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## ZigBee Based Real Time Weather Monitoring System Using Matlab GUI

**K. Tanveer Alam**

Rayalaseema Univerisity, Andhra Pradesh  
[tanveeralamphd@gmail.com](mailto:tanveeralamphd@gmail.com)

**Mohammad Dada .V**

Rayalaseema Univerisity, Andhra Pradesh  
[ahmadvalli@gmail.com](mailto:ahmadvalli@gmail.com)

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**Abstract:** Weather monitoring is very essential to aviation services in real time. In this project, we are monitoring the atmospheric parameters such as Temperature and Humidity through the wireless system with the help of ZigBee module which is operating in 2.4GHz frequency and IEEE 802.15.4 protocol. The wireless system consist of two modules one is Transmitter and another one is Receiver module. The transmitter section consists of atmospheric parameters (i.e. Temperature and Humidity with real time), Microcontroller and ZigBee module. At the receiver section using Personal Computer to monitor the parameters and store them for the further process.

**Keywords:** Microcontroller, ZigBee, MATLAB.

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### I. INTRODUCTION

Transmission, therefore these type of platforms are very easy to interface with PC using the embedded C and MATLAB to measure the required parameters.

#### **Theory**

The working of this project can be classified into two section/parts as below.

1. Transmitter
2. Receiver

In the transmitter, part/section contains sensors such as Temperature, Humidity. Analog to Digital converter, Microcontroller, and ZigBee wireless transmitter.

In the receiver part/section contains ZigBee receiver which is interfaced to PC which can be used to process the received data as per our requirement such as data analysis, storing etc.

In some of the manufacturing industries during certain hazards it will be very difficult to monitor the parameter through wires and analog devices such as sensors/transducers. To overcome such type of problems we can take/use the wireless device(s) to monitor the parameters so that we can take small steps even in worst case. A few years back the use of the wireless device(s) was very less, but due to the rapid development of technology nowadays we can use maximum data transfer through wireless like Wi-Fi, Bluetooth, ZigBee, etc.

In view of all these things, the design of wireless parameter progress helps in an industry to monitor the parameters in real time with the use of ZigBee, is an easy installation platform, cost-effective method for the low bit rate

### II. HARDWARE IMPLEMENTATION

#### **2.1 BLOCK DIAGRAM**

The block diagram of the transmitter is shown in Fig 1.

The block diagram of the receiver is shown in Fig 2.



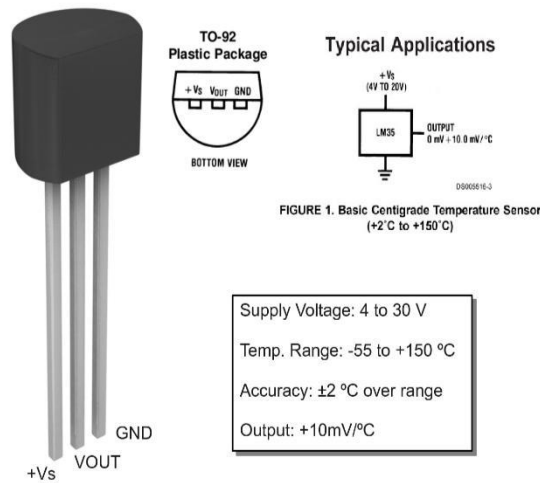


Fig-3: LM35 pin diagram

### 2.3 SY-HS 230A

Humidity is the presence of water in the air. The amount of water vapor in the air can affect human comfort as well as many manufacturing processes in industries. The presence of water vapour also influences various physical, chemical, and biological processes. Humidity measurement in industries is critical because it may affect the business cost of the product and the health and safety of the personnel. Hence, humidity sensing is very important, especially in the control systems for industrial processes and human comfort. We are using capacitive type sensor HY-HS 230.

SY-HS 230 is a Humidity sensor. This module converts the relative humidity in the atmosphere into an output voltage that is proportional to the relative humidity. The pin diagram of SY-HS 230A as shown in fig.4.

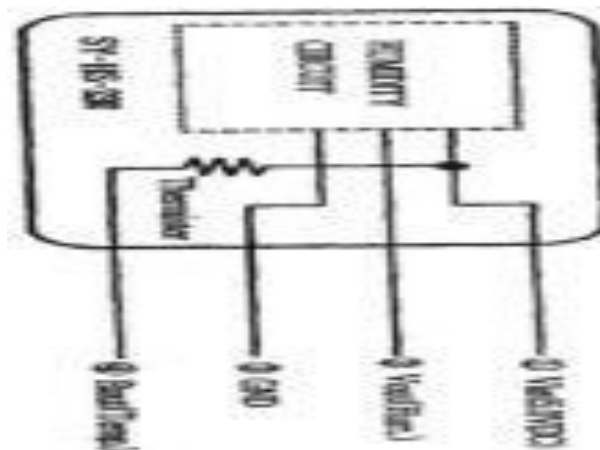


Fig.4: SY-HS 230A Pin Diagram

The standard characteristics of SY-HS230 are as shown in fig.5.

### Standard Characteristics

%RH	Spec. (µV)	
	HS-230A	HS-230B
10	580	700
20	760	920
30	1030	1310
40	1360	1700
50	1700	2050
60	2040	2380
70	2350	2710
80	2620	2970
90	2870	3180

Fig.5 standard characteristics of SY-HS230

### 2.4 ANALOG TO DIGITAL CONVERTER

An Analog-Digital Converter (ADC) is a widely used electronic component that converts an analog electric signal (usually a voltage) into a digital representation. The ADCs are at the front-end of any digital circuit that needs to process signals coming from the exterior world. Its schematic symbol is as shown in the fig.6.



Fig.6



In this project, we used 8591ADC to convert the analog to digital.

#### 2.4.1 ADC 8591 IC

The PCF8591 is a single-chip, single-supply low power 8-bit CMOS data acquisition device with four analog inputs, one analog output, and a serial I2C-bus interface. Three address pins A0, A1, and A2 are used for programming the hardware address, allowing the use of up to eight devices connected to the I2C-bus without additional hardware. Address, control, and data to and from the device are transferred serially via the two-line bidirectional I2C-bus.

The functions of the device include analog input multiplexing, on-chip track and hold function, 8-bit analog-to-digital conversion, and an 8-bit digital-to-analog conversion. The maximum conversion rate is given by the maximum speed of the I2C-bus. The block diagram of 8591 is as shown in the fig.7 and pin diagram of 8591 ADC is as shown in fig.8.

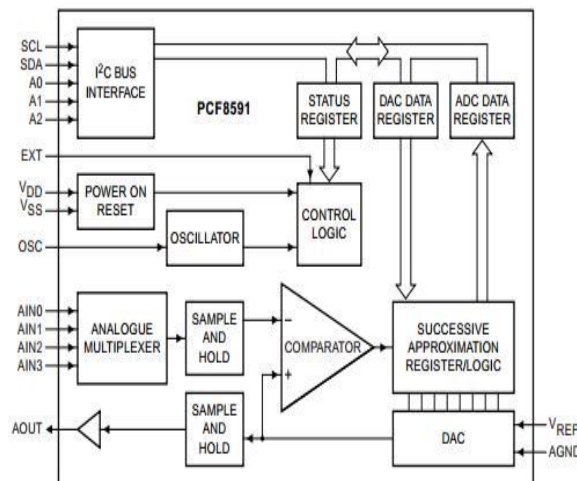


Fig.7: Block diagram of 8591 ADC

Fig.8: Pin diagram of 8591 ADC

### 2.5 TarangF4 ZigBee Module:

Tarang modules are designed with low to medium transmit power and for high-reliability wireless networks. The modules require minimal power and provide reliable delivery of data between devices. The interfaces provided with the module help to directly fit into many industrial applications. The modules operate within the ISM 2.4-2.4835 GHz frequency band with IEEE 802.15.4 baseband. The tarangF4 is as shown in the fig.9.



Fig.9: TarangF4

### 2.6 8051 MICRO CONTROLLER

#### Description

The 8051 microcontroller is a member of the MCS-51 family, originally designed in the 1980's by Intel. The 8051 has gained great popularity since its introduction and is estimated it is used in a large percentage of all embedded system products. The basic form of 8051 core includes several on-chip peripherals, like timers and counters, additionally, there are 128 bytes of on-chip data memory and up to 4K bytes of on-chip program memory.

#### Features

8-bit CPU optimized for control applications.

128 byte of on-chip data RAM. 4k bytes of on-chip ROM.

64k bytes of external ROM and RAM. 4, 8 bit wide I/O ports.

Two 16-bit timer/counters.

## III SOFTWARE IMPLEMENTATION

In this project work software was developed in transmitter and receiver section.

### 3.1 Transmitter Section

In transmitter section, the entire software is written in embedded C which was developed in KEIL Embedded software development environment. It is used for the program development and compilation. It makes cushy source code editing, program debugging and complete simulation in one powerful environment. The micro version development platform is easy to use and helping us quickly create embedded programs. The micro version editor and debugger are integrated into a single application that provides an embedded project development environment. The flow chart of the transmitter section is shown in fig.10.

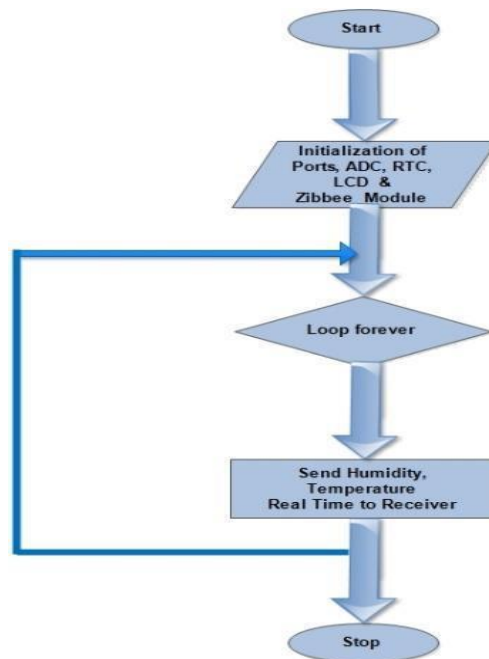


Fig .10: Flow chart of Transmitter section

### 3.2 Receiver section

In receiver section software is design and developed in MATLAB GUI which gives rich graphical user interface. The MATLAB Graphical User Interface Development Environment(GUIDE), provides a set of tools for creating graphical user interfaces (GUIs), which consists of a Figure window containing menus, buttons, text, graphics, etc., that a user can manipulate interactively with the mouse and keyboard. Figure-11 shows GUI description panel. There are two main steps in creating a GUI viz. One is designing its layout, and the other is writing call back functions that perform the desired operations when the user selects different features.

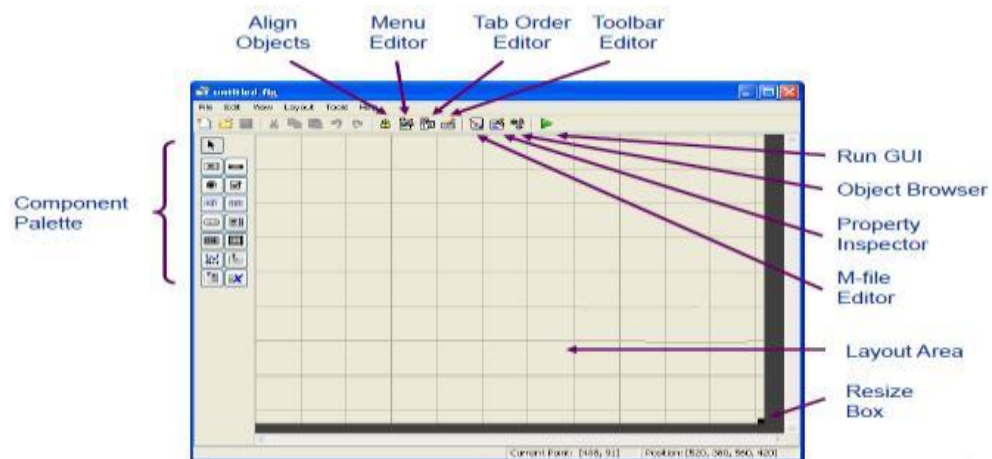


Fig-11: GUI description panel.

#### 3.2.1 MATLAB Database Toolbox

MATLAB Database Toolbox supports communication using ODBC or JDBC driver with a compatible database including IBM DB2, IBM Informix, and Ingres, Microsoft access, Microsoft Excel, Microsoft SQL Server, MySQL, Oracle, Post greSQL, Sybase SQL Anywhere and Sy base SQL Server. A JDBC driver is a software component enabling a Java application to communicate with a database. To connect with each databases type JDBC requires drivers. The JDBC driver provides the connection to the database and implements the protocol for transferring the communication between client and database. Figure-12 shows Visual query builder.



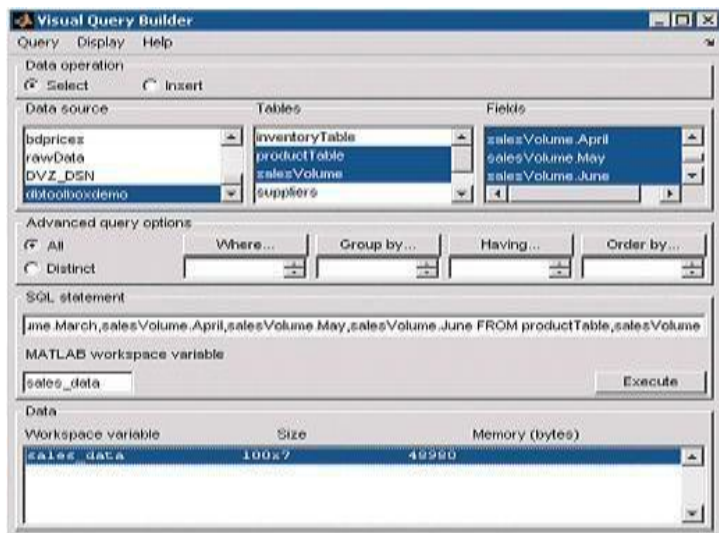


Fig-12. Visual query builder

The flow chart of the receiver section is shown in fig.13.

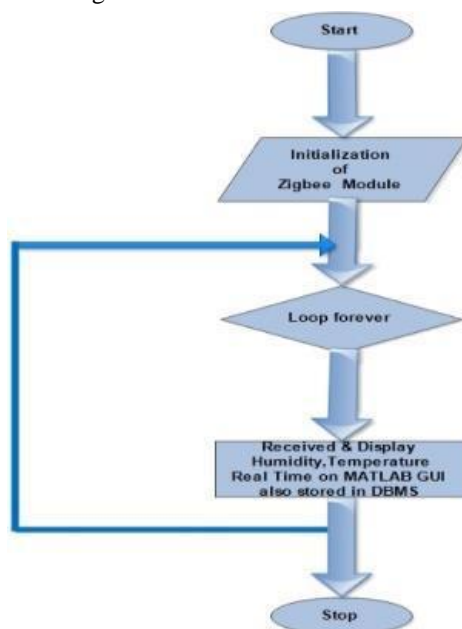


Fig-13: Flow chart of Receiver section

### RESULT AND CONCLUSION

The proposed system was successively developed and implemented in our university is shown in figure-14 and Figure-15 respectively.

Figure -14 shows the measurement of temperature, humidity with real time and send it to the receiver via ZigBee protocol.

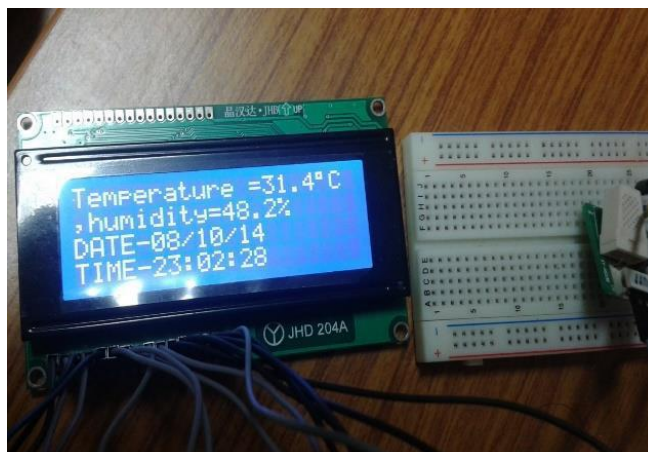


Fig-14- At Transmitter Side

Figure – 15 shows the receiver side receives the weather parameters like Temperature and humidity with respective real time from the transmitter system via ZigBee protocol and store the data in MySQL database. Here, the Matlab GUI used to shows the parameters.

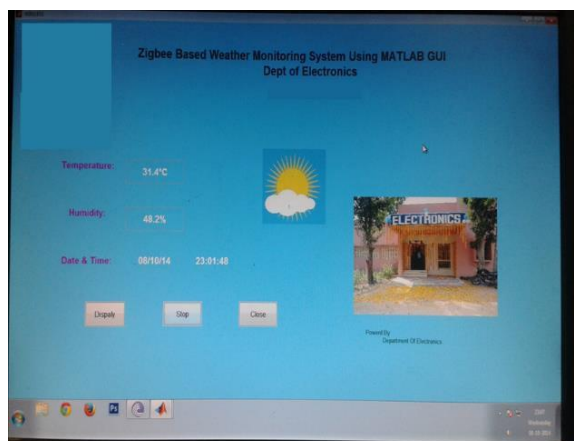


Fig-15 At receiver side MATLAB GUI

In this paper, ZigBee-based weather monitoring system has been introduced. Thus we concluded that this system can be customized to suit that industrial requirements (poultry and greenhouse etc.) to monitoring the weather parameters. The developed system is satisfactorily working within standard limits. Further for future extension the system has been connected to local network (LAN) via Ethernet port of the receiver system to broadcasting and monitoring the weather parameters.

#### REFERENCES

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