RF BASED INFORMATION ANNOUNCEMENT SYSTEM USING PIC MICROCONTROLLER

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Abstract - The Radio Frequency Module is basically a PIC Microcontroller Based Wireless announcement System. Wireless RF Module Technology enables a vast edge to any electronics project & provide many consistent advantages, which leads it to today's up-to-date technology. An RF module is a small electronic circuit used to transmit, receive, or transceiver radio waves on one of a number of carrier frequencies. RF modules are widely used in consumer applications such as garage door openers, wireless alarm systems, industrial remote controls, smart sensor applications and wireless home automation systems. They are often used instead of infrared remote controls as they have the advantage of not requiring a line-of-sight operation. Radio Frequency involves two subunits named, Transmitter & Receiver. As their name implies transmitter is used to transmit or to send the data from input & it converts into serial port data by using HT12E encoder. This encoded data get received by receiver placing far away from it. The first job that a receiver do after receiving it, Is to convert or decode the data into parallel ports by using HT12D decoder. After converting the data into the parallel form we simply connect the receiver side circuit with a relay so that we can operate AC devices with RF Module. Today's one of the vast & leading technology Named RFID is based on this principle of RF module. The wireless mouse also works on the same principle.

Keywords- Radio Frequency, Announcement System, PIC, Microcontroller

Introduction

Radio Frequency (RF) is a rate of oscillation in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals. It is the use of radio signals to communicate real-time data from the warehouse floor to the WMS database and back to the floor. This expedites processing in the warehouse. Scanners collect the data and transmit it via radio frequency to antennas located throughout the warehouse. From the antennas, the signal proceeds to an access point that communicates with the warehouse management system. This process reduces paper, data entry time delays, cycle count processing, out of stock quantities, typing errors, and mis-shipments. An RF Module is a (usually) small electronic circuit used to transmit, receive, or transceiver radio waves on one of a number of carrier frequencies. RF Modules are widely used in consumer application such as garage door openers, wireless alarm systems, industrial remote controls, smart sensor applications, and wireless home automation systems. They are often used instead of infrared remote controls as they have the advantage of not requiring line-of-sight operation.

Statement of Problem

1. As with any other radio-frequency device, the performance of an RF Module will depend on a number of factors. For example, by increasing the transmitter power, a larger communication distance will be achieved. However, this will also result in a higher electrical power drain on the transmitter device, which will cause a shorter operating life for battery-powered devices.

2. Also, using a higher transmit power will make the system more prone to interference with other RF devices, and may in fact possibly cause the device to become illegal depending on the jurisdiction.

Design

PCB stands for "PRINTED CIRCUIT BOARD". The printed circuit board (PCB) provides both the physical structure for mounting and holding the components as well as the electrical interconnection between the components. That means a PCB or PWB (printed wiring board) is the platform upon which electronic components such as integrated circuit chips and other components are mounted. A PCB consists of a non-conducting substrate (typical fibreglass with epoxy as resin) upon which the conductive pattern or circuitry is formed. Copper is the most prevalent conductor although nickel, silver and tin are also used in some cases.

Types of PCB PCB may be of different types:- 1) Single-sided 2) Double-sided 3) Multilayer

Single-sided PCBs: - As the name suggests in these designs the conductive pattern is only at in one side. And also the size is large in this case but these are cheap. Double-sided PCBs:-These are the PCBs on which the conductive pattern is in on both sides. The size of the board is small in this case but it is costlier than that of above. Multilayer PCBs:- In this case, the board consists of alternating layers of conducting pattern and insulating material. The conductive material is connected across the layers through plated Through holes.

The size of this PCB is smaller than that of double-sided PCB but it is very costly. PCBs may also be either rigid, flexible, or the combination of two (rigid-flex). When the electronic components have been mounted on the PCB, the combination of PCB and components is an electronic assembly, also called PRINTED CIRCUIT ASSEMBLY. This assembly is the basic building block for all the electronic appliances such as television, computer and other goods.

Techniques Used For PCB Designing

There mainly two techniques which are used for the PCB designs.

1. Hand Taping

2. Computer-Aided Design

- PCBs using Hand Taping
- PCB design using hand taping is the process of technical drawing.
- In hand taping, method layout should be prepared on grid paper.
- In hand taping, components pads can be prepared by using black pads.
- Routing of the board can be done by tapes with different widths.
- Each layer (top, bottom) has to prepare separately.

Disadvantages of Hand-Taping For PCB Designing

- Each layer has to be designed separately.
- We cannot generate NCD files for CNC drilling.
- Difficult to modify the design in the designing process or after designing.
- Difficult to get good design overview.

PCB Designing Using CAD

All the above difficulties can be removed by using the CAB system.

CAD system for PCB designing requires the following:

- A computer system.
- PCB design software like OrCad, CADSTAR, Protel, TANGO, Mentor etc.
- A photo plotter for art work generation.

There are many enhanced features in electronics design automation tools which not possible in the hand taping.

The Main Advantages Are Given Below

- Auto placement
- Auto routing
- After routing, optimization of tracks can be done.
- Provides physical design reuse modules
- Electrical rule check (ERC)

- All the layers are generated from the same design by giving different options.
- Bill of material can be generated which contains number of different components used.
- We can draw conductors as an arc, semi-circular at different angles.
- Design Rule Check
- Advanced CAD systems have high speed analysis.
- CAD system provides all NCD files and Gerber data files for photo plotting

Working of RF Module

As with any other radio-frequency device, the performance of an RF Module will depend on a number of factors. For example, by increasing the transmitter power, a larger communication distance will be achieved. However, this will also result in a higher electrical power drain on the transmitter device, which will cause a shorter operating life for battery-powered devices. Also, using a higher transmit power will make the system more prone to interference with other RF devices, and may in fact possibly cause the device to become illegal depending on the jurisdiction. Correspondingly, increasing the receiver sensitivity will also increase the effective communication range, but will also potentially cause malfunction due to interference with other RF devices. The frequency of RF is shown in the Table 1.

Table 1: Frequencies Table of RF

Frequency	Wavelength	Designation	Abbreviation[2]
3 – 30 Hz	10^4 – 10^5 km	Extremely low frequency	ELF
30 – 300 Hz	10^3 – 10^4 km	Super low frequency	SLF
300 – 3000 Hz	100 – 10^3 km	Ultra low frequency	ULF
3 – 30 kHz	10 – 100 km	Very low frequency	VLF
30 – 300 kHz	1 – 10 km	Low frequency	LF
300 kHz – 3 MHz	100 m – 1 km	Medium frequency	MF
3 – 30 MHz	10 – 100 m	High frequency	HF
30 – 300 MHz	1 – 10 m	Very high frequency	VHF
300 MHz – 3 GHz	10 cm – 1 m	Ultra high frequency	UHF
3 – 30 GHz	1 – 10 cm	Super high frequency	SHF
30 – 300 GHz	1 mm – 1 cm	Extremely high frequency	EHF

RF Module interfacing with PIC

The term wireless is very much hyped! Whenever we hear the term wireless, stuffs like Mobile telecommunication (GSM), Wi-Fi, Bluetooth, RF Communication, Wireless networks, Zigbee, I2C, SPI, DTMF, 802.11b, simplicity etc etc etc. Well, fortunately, or unfortunately, all of these protocols can be interfaced with a microcontroller in one way or the other. But what matters is the level of complexity. To start off, RF (Radio Frequency) Communication is the most preferred and low-cost solution. All we need is an RF Module (Transmitter-Receiver Pair). Now, that's not all. RF Communication works on the principle of Serial Communication. Thus, we need which converts the conventional n-bit (4-bit, 8-bit, 16-bit, etc) data into serial data.

For this, we have two choices:

- Use a microcontroller to convert the n-bit data into serial data and vice versa
- Use serial encoders/decoders to do the same.

But, If We Use the Both Then It Would Be More Innovative & Impressive As We'll Be Able To Get The Output On L.C.D As Well. For L.C.D Interfacing With Encoder/Decode & Serial Ports, We Strongly Need a Microcontroller, Which In Our article is PIC 16F73.

Results & Conclusion

Circuit Implementation

Four switches S1, S2, S3 and S4 to give 4-bit parallel data (D0-D3). Since the switches are in active low state (i.e. low signal is sent when the switch is pressed), we need to add external pull-up resistors as shown, so as to provide a high signal by default. A resistance as high as 1M ohm is required in between OSC1 and OSC2 pins. The Transmitter Enable (TE, pin 14) pin is an active low pin. Thus, it is permanently grounded, so as to enable the transistor always. The output serial data DOUT is fed to the RF Transmitter Module directly. The most important thing lies in the address pins (A0-A7, pin1-8). Suppose we have two wireless devices (A and B) in our house, both have different remote controls (AA and BB) and both implement the same type of RF module (say 433 MHz). AA is the remote control of A and BB is of B. Now, we obviously wouldn't want AA to control. This is where address pins come into play. There are 8 address pins, thus giving us an opportunity to have 8! (8 factorial) different and independent ways to connect to a device, so that there is no interference. The address pins MUST have the same address in both transmitter and receiver, or else the data won't be transferred. Refer to the receiver circuit for more details. Fig 1 and Fig.2 depicts the results.

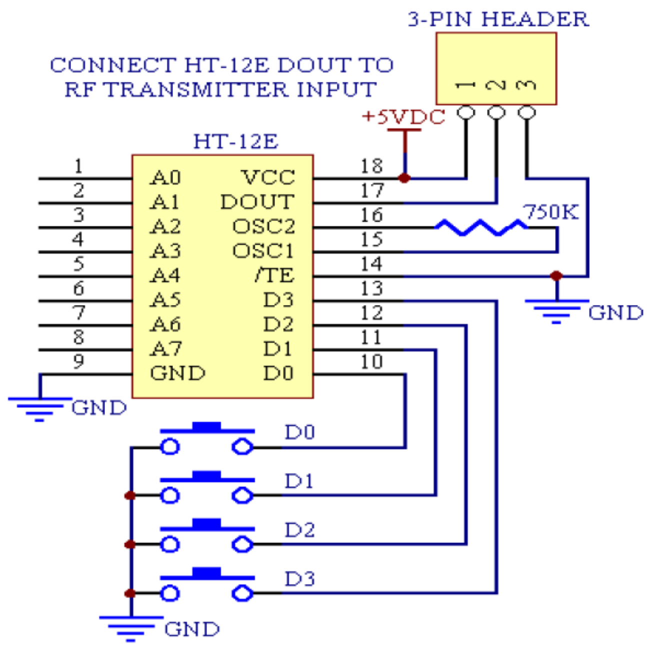

Fig.1 Transmitter Section

The circuit of the receiver is also quite simple. Capacitor C1 is used between Vcc and GND for noise filtering. Apart from that, all the address pins (A0-A7, pin 1-8) are grounded, just as in transmitter. This is to ensure that the transmitted data is being received. Both the transmitter and the receiver MUST have the same address pins configuration. Pin 17 (VT) is enabled whenever the receiver receives any data. The serial data received by the RF Receiver module is directly fed to pin 14 (DIN), which is then converted into 4-bit parallel data (D0-D3). A 33k ohm resistor is connected in between OSC1 and OSC2.

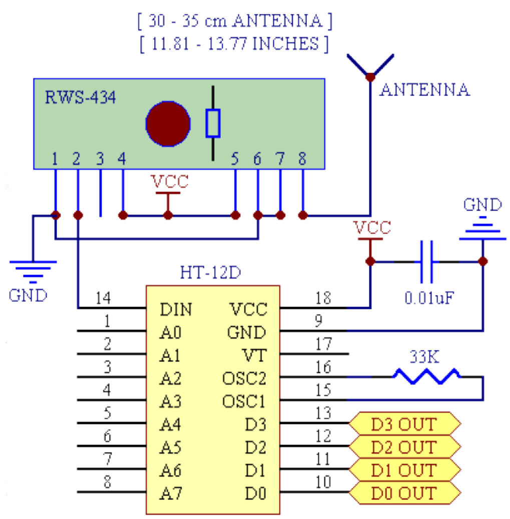

Fig. 2 Receiver Section

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