WIRELESS SENSOR NETWORK BASED SMART MONITORING SYSTEM IN INDUSTRIES USING MASTER AND SLAVES

Mr. Shivaprasad B[1], Asst Prof. Pushpalatha S[2]

[1]M Tech Student, Dr.AIT Bangalore.

[2]Assistant Professor, Department of ISE, Dr.AIT, Bangalore.

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Abstract- *A wireless network based smart monitoring system is presented in this paper. The project designs and develops a smart monitoring system for industries in real time. The system principally monitors the temperature of the conveyor, lighting system in the office and also the entry of the unauthorized person inside the restricted area. The developed system is a low cost and multitasking capability it uses two slaves and one master two perform all the three operations. Basically slaves are provided with reference values with respect to their operation. Master will periodically fetches the information from the slaves, if there is any mismatch in the reference value in the slaves, then it is considered as malfunction then the slaves will inform to the master. Then master display the information with the help of LCD display and also alert to the security system using buzzer. The communication between master and slaves is established with the help of Zig-Bee wireless network.*

Keyword: Zig-Bee, Smart, Monitoring, Master, Slaves, Buzzer

1. INTRODUCTION

In the existing system CC Tv's are used for the purpose of monitoring system and it requires to monitor continuously. To overcome from this problem, in this system smart monitoring system concept is introduced with some sensors to detect defects in the devices and alert the security system.

Here two slaves with one master is using, these two slaves are capable of doing some particular functions and master is used to control the slaves and to provide information to the security system.

In previous years to send the data between the master and slaves LAN cables are used to connect each other. When these slaves are placed in long distances from the master then it requires more LAN cables to connect each other this will leads to the connection overhead and when the distance increases then more cables are required so it leads to more cost. To overcome from this problem the concept of wireless sensor network used to send the data between slaves and master and this project eliminates the use of LAN cables for connection and thus reduces connection overhead and cost.

The system focuses on human-friendly technical solutions for monitoring and easy control of industrial appliances.

The developed system has the following distinct functions.

a) It uses the temperature sensor to control the temperature of the conveyor. Basically this sensor is provided with reference value, if temperature of conveyor exceeds its threshold level then slave will send information to the master to alert the security system.

b) Light detection resistor is used to monitor the lighting system of the industry and this will

automatically control the on/off of the lighting system.

c) It is also capable of detecting the entry of unauthorised person to the restricted area in the industry. If it found any entry to the restricted area it will alert the security system with buzzer.

2. HARDWARE DESCRIPTION

The system has designed for monitoring entry of unauthorized person, control the temperature of the conveyor and also to control the lightings in the industries. Important functions to the system are smart monitoring, alerting the security system, and wireless control of the devices. The measurement is done by interfacing the slaves with sensors. The output signals from the sensors are integrated and connected to Zig-Bee module for transmitting data wirelessly to the master.

2.1. System architecture

This developed system contains two slaves and one master for smart monitoring system in real time control of the devices inside the industry. Slave 1 is capable of monitoring and controlling the lighting system of the industry based on the available sun light and also this slave is capable of detecting the entry of unauthorized person and it will alert the security system. Slave 2 is used to monitor the temperature of the conveyor and to control the heating process with alert system. Master is used to control the operation of the slaves and it is continuously fetches the information from the slaves to check the working of the devices.

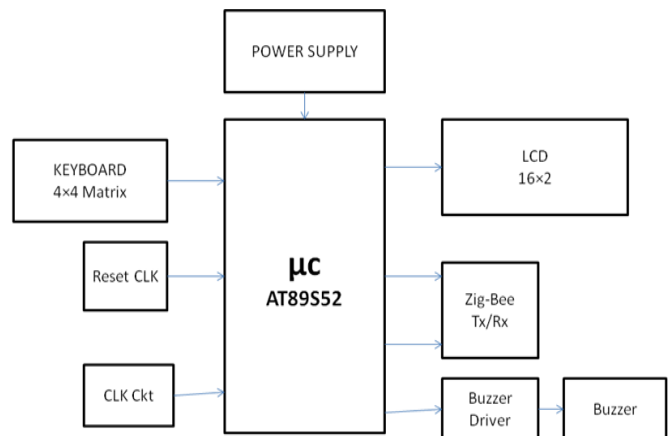The figure given below shows the system architecture

Master:

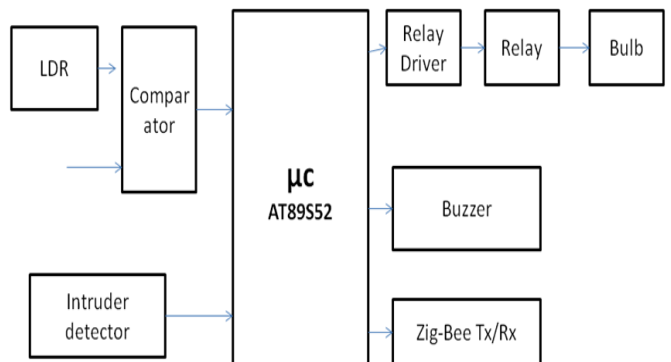Fig.1.1: Block diagram of master

Slave 1:

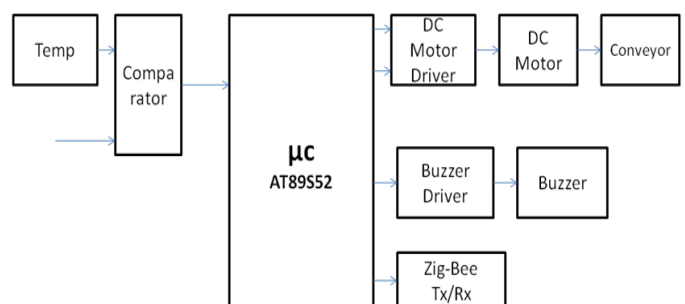
Fig.1.2: Block diagram of slave1

Slave 2:

Fig.1.3: Block diagram of slave2

The main 3 different functions carried out by the system are described below:

a. Temperature sensor:

Fig.2.1:Thermistor

The figure shows the temperature sensing resistor (Thermistor) interfaced in slave 2, it will continuously monitor the temperature of the conveyor. To monitor the temperature of the heating process it uses the temperature sensing resistor, where this resistor is provided with a particular reference valve with the help of variable resistor. While heating if temperature exceeds the reference value then this slave generate a signal and send it to the master by indicating over heating of the conveyor, then master will alert the security system with alarm system and also it provides the option to control the heating process with the help of keypad.

b. Light sensor:

To control the lighting system in the industry this system uses the light detection resistor (LDR), which is connected to the slave 1. This LDR is provided with a reference value by using the variable resistor, if there is any mismatch in the reference value then it is considered as defect and slave 1 will send the information to the master to take action.
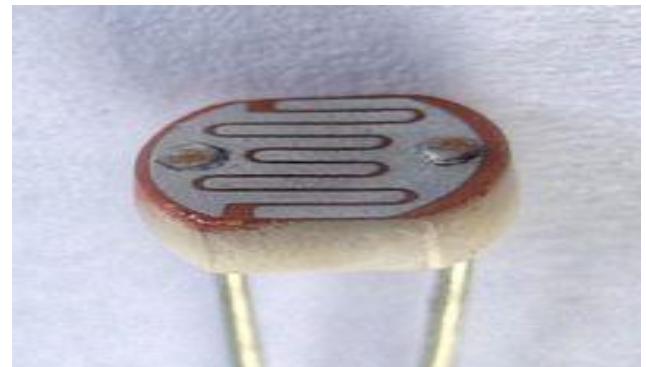

Fig 2.2: Light dependent resistor

c. Intrusion detector:

One more major function of the smart monitoring system is intrusion detection. In this if any unauthorized person enters to the restricted area it will be detected and alerted to the security system. To do this operation an IR transmitter/receiver is used to detect the intrusion. In this IR transmitter will continuously emit the light and IR receiver is continuously looks for the receiving light, if the receiver receives the reflected light of the transmitted light then it will generate a signal and send it to the master and then it will alert the security system using buzzer.
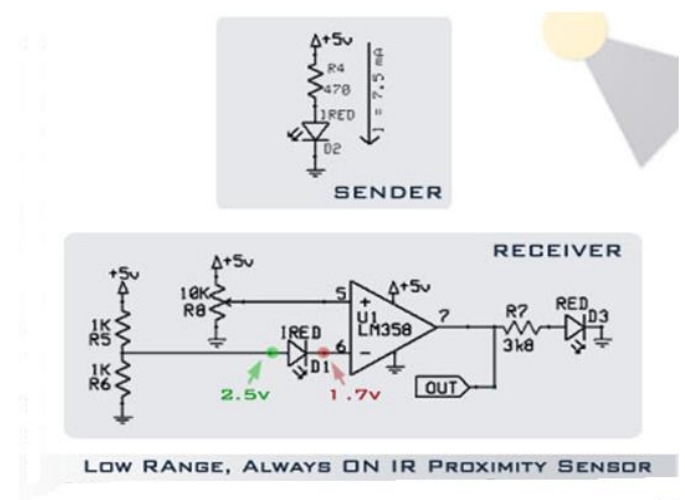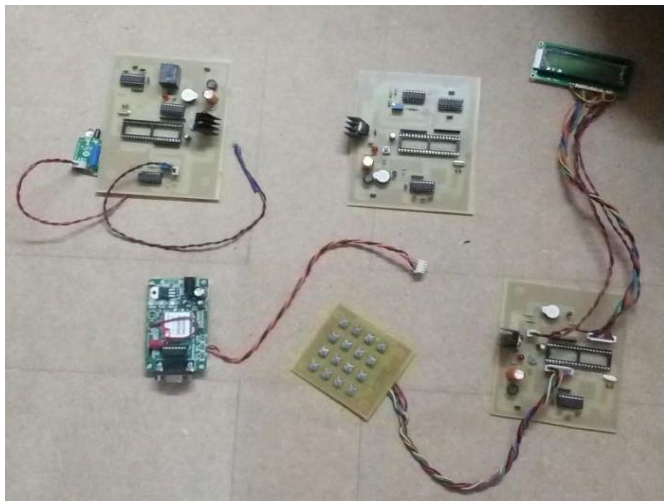

Fig.2.3: IR transmitter/receiver

Fig 2.4: System hardware

2.2 Zig-Bee communication

Zig-Bee is an emerging wireless communication technology. It has several advantages over other existing wireless communication technologies which make it a better choice for smart monitoring system applications.

These advantages are as follows:

1) Low-cost device compared to others.

2) Less complexity for the users.

3) Flexibility for expansion in future.

4) Possibility for multi pointer connections.

5) Low power consumption device.

A comparison between different existing wireless communications technologies and the above-mentioned characteristics is presented in Table I. From this table, it can be seen that Zig-Bee is the most preferred technology. In terms of communication capabilities, there are two types of Zig-Bee devices, i.e., full function device (FFD) and reduced function device (RFD). An RFD has the capability to connect to sensors, actuators, and meters. However, it does not have the capability to communicate with other RFDs. On the other hand, an FFD has the capability to communicate with other

FFDs as well as the sensors, actuators and meters. The RFD acts as a Zig-Bee end-device, whereas the FFD can act as a router or a coordinator. The router is used for data routing or communication with other routers or coordinators, extending the covered area as well as strengthening the transmitted signals. The coordinator is used to establish and manage the network.

Table I: Comparisons of existing wireless communications

Specifications	ZigBee	WiFi	WiMax	Bluetooth	Cellular
Low-cost device	✓			✓	
Less complexity	✓			✓	
Point-to-multi point connections	✓	✓	✓		✓
Direct connection to sensor/meter	✓			✓	
Low consumption	✓			✓	
Flexible for expansion	✓	✓		✓	
Encryption code	✓	✓	✓		

3. TEST RESULTS

Fig 3.1: Smart monitoring system

The smart monitoring system is designed has three functionalities and are tested in three different environments are described below:

Environment1: where the heating process is carried out in a conveyor, when the temperature exceeds the reference threshold level, then it generated a signal and it will inform to the master through the Zig-Bee wireless network. Then master take action by alerting the security with buzzer and it display the message in the LCD. DC motor is used to turn off the conveyor; this dc motor can run in both the directions.

Environment2: when no one enters the restricted area then IR transmitter/receiver will not produce any output, when a person enters to this restricted area then a signal is generated in the slave 1 and sent to the master. Master is alerted the security system with the help of buzzer.

Environment3: In the absence of external light, the lights in the industry are turned on it is indicated by the relay light in this project. When the external light (sun light) is available then LDR will send the message to the master informing to turn off the light and then lights are turned off automatically.

CONCLUSIONS

In this project has designed the smart monitoring system with three different functionalities to monitor and control the temperature of the conveyor, lighting system and intrusion detection. From the test results of these three environments it concluded that the wireless Zig-Bee communication provide the efficient smart monitoring in real time application of the industry. It then could be concluded that if it has no any variation in the reference value provided to the sensor then it will not generate any signal to turn on the buzzer, when there is any variation in the reference value of the sensor then it will send the information to the master and alert the security system with buzzer and this message is displayed in the LCD.

FUTURE ENHANCEMENT

In this project Zig-Bee wireless network communication has some drawback because of its range of communication. For long distance communication this will not provide effective solution. In future, Zig-Bee communication can be replaced by other type wireless sensor communication like radio frequency communication. Power consumption of this project is more due to separate power supply is required for each of the devices like master, slave1, slave2 this drawback can be solved in future.

REFERENCES

[1] Bo-jie-Hou,Jian-she Gao, Yun-fei Zhou, "the development of an ultra precision dual-stage based on a master slave control system" ,IEEE 2012

[2] Hsien- Wei Tseng,Yang-Han Lee , "ZigBee(2.4G) Wireless Sensor Network Application on Indoor Intrusion Detection" , 2015 International Conference on Consumer Electronics-Taiwan (ICCE-TW)

[3] Nagender Kumar Suryadevara, Student Member, IEEE, Subhas Chandra Mukhopadhyay, "WSN-Based Smart Sensors and Actuator for Power Management in Intelligent Buildings" , IEEE/ASME TRANSACTIONS ON MECHATRONICS, VOL. 20, NO. 2, APRIL 2015.

[4] Made A. Setiawan, Student Member, IEEE, Farhad Shahnia, Member, IEEE, Sumedha Rajakaruna, Member, IEEE, and Arindam Ghosh, Fellow, IEEE, "ZigBee-Based Communication System for Data Transfer Within Future Microgrids" , IEEE TRANSACTIONS ON SMART GRID, VOL. 6, NO. 5, SEPTEMBER 2015.