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Rf Secure Coded Communications System

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Abstract

With the increasing challenge of making communication more and more secure, it is now essential that some extensive research needs to be done in this area for the safety and privacy of personal information which can guarantee high data transfer rate as well as security for the data. In this project, various low cost alternatives are explored which can be easily implemented on a small scale and after few improvements can be also used for large networks. The data is sent at a particular frequency(unconventional) or unknown to general people, which is then encrypted in between by encoder .Then the data is decrypted by decoder and received by receiver in that band limited range. The security of the data is increased by changing the pattern of the encoder accordingly with decoder(keeping both of them in sync) which is hardwired at both the ends. The project can further be improved by using GSM technique in place of RF communication technique for larger networks.

Keywords: RF Communication, Encryption, Decryption, GSM.

Introduction

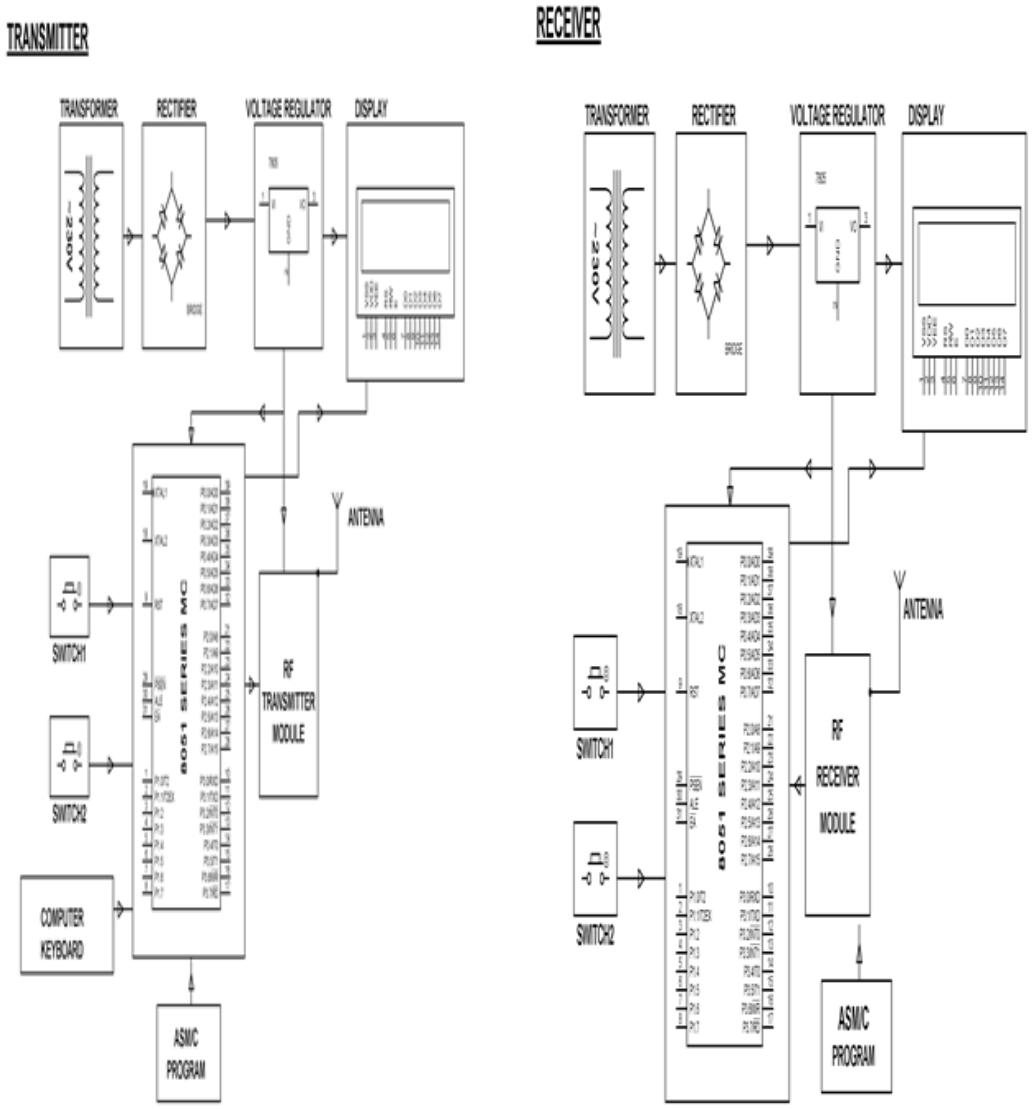
The project is designed to send secured message by using a secret code from a keypad connected to the transmitting unit via RF technology. The message is retrieved at the receiver end only upon entering the secret code used by the transmitter. Thus, complete secrecy is maintained in this communication process. Encoder and Decoder are used for increasing the security of data. For example in military operations, secrecy is of paramount importance. So , when there is a need for sending any secret message, one can type the message through a computer keyboard interfaced with the system comprising of a 8051 family microcontroller and a RF transmitting module This project has a unique feature of tagging the message with a secret code as selected by the sender. The message is then transmitted through the RF transmitting module. At the receiver end the signal is received by the RF receiver module. The message is

then retrieved only if the secret code is known to the receiving personnel. Once the secret code is entered, then message is displayed on the receiving unit on the LCD (Liquid Crystal Display) display. The pattern of the encoder can be modified to increase the security of the data. The same pattern is used by decoder to decrypt the data and hence obtain the useful message. There is certain limit specified up-to which if wrong secret code is entered the receiver end will lose its received data, thus making it irretrievable. The project can be extended by using GSM in place of RF communication technique .It will also increase the range of RF communication technique immensely. The communication technique can also be made bidirectional.

Working

As the project consist of two parts, one being the transmitter and other being the receiver connected wirelessly through the RF transceiver module. On the transmitter end LCD and keypad are interfaced along with the encoder and RF transmitter, microcontroller recognizes the key pressed and sends it to the encoder nibble by nibble serially with the max data rate supported by the receiver module. At first the higher nibble is sent followed by the lower nibble. The encoder then serializes the data along with its address pins total of which becomes 12 bits of data and latched to its data out pin serially which is connected to the data input pin of the RF transmitter. RF transmitter then transmits the data serially in the wireless medium with the carrier frequency 434MHz. The transmitted data is then received by the RF receiver and its data out pin sends the data serially towards the decoder which at first checks for the validity of the data and if the data is valid then the VT pin of the decoder goes high indicating the same where a LED can be connected to check visually if data transfer is being done or not.

Further the data is read from the four data pins of the decoder that is nibble by nibble. The nibbles are combined to a byte to convert the data in its original form and proper action is then taken by microcontroller. Upon reception of a valid incoming data the microcontroller prompts for the secret code known to only a genuine receiver of the data. As soon as user enters the secret code, the data starts to flow in and is displayed on the LCD, extra data is buffered into the additional flash memory. So, this also puts a limitation to the receiver end that how much amount of data it can keep receiving until the memory runs out. This limitation can be avoided by using microcontroller with 16 or 32-bit data pointer and using a larger flash storage for the data.



Construction and Working of Circuit

Step-Down Transformer

Since,
N1/N2 = V1/V2
N1/N2 = I2/I1
So for V2 to be lower than V1,
N2 should be lower than N1.
Thus, if N1 is higher than N2, I2 would be lower.

Rectifier

A rectifier is an electrical circuit that converts alternating current (AC) to direct current (DC), which flows in only one direction. The process is known as rectification.

Keypad Interfacing

4x4 matrix keypad is used which is programmed to print all the alphabets of English and 0-9 digits with some more extra symbols. Each key of the keypad is assigned four characters for printing and a proper algorithm is used to mimic the working of the keypad somewhat similar to a mobile phone keypad.

The algorithm is based upon the wise use of delay after any key is pressed. A specific amount of time is fixed as delay according to which if the amount of delay fixes which character to print after a specific amount of time has passed.

LCD Interfacing

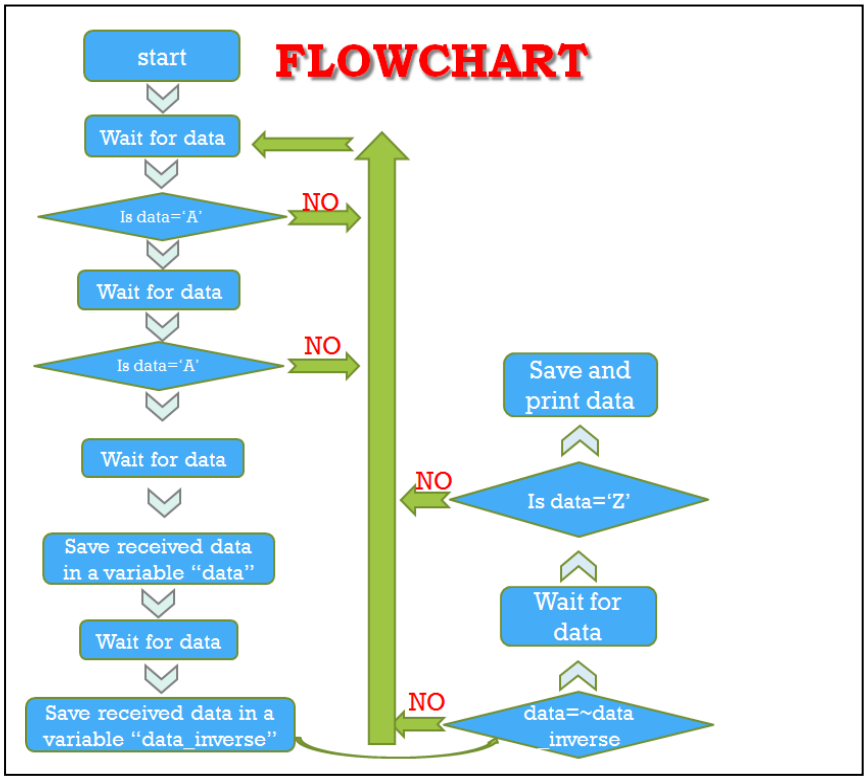
If RS=0, the instruction command code is selected which is used to send a command such as clear display. If RS=1, the data register is selected allowing the user to send data to be displayed on the LCD . R/W=1, when reading, R/W =0, when writing. When data is supplied to data pins , a high-to-low pulse must be applied to the pin in order for the LCD to latch in the data present at the data pins .This pulse must be a minimum of 450 ns wide . The 8-bit data pins ,D0-D7 are used to send information to the LCD or read the contents of the LCD's internal registers . When D7=0, the LCD is ready to receive new information. To read the command register we make R/W=1 and RS=0 , and a L-to-H pulse . E line is negative-edge triggered for the write while it is positive-edge triggered for the read operation.

Here, we are using 4 bit format for the programming of LCD Display as it will help to save the precious pins of microcontroller. DD RAM (Display Data Random Access Memory) corresponds to the cursor address. CGRAM (Character Generator Random Access Memory) is used to write the data to each pixel of the LCD individually.

RF Module

Wide range, from few meters to millions of kilometers. Does not requires two devices to be in line of sight. Can cross many obstacles. Circuits can be complicated and costly. Widely used, including Bluetooth, Radios, Cell phones, Satellite etc. When the TX unit is switched off or not transmitting data, it is said the "data out" of RX will be oscillating high and low and as this is connected to RX of MCU's USART, the MCU#2 will be receiving garbage data. And when TX unit will send some data, MCU#2 will also be receiving them. So MCU #2 is always receiving data, even when MCU#1 is not sending anything. So there must be a mechanism to differentiate real data with garbage data. Shown below is a simple algorithm that we used.

Algorithm Flowchart



ConclusionThe implementation of RF secure communication presented in this paper showed that how we can easily implement low cost but highly secure communication link. Though it has several limitations but they can be overcome easily by using complex protocols and bidirectional RF transceiver. MAC protocol implementation will make this communication system even more impressive by providing a reliable as well as secure connection 24x7.

Implementation of energy saving protocols can make it mobile as well with a long active time without the need of re-charging. Instead of using a fixed bandwidth, spread spectrum technique can be used to improve the security of the data even further.

Here, we had used a simple 8051 microcontroller which can be replaced with a low power microcontroller to improve the performance.

References

[1] MUHAMMAD ALI MAZIDI AND JANICE GILLISPIE MAZIDI "8051 micro controller and embedded systems".