOR- DHT11

The DHT11Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.

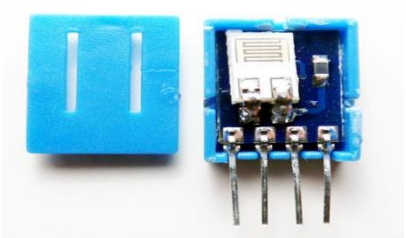


Fig 5. Humidity Sensor

Specifications:

- Measurement Range: 20-90%RH, 0-50^{o}C.
- Humidity Accuracy: +-_5%
- Temperature Accuracy: +- 2^{o}C
- Package: 4 Pin Single Row.
- Resolution:1% RH

RAINDROP SENSOR

Fig.6 Raindrop Sensor

Specification:

- Easy to use.
- Power supply: 3.3v or 5v
- Output voltage signal: 0~4.2v
- Current: 35mA
- Pins : Analog output, Vcc & Gnd
- Size: 60x20x5cm

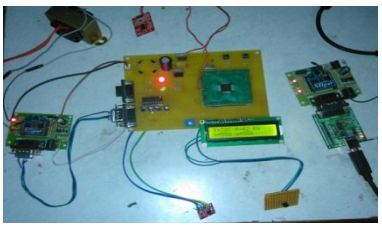
ADVANTAGES

- Reduces manpower
- Wireless Sensor Systems
- Accurate system
- Faster Data transfer
- Automatic Indication
- Low cost
- Less circuitry required because of software used
- Time saving
- Low power consumption
- Weather can be monitored from remote place.
- Detection of the Temperature conditions will help us to avoid damages

DISADVANTAGES

- If we want continuous monitoring of required parameter then we have to keep pc on at receiver that will increase the power consumption.
- Limited Communication range.
- Less Secured
- Low data rate

RESULT



Location: Viman Nagar, Pune

Date:12th March, 2015, Time: 7:30PM

Temperature: 32°C
Humidity: 42%RH
Accelerometer: X- 558
Y- 597

Location: Vishrantwadi, Pune
Date: 13th March, 2015, Time: 8:45PM

Temperature: 34^{o}C
Humidity:40%RH
Accelerometer: X- 520
Y- 553

V. CONCLUSION

Zigbee-based agriculture monitoring system serves as a reliable and efficient system for efficiently monitor the environmental parameters. Wireless monitoring of field not only allows user to reduce the human power, but it also allows user to see accurate changes in it. It is much cheaper in cost, consumes less power and can control 254 devices, which in turn leads to the development of lots of new technologies like Home Automation, Health Care Automation etc. .

A project of such a comprehensive coverage cannot be prepared without help from numerous sources.

VI. ACKNOWLEDGMENT

We feel great pleasure in submitting this report on '**Zigbee based Weather monitoring System'**.

We gratefully acknowledge the generous help of **Prof. Archana Thite.** She inspired, guided and assisted us at all stages of this project work. We owe her a great debt of gratitude for without her support this work would not have been completed, indeed. We have no words to express our obligations to this learned and noble scholar.

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Although we have tried to produce the best out of our endeavour but there might be some errors, for human beings are not perfect.

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