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Cold Store Remote Control Using X-BEE technology

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Abstract: The X-bee data transmission and reception module is basically used for wireless transmission and reception of data . The module use ASK technique in the transmission and reception of data. This paper focuses on using the X-bee module as a means of remote control. Therefore, it would be suitable to use this module as a tool of remote control.
Here, the X-bee is used to serve as a remote control for a cold store . The remote control system consists of two X-bee modules , two microcontrollers connected to each module , a personal computer (PC) , a cold store, and a designed circuit. The (PC) is used to develop a program in order to download it in the microcontroller . One X-bee module serves as a remote control, while the other is used to receive commands from the first one. When a command is received the microcontroller in the reception site decodes the command. The decoded command is used to control the operations in the cold store . This remote control system can be used for any electronic or electrical device to operate it from anywhere using the X-bee technology.

Keywords: *control system, remote control ,PC , X-bee , ASK , cold store.*

INTRODUCTION

Remote control is the process of using data (or information) in such a way that it can be used for activation or deactivation of electronic and electrical devices. Here, cold stores are considered to be remotely controlled . Implementing a hardware model comprises of using Microcontrollers, two wireless X-Bee modules, a computer and Bascom language for programming the microcontrollers .The control process can be carried out inside the system or remotely. The remote control process can be easily classified into:
First : wired control that uses compatible media such as metallic cable or fiber optics. Second : wireless remote control that uses Infra-Red (IR) technology, Ultrasonic (for short ranges) , and cellular mobile or internet technologies for long ranges.This approach of remote control process improves the control system for better operation and performance to meet thet requirements within reasonable limit of low economical cost and effective impact.
The system design adopts two factors .The first factor is based on making the hardware design simple .The second factor is based on making the system user friendly.

APPROACH

First of all, it is necessary to analyze the system operation. According to the analysis procedures, the system operations can be transformed from local mode of operation into remote mode of operation. The designed circuit for remote mode must perform the same operations conducted in the cold store in the local mode of operation . The only difference is that the operations are executed remotely by using the ASK technology . The sequence of operations to be performed in the cold store remotely are :

- Control of the power supply activation .
- Compressor operation.
- Thirty seconds delay.
- Evaporator operation.

Figure (1) below shows the block diagram for the cold store remote control system by using X-Bee transmitter / receiver modules.

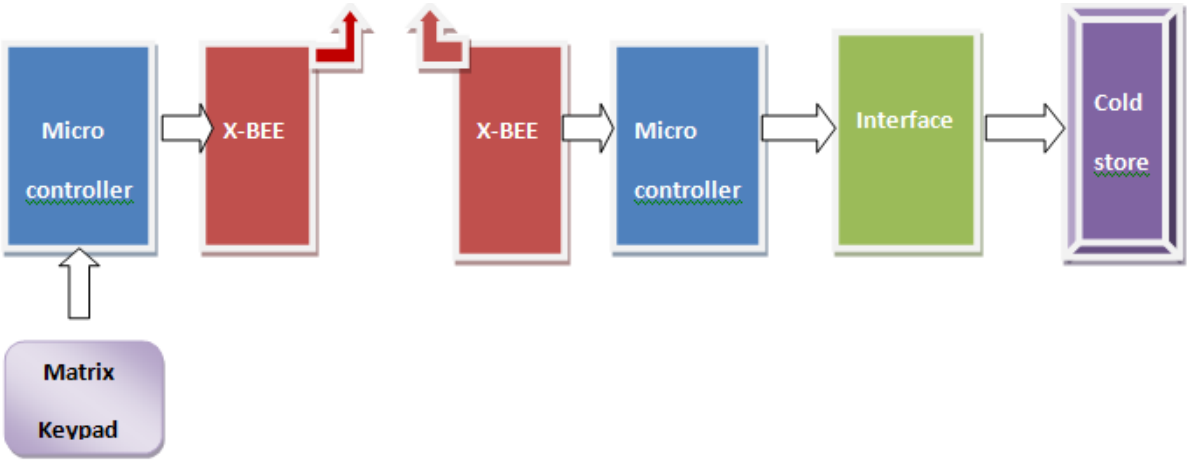

Figure (1) block diagram of the remote control system

The remote shut down sequence is just the opposite of the remote operation sequence.

SYSTEM COMPONENTS

The system components in the design contains two parts. The first part is the hardware and the second part is the software. The details of the hardware and the software are:

A . HARDWARE :

The hardware components for the design are :

Microcontrollers:

Microcontrollers are frequently used devices in embedded electronic systems in which the applications varies from computing, calculating, smart decision-making capabilities, and processing the data. Most of the electrical/electronic device, sensors and high-tech gadget can be easily interfaced and interact with microcontrollers to automate a system structure. For this research Atmega microcontrollers are used.

The Atmega32 microcontroller has a 40-pin Dual Inline Package (DIP) used for I/O interface. Each pin can source (supply) a maximum current of 40mA and sink (draw) a maximum current of 50mA. A range of 5 to 15 direct current (VDC) power supply is sufficient to turn on the microcontroller , because a voltage regulator is embedded inside it, provides a steady 5VDC supply to it such that the high voltage will not damage the IC. The microcontroller has 2KByte memory It is programmed by using Bascom language. The user-define program is downloaded into the memory from a PC through a DB-25 parallel cable connection between the PC and the microcontroller.

X-Bee:

X-Bee module is a device used to communicate via wireless network, it utilizes the IEEE 802.15.4 protocol which implements the entire features list below as to ensure data delivery and integrity:

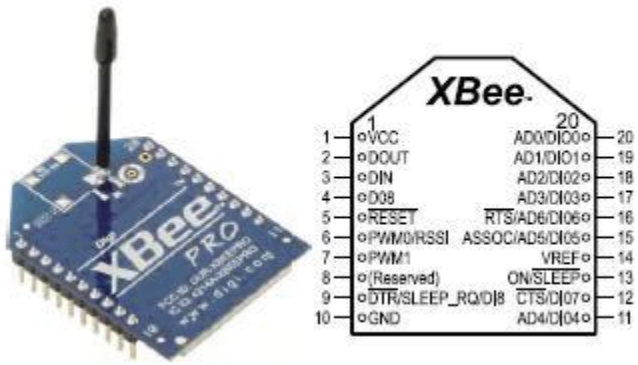

Figure (2) X-Bee Pro modules and Pin outs

Computer:

To program the microcontroller , an IBM PC or compatible computer system is used.

HD74LS373 Latching IC:

The HD74LS373 is eight bit is register IO mapped used as a buffer which stores signals . Different types of latches are available HD74LS373 octal D-type transparent latch will be used in this system. This type of latch is suitable for driving high capacitive and impedance loads.

ULN 2803 Darlington IC:

The ULN2803A is a high-voltage, high-current Darlington transistor array. The device consists of eight NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of each Darlington pair is 500 mA. The Darlington pairs may be connected in parallel for higher current capability.

- cold store :

The cold store is a chamber used for storage of food products. It is supplied with a manual control panel. [1]

3×4 matrix keypad:

This device is used to enter commands to the microcontroller for the different phases of operations of the cold store. Figure (4) shows the twelve keys matrix keypad.

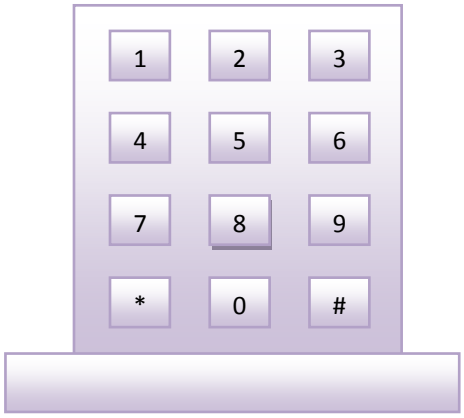

Figure (4) twelve keys matrix keypad.

D-25 Connector:

This component is used to interface the computer to the electronic circuit. The D25 connecter is used to connect the microcontroller to the computer parallel port for programming. Figure(5) shows the pin outs of the female D-25 connecter.

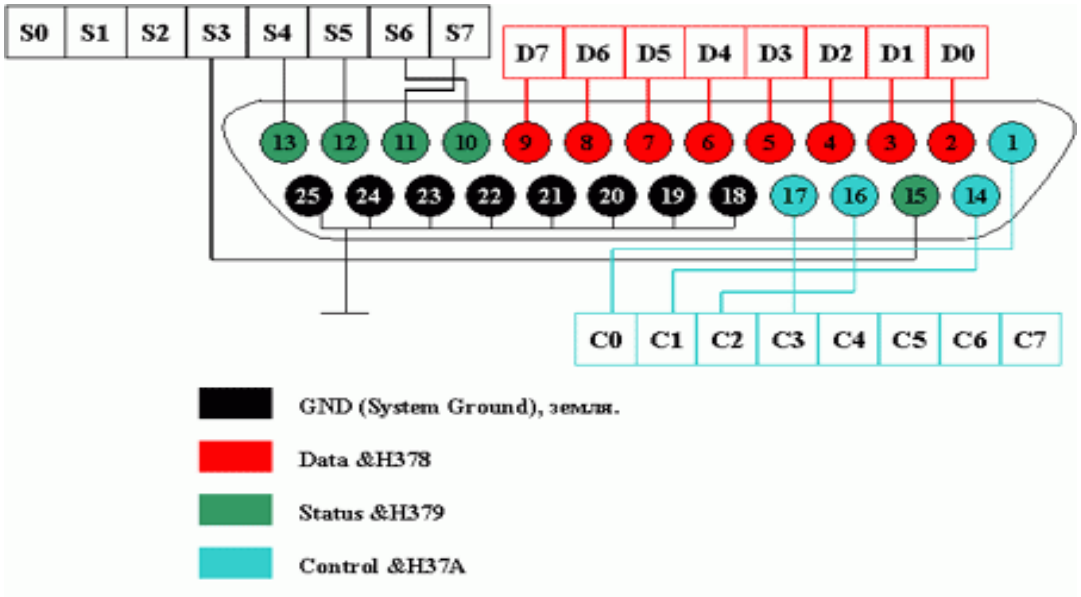

Figure (5) The female D-25 connecter

Lab link cable:

The lab link cable is used to connect the computer to the microcontroller for downloading the (.hex) file into the microcontroller.

B. SOFTWARE:

The software used is Bascom language . The downloading software is (Pony Prog) program.

ALGORITHM

The proposed computer algorithm includes a strict sequence of steps for the operation of the cold store . Similarly a reverse steps are to be conducted to shut down the cold store . Pressing key (0) initializes the system and clears all outputs. Pressing key (1) puts the system into operation remotely. Pressing key (2) shuts down the system remotely. Pressing key (*) ends the program. Equations (1) and (2) indicate the ON and OFF operations of the cold store .

(Cold Store) ON = Σ (power)ON + (Compressor)ON + (Evaporator)ON …….. (1)
(Cold Store) OFF = Σ (Evaporator)OFF + (Compressor)OFF + (power)OFF …… (2)

The algorithm for the execution of the ON and shut down operations of the cold store is :

Start
Authorization:
--- Enter authorization code from the keypad.
--- If the cod is correct , then go to system operation.
---If the cod is incorrect , then access is denied and go to end of the program.
System operation:
--- If the (key pressed = 0) , then clear all outputs of the system.
--- If the (key pressed = 1) , then activate the power supply of the cold store, activate the processor of the cold store , generate a thirty secinds delay . activate the evaporator of the cold store .
--- If the (key pressed = 2), then put off the evaporator of the cold store , put off the processor of the cold s**tore,** put off the power supply of the cold s**tore.**
--- If the (key pressed = *), then go to end of the program.
--- Go to system operation.
End.

RESULTS

Table (1) below shows the results of control commands in the system with the corresponding devices.

Table (1) System commands and their correspondent action on the devices

Pressed key	Command	Device	Result
0	**initialization**	Clear all outputs	**System is ready to operate**
1	**PUT ON the cold store remotely**	Power supply ON. Compressor ON. Delay (30 sec.). Evaporator ON.	**The system is in operation**
2	**Shut down the cold store remotely**	Evaporator OFF. Compressor OFF. Deactivate power.	**The system is shut down**
*****	**End of the program**	----------	**Termination of the system operation.**

CONCLUSION

A remote control is useful for the cold stores operations. The designed circuit makes use of the transmitted commands and hence it can be used for the remote control of the cold store .

Security is essential to ensure that the system is accessible by the authorized personnel only. The microcontroller accepts the programmed code to operate the system. Non authorized codes to the system will be denied and the system does not respond to the commands.

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