Research Article

ARM Based Electronic Notice Board through Zigbee with Room Lights Control using PIR Sensor

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Abstract

The importance of notice board in every academic is well known to us, every time the notices changes iteratively which have to be done manually. Also the importance of room light control is increasing day by day for same academic works. In this paper we are proposing the work using ARM 7-LPC 2138 interfaced with graphical display and Zigbee modem to overcome the above drawbacks. A single ARM 7 is used to display the various notices from HR person's computer through Zigbee modem. The LPC 2138 is also interfaced with PIR sensor which will sense the absence of human activity within the class rooms and will make the lights/ fans OFF automatically.

*Keywords: LPC 2138, Zigbee modem, PIR sensor, MAX 232, 20*4 LCD.*

1. Introduction

The increasing demand of today's scenario for various academic institutions is its automation. Every institution displays number of notices on its notice board which require the manual work. Also the problem of forgetting to switch off the class/cabin room lights and fan causes the wastage of electricity which indirectly increases the financial requirement of the institution.

To overcome the above limitations, here we are presenting a system using LPC 2138 ARM 7 controller interfaced with the Zigbee modem and graphical display. The transmitter of Zigbee is connected to the Computer which will transmit the required messages. These messages will be received using Zigbee receiver section (Nivetha S.R et al, 2013) interfaced with LPC 2138 which will display the message on Graphical display. At the same time a PIR sensor will detect the human activity within the class rooms/cabins and will turn ON/OFF automatically using LPC 2138 through relay (Ying-Wen Bai et al, 2008).

This paper provides the detail of the system proposed for the above application. In second section a proposed system is explained with its all details. In section third, the flow of algorithm for ARM 7 is explained and the result for various messages are explained in further sections.

2. Proposed System

The system shown in fig.1 is used to solve the both objective given above. LPC 2138 ARM 7 controller is acting as a heart of the system which controls the overall operation of the system. This LPC 2138 is interfaced with the Zigbee receiver and PIR sensor through relay (Scornavacca E. et al,2007,Ying-Wen Bai et al, 2008). An EEPROM is used to store the present message in case if the failure of power is occurred. A 20×4 LCD display is used to display all types of messages.
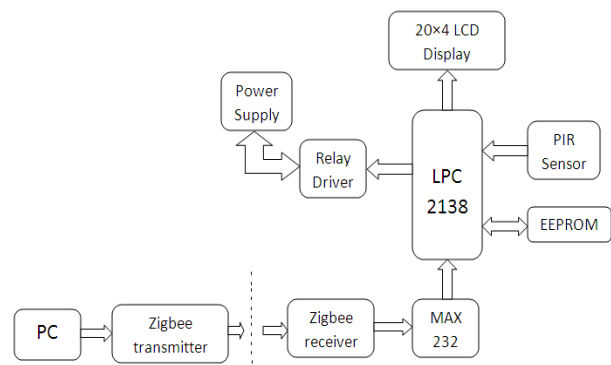

Fig.1 Block diagram for Zigbee based notice –board with Room lights/fans control using ARM controller.

2.1 LPC2138 ARM Controller

This system consists of LPC2138 processor as a heart of the system which is based on a 16/32 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support that combines the microcontroller with 32kB, 64 kB, 128 kB, 256 kB and 512 kB of embedded high speed Flash memory.

This LPC2138 interfaced with CC2430 Zigbee through MAX 232 lines. LPC 2138 accepts the input message from the PC through Zigbee and display it on 20× 4 LCD

display. A PIR sensor is used which detects the human activity within the class room/cabin and sends the information to the LPC 2138. An automatic ON/OFF of the room lights/fans get controller by LPC 2138 using Relay driver.

2.2 PIR sensor

The PIR sensor used allows us to sense the motion of human activity is shown in fig.2. If presence of human activity is detected, the lights/fan will be turn ON (Sarath M.R et al, 2011). Otherwise it will become OFF. PIR is controlled using LPC2138.

Fig.2 PIR sensor

2.3 Zigbee Modem

In this system we are using the Zigbee modem which are having the two sections i.e. transmitter section and receiver section as shown in fig.3 (Swiatkowski, M. et al,2006, Li, Xuemei et al, 2010). Transmitter section is connected to the PC which is used to send the various messages to LPC 2138 through Zigbee receiver section. The Zigbee modem used is having the range of 30m.

2.4 LCD Display

A 20*4 character LCD with black text on green background display is used as shown in fig.4. Being sufficiently wide it serves the purpose of a notice board display screen and operates at 5V DC with a duty cycle of 1/16. This LCD is interfaced with the LPC 2138 and displays the various types of messages send through Zigbee by PC.
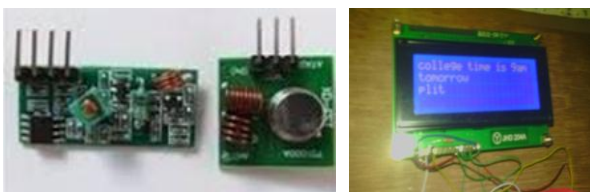
Fig.3 Zigbee modem   **Fig.4** LCD display

2.5 RS-232Protocol

RS-232 was created for one purpose, to interface between Data Terminal Equipment (DTE) and Data Communications Equipment (DCE) employing serial

binary data interchange. So as stated the DTE is the terminal or computer and the DCE is the modem or other communications device. Here, Rs232 cannot directly connect to ARM 07 hence we are connecting this by using MAX232 connector.

2.6 RELAY driver

Relays are components which allow a low-power circuit to switch a relatively high current on and off, or to control signals that must be electrically isolated from the controlling circuit itself. To make a relay operate, we have to pass a suitable pull-in and holding current (DC) through its energizing coil. In each case the coil has a resistance which will draw the right pull-in and holding currents when it is connected to that supply voltage. In our system we are using this relay interfaced with LPC 2148 and Load (lights/fans) as shown in fig.5. When the PIR sensor detects human activity, ARM 7 sends the input to Relay driver so that it will keep ON the lights/fans. If no human activity is detected, the lights/fans will turn OFF automatically (Sarath M.R et al, 2011).
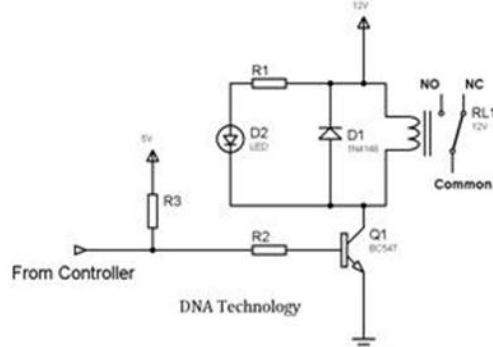
Fig.5 Relay driver

2.7 EEPROM

As the ARM07 do not have the inbuilt memory hence we are using the external memory known as EEPROM. It will save the messages in case if the power gets off, and the messages will continues to display without losing any parameter.

2.8 VB Tool

Visual Basic (VB) is a programming environment and language, which based the language on an existing version for beginning programmers, BASIC. Prior to VB, programmers wrote programs in the C or C++ programming language, which had no built-in support for accessing Windows functions. VB does have such support as part of its object-oriented programming approach. This system uses VB for writing the various notices information. The ARM7 controller gets the required information from the computer using VB.

2.9 POWER supply

The power supply is used for giving the power to the electrically controlled devices as shown in fig.6. Here we

are giving the power supply by using IC7805, rectifier circuit, and filter circuit. The pull up resistor shown is used for compatibility purpose i.e. to convert 5V to 3.3V.
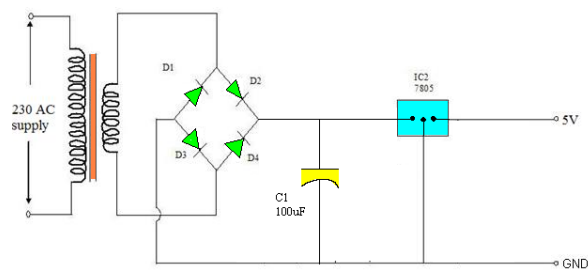

Fig.6 Power supply

3. Programming flow

Here we are using ARM7 which is the heart of system. The proposed programming flow for the above system is shown in fig7. Firstly we are initializing the all Input and output ports used for interfacing, an initialization of LCD is followed next.

The ARM7 will check first for any input from the Zigbee (Mohd Hafizuddin Bin Hasnan et al, 2009, Soyoung Hwang et al 2012). If YES, then it will observe for new message to display. In case the new messages is not observed then an old messages stored in EEPROM will be displayed. If NO, then it will check for any input from PIR sensor. The PIR sensor will detect any human activity which shows the presence of human being within the class rooms/labs/cabins, and then the lights/fans will remain ON. In case if no human activity is detected, it means no human being is present then it will automatically OFF the lights/fans.
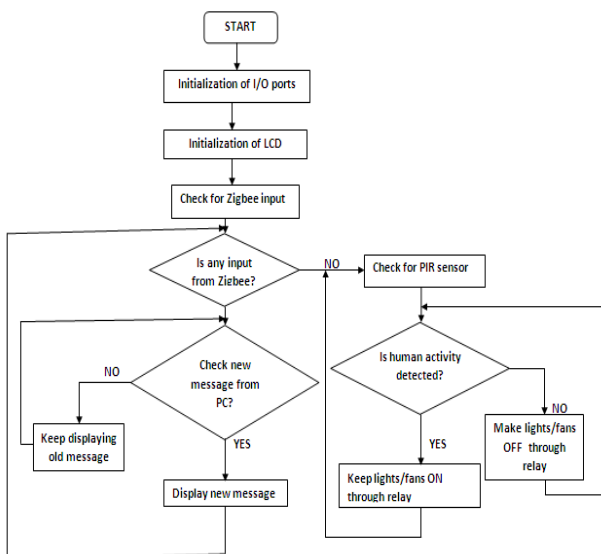

Fig.7 Flowchart of Proposed System

4. Results

For this system, we have taken number of results as shown in following figures.

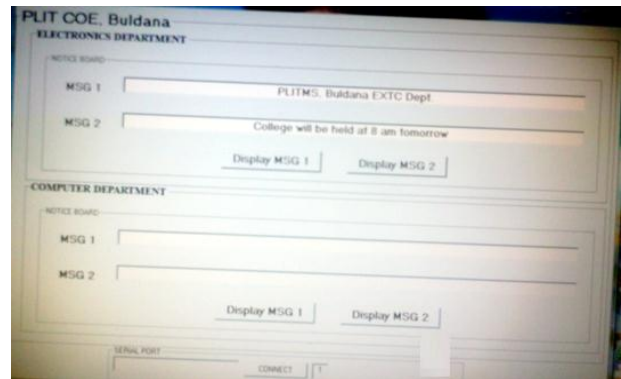

Fig 8 Overall system using LPC 2138 ARM 7 controller.

Fig.9 Window using VB tool to send the required message.
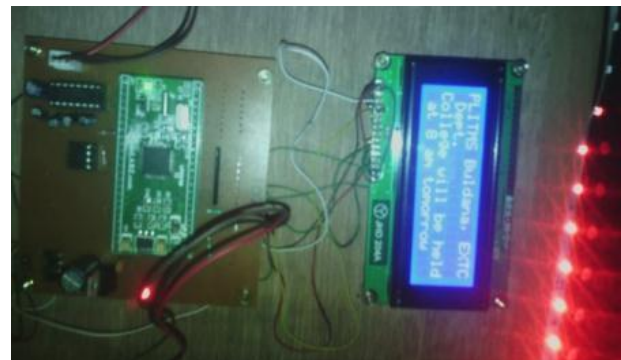

Fig.10 Graphical display showing the message received at the receiver.

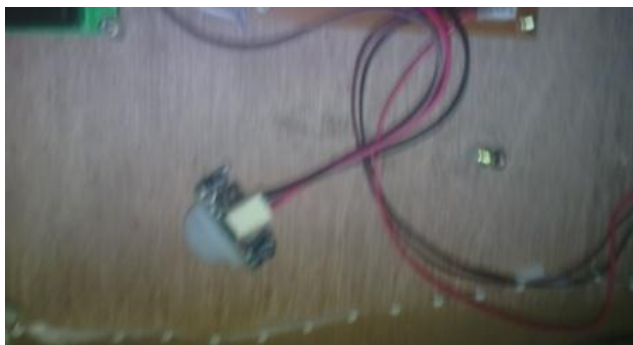**Fig.11** Automatic ON of lights when human activity is detected.

Fig.12 Automatic OFF of lights when no human activity is detected.

5. Conclusion

The development of this system minimizes basically two objectives. First one is no manual replacement of notices iteratively reduces the required man power and time. Secondly it prevents the loss of electricity due to unnecessary use of lights/fans. Thus this system can bring a wide change in academic institutions if implemented using LPC 2138 ARM 7 controller. It is easy to design and also requires very low cost. So here we have designed ARM Based Electronic Notice Board through Zigbee with Room Lights Control Using PIR Sensor which covers both above required objectives.

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