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Home Automation using Power Line Carrier

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Abstract—*With the definition of power line communication technology ,there has been considerable research in power line communication worldwide. By using Direct sequence spread spectrum modulation bidirection transmission and reciver is highly suitable for home automation as data communication over PLCC power line carrier communication eliminate the need of costlier zig-bee public radio.*
For demonstration consider the application of data communication over PLCC in control domain by making a prototype which is control four device and can read sensor data to central hub. Implementation of addressable DSSS Direct sequence spread spectrum protocol for data communication over power line in household environment.

Keywords*: Direct sequence spread spectrum, plcc module , printed circuit board, microcontroller with A/D converter.*

1. INTRODUCTION

This paper consider the home automation using power line carrier data can be transmit over direct sequence spread spectrum modulation technique.

Basically radio spectrum is highly consisted and there are very few free channel available. Although some frequency are freely available in ISM.Such as 433Mhz & 2.4Ghz but with the advent of wireless device and protocol such as wi-fi , bluethoot, zig-bee the spectrum for these frequency is already ighly consisted. Radio signal cannot be confined easily so they possessva higher sequirity threats. .Data Communication using PLCC is in a preliminary phase in the growing bandwidth concerned market used of older technique such as FSK , ASK for PLCC is in probable. However some spread spectrum devices are available but all of them some or significant drawback.

By using Direct sequence spread spectrum modulation bidirection transmission and reciver is highly suitable for home automation as data communication over PLCC power line carrier communication eliminate the need of costlier zig-bee public radio.

Implementation of addressable DSSS Direct sequence spread spectrum protocol for data communication over power line in household environment.

2. WORKING

This circuit contains PC on one side and microcontroller based relay switching drives on another side. We send the data using program prepared in Visual Basic (VB) through serial port. This serial port is connected to PLM. This PLM is assigned supply of 230v mains. On the receiver side, same circuit is connected to power line on the same phase. This circuit receives data from the PC attached with the circuit which is connected to PIC microcontroller. Whenever it gets data (for ex) A, microcontroller reads the data and ON the first relay. When it gets B, 1st relay becomes OFF. When it gets D, the second relay becomes OFF. Thus this process is carried out. Visual Basic contains the program of scheduling and manual switching operation. As this program starts, some atomization functions starts performing for the atomization industry. The PC side circuit is connected to MAX 232 for the voltage. shifting. On the other side of microcontroller, relay driver is connected to relay circuit.

First, we prepare the program for microcontroller serial baud rate i.e. 600 bits/sec. This program is also applicable for PC side. Then serial values come to microcontroller. This microcontroller reads the value and compare it whether these are A, B, C or D. When it finds equal, particular task i.e. relay ON/OFF is carried out.

2.1 Processing gain:

To achieve most of the claims made for the spread spectrum it is necessary that the bandwidth over which the message is spread be very much greater than the bandwidth of the message itself. Each DSBSC of the DSSS signal is at a level below the noise, but each is processed by the synchronous demodulator to give a 3 dB SNR improvement. The total improvement is proportional to the number of individual DSBSC components. In fact the *processing gain* of the system is equal to the ratio of DSSS bandwidth to message bandwidth.

2.2 A DSSS generator:

To generate a spread spectrum signal one requires

1. A modulated signal somewhere in the RF spectrum

2. A PN sequence to spread it

There are two bandwidths involved here: that of the modulated signal, and the spreading sequence. The first will be very much less than the second. The output spread spectrum signal will be spread either side of the original RF carrier (ω_0) by an amount equal to the bandwidth of the PN sequence.

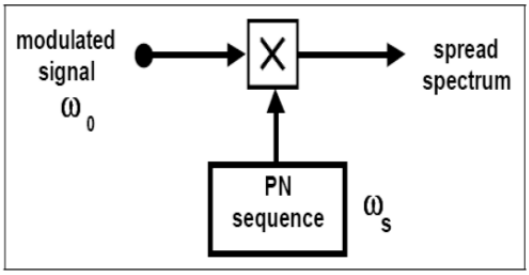


Figure 1: basis of spread spectrum

Most of the energy of the sequence will lie in the range DC to ω_s, where ω_s is the sequence clock. The longer the sequence the more spectral components will lie in this range. It is necessary and usual that $\omega_0 >> \omega_s$, although in the experiment to follow the difference will not be large

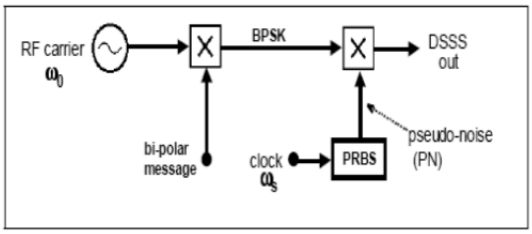
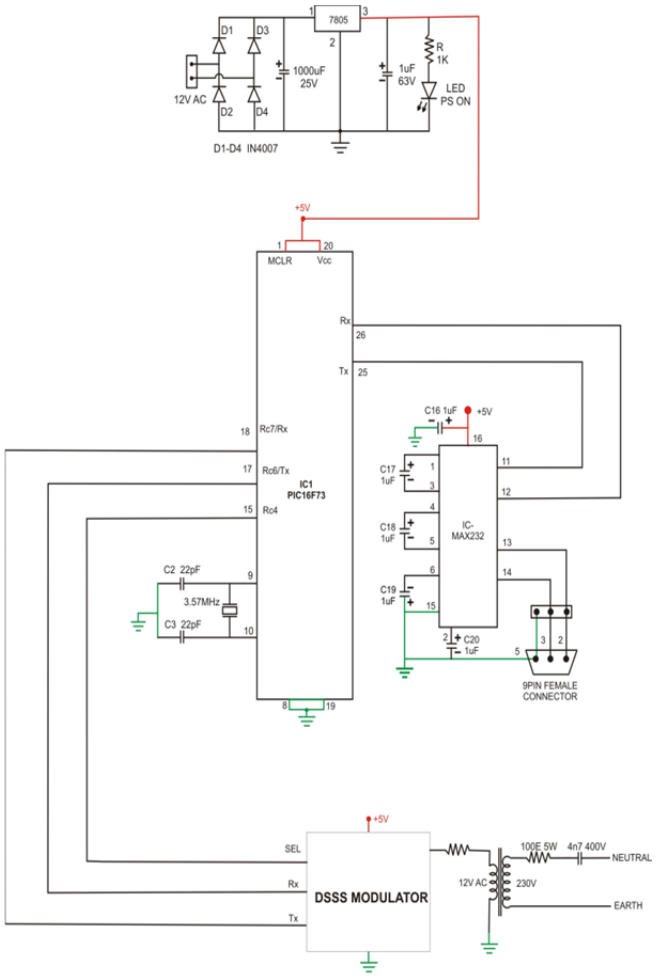


Figure 2: a spread BPSK signal

The modulated signal can be of any type, but typically digitally-derived, such as binary phase shift keyed - BPSK. In this case the arrangement of Figure 1 can be expanded to that of Figure 2.

A digital message is preferred in an operational spread spectrum system, since it makes the task of the eavesdropper even more difficult The arrangement of Figure 2 can be simplified by noting that, if the clock of the bipolar message is a sub-multiple of the clock of the PN sequence, then the module two sum of the message and the PN sequence can be used to multiply the RF carrier, generating a DSSS signal with a single multiplier. Such a simplification will not be implemented in this experiment.

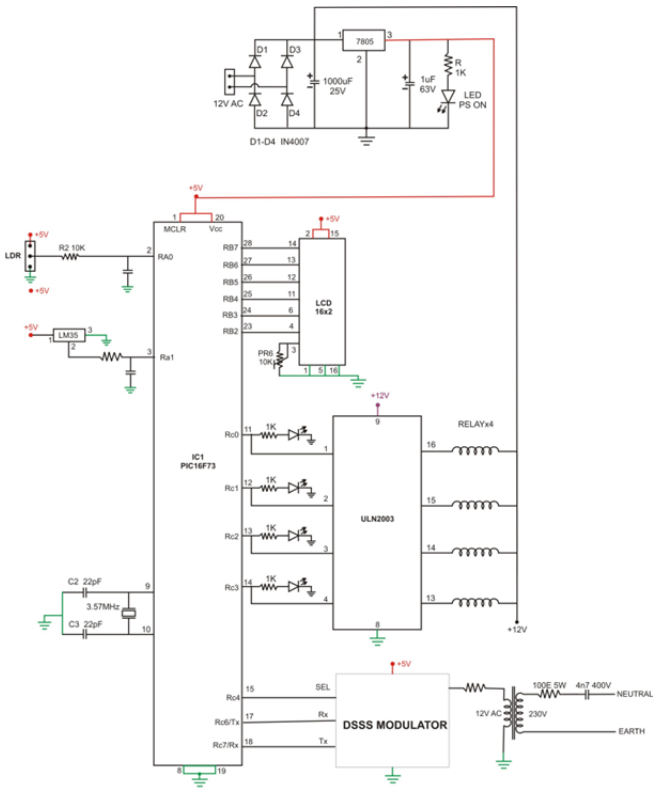
3. CIRCUIT DIAGRAM: -



CIRCUIT DIAGRAM OF DSSS PLCC FOR HOME AUTOMATION - HUB

4. PROBLEM FORMULATION:

- Radio signal cannot be confined easily so they possess a higher security threats.
- Radio signal suffer from unknown and unpredictable adjacent channel interference.
- Radio spectrum is highly congested and there are few free channels available .Although some frequency are freely available in ISM. Such as 433Mhz &2.4GHz but with adjacent of wireless device and protocol such as wi-fi,Bluetooth and zig-bee the spectrum for these frequency is highly congested.



CIRCUIT DIAGRAM OF DSSS PLCC FOR HOME AUTOMATION - NODE 'X'

5. APPLICATIONS:-

- Home & Industrial Automation.
- Automatic Meter Reading.
- Lighting Control.
- Status Monitoring and Control.
- Low Speed Data Communication Networks.
- Intelligent Buildings.
- Power Distribution Management.

6. CONCLUSION

The concept of Direct sequence spread spectrum was proven to be a solution of the communication ver electric power lines in bidirection.Power line communication is not so powered because of less inventions due to that cost required to design transceiver at each station is very high. So, in future improvement include the implementation of closed loop feedback system on one or more control channel and our system enable automatic logging ,schedule control capability and schedule data recording facility.

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