Remote Controlled Android Using RF

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ABSTRACT

Through our paper we can control the robot by using wireless communication i.e. from Control section (acts as transmitter) we are sending the control signals, then the robot receives (acts as receiver) the signals, according to the signals being received the direction of the robot is controlled. This designed around a Microcontroller which forms the control unit. According to this, an RF transmitter is used to transmit the control signals, which controls the direction of the robot and its operating frequency is 434 MHz (free band frequency). Range of RF module is 10 to 20 meters. By using 2.4 GHz we can access RF technology and it is called as ‘zigbee’. In the same way, RF receiver which is placed on the robot receives the RF signals according to which the direction of the robot is controlled. In this we will be having two motor’s, to control the motor’s we use two H-bridge circuits each H-bridge circuit will control one motor. The microcontroller plays important role in controlling the direction according to RF signals being received at the Receiver side i.e. Robot section. We can do any robotic applications and find its place in place where one wants to control the direction of any automated device using wireless communication.

Keywords: RF technology, H-bridge, Zigbee.

INTRODUCTION

A system designed to record and report on discrete activities within a process is called as Tracking System. In the same procedure we have developed a methodology of robot direction system for robotics to control and achieve accurate direction for a class of non-linear systems in the presence of disturbances and parameter variations by using wireless communication technique. In our project we can control the robot by using wireless communication i.e. from Control section (acts as transmitter) we are sending the control signals, then the robot receives (acts as receiver) the signals, according to the signals being received the direction of the robot is controlled. This project is designed around a Microcontroller which forms the control unit of the project. According to this project, an RF transmitter is used to transmit the control signals, which controls the direction of the robot. In the same way, RF receiver which is placed on the robot receives the RF signals according to which the direction of the robot is controlled. The microcontroller plays important role in controlling the direction according to RF signals being received at the Receiver side i.e. Robot section. This project finds its place in places where one wants to control the direction of any automated device using wireless communication.

An embedded system is a special-purpose system in which the computer is completely encapsulated by or dedicated to the device or system it controls. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few predefined tasks, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Embedded systems are often mass-produced, benefiting from economies of scale.

2. Block Diagram
MICRO CONTROLLER (AT89S51)
Introduction
A Micro controller consists of a powerful CPU tightly coupled with memory, various I/O interfaces such as serial port, parallel port timer or counter, interrupt controller, data acquisition interfaces—Analog to Digital converter, Digital to Analog converter, integrated on to a single silicon chip.

If a system is developed with a microprocessor, the designer has to go for external memory such as RAM, ROM, EPROM and peripherals. But controller is provided all these facilities on a single chip. Development of a Micro controller reduces PCB size and cost of design.

One of the major differences between a Microprocessor and a Micro controller is that a controller often deals with bits not bytes as in the real world application.

Intel has introduced a family of Micro controllers called the MCS-51.

Features:
- Compatible with MCS-51® Products
- 4K Bytes of In-System Programmable (ISP) Flash Memory—Endurance: 1000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 MHz
- Three-level Program Memory Lock
- 128 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Two 16-bit Timer/Counters
- Six Interrupt Sources

The AT89S51 provides the following standard features:
4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, two 16-bit timer/counters, a five vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next external interrupt or hardware reset.

Transmitter section:
RF Encoder:
This module is used to encode the given binary data into RF format and is given to RF transmitter. This module consists of 8 data lines and 10 address lines (A0 to A9) and these address lines are all connected to VSS (ground) pin of power supply. The 8 data lines are connected to 8 switches and TE (Transmit enable) pin is connected to VCC pin of power supply. And the encoded data is then transmitted to RF transmitter through DOUT pin (pin9) of RF encoder. And the supply connections are given from the Power supply output 7805 to the VCC and VSS pins of RF encoder.

RF Transmitter:
This module transmits the RF data which is given by RF encoder. It consists of 4 pins. One is antenna to transmit the data, two pin are power supply pins and one is input pin namely DATA pin to receive the RF data from RF encoder. The DATA pin of this RF transmitter is connected to pin9 (DOUT) of RF encoder.

RF Decoder:
This module is used to decode the RF signal received from RF receiver and the data from the output pin of RF decoder is given to microcontroller pin12 of controller. This module consists of 8 data lines D1 – D8, which are connected to 8 pins of port1 (P1). It will receive RF signal through DIN pin from RF receiver. Additionally it contains 10 address line and all are connected to ground (VSS). And the supply connections are given from the Power supply output 7805 to the VCC and VSS pins of the RF decoder.

RF Receiver:
This module receives the RF signal, which is transmitted by RF transmitter and RF signal is given to pin9 of RF decoder DIN pin. It also consists of one antenna pin namely ANT through which, RF signals is received. And the supply connections are given from the Power supply output 7805 to the VCC and VSS pins of the RF receiver.

H-BRIDGE:
DC motors are typically controlled by using a transistor configuration called an "H-bridge". This consists of a minimum of four mechanical or solid-state switches, such as two NPN and two PNP transistors. One NPN and
one PNP transistor are activated at a time. Both NPN and PNP transistors can be activated to cause a short across the motor terminals, which can be useful for slowing down the motor from the back EMF it creates.

**Basic Theory:**

H-bridge. Sometimes called a "full bridge" the H-bridge is so named because it has four switching elements at the "corners" of the H and the motor forms the cross bar. The key fact to note is that there are, in theory, four switching elements within the bridge. These four elements are often called, high side left, high side right, low side right, and low side left (when traversing in clockwise order).

The switches are turned on in pairs, either high left and lower right, or lower left and high right, but never both switches on the same "side" of the bridge. If both switches on one side of a bridge are turned on it creates a short circuit between the battery plus and battery minus terminals. If the bridge is sufficiently powerful it will absorb that load and your batteries will simply drain quickly. Usually however the switches in question melt.

To power the motor, you turn on two switches that are diagonally opposed. In the picture to the right, imagine that the high side left and low side right switches are turned on. The current flows and the motor begins to turn in a "positive" direction. Turn on the high side right and low side left switches, then current flows the other direction through the motor and the motor turns in the opposite direction.

Actually it is just that simple, the tricky part comes in when you decide what to use for switches. Anything that can carry a current will work, from four SPST switches, one DPDT switch, relays, transistors, to enhancement mode power MOSFETs.

One more topic in the basic theory section, quadrants. If each switch can be controlled independently then you can do some interesting things with the bridge, some folks call such a bridge a "four quadrant device" (4QD get it?). If you built it out of a single DPDT relay, you can really only control forward or reverse. You can build a small truth table that tells you for each of the switch's states, what the bridge will do. As each switch has one of two states, and there are four switches, there are 16 possible states. However, since any state that turns both switches on one side on is "bad" (smoke issues forth: P), there are in fact only four useful states (the four quadrants) where the transistors are turned on.

The last two rows describe a maneuver where you "short circuit" the motor which causes the motors generator effect to work against itself. The turning motor generates a voltage which tries to force the motor to turn the opposite direction. This causes the motor to rapidly stop spinning and is called "braking" on a lot of H-bridge designs. Of course there is also the state where all the transistors are turned off. In this case the motor coasts freely if it was spinning and does nothing if it was doing nothing.

**RF Module:**

**Radio Frequency:**

Radio Frequency (RF) does not refer just to radio broadcasting but rather encompasses all of the electromagnetic spectrum. RF energy is classified according to frequency. The range of frequencies is called the Radio Spectrum. While there is no precise beginning or end to frequencies making up the RF spectrum, Figure 1 shows the generally accepted ranges and class designations.

**HOW IS THE RF HARNESSED**

In order for a signal to be transmitted wireless, it is necessary for the signal to be conveyed into free space then recovered and restored to its original form. Two devices are used to accomplish this task: the transmitter and the receiver.

**The Transmitter**
The function of a transmitter is to take an analog or digital signal and, through an antenna, deliver it into free space. A simple transmitter is illustrated below.

You will notice the transmitter has three primary components: a frequency source (the oscillator), a gain stage (the amplifier) and a free space coupler (the antenna). The oscillator generates the frequency at which the transmitter will operate. This frequency is called the Fundamental. In order for the fundamental frequency to be transmitted effectively through the resistance of free space, it is necessary for the signal to be amplified. This is the purpose of the gain stage. Once the oscillator’s frequency has been amplified, it must transition from being a frequency contained within conductors (called transmission lines) into free space. This is the function of the antenna. The transmitting antenna allows the RF energy to be efficiently radiated from the output stage into free space. It is, in essence, a bridge between a guided wave and free space.

**MODULATION**

Now that you have a basic understanding of how a signal finds itself delivered into free space, you may be wondering how any useful information could be represented by that signal. The answer is Modulation. Modulation is the process whereby a carrier medium is impressed with content. The frequency to be controlled is called the Carrier. A carrier is like a moving truck. Just as you might place the contents of your house on the truck, so the information you wish to transmit is loaded onto a carrier. That signal, which has been impressed onto the carrier for “transportation”, is called the Program or Control Signal. In the case of digital data transmission, a carrier frequency is modulated with a control signal consisting of binary data.

**The Receiver:**

The purpose of a receiver is to receive the modulated carrier, remove it, and recover the original program signal. This process is called Demodulation. Below figure shows the block diagram of the simple receiver.

While receiver topologies vary widely all involve several stages to affect the reception and recovery process. First, the receiving antenna intercepts the electromagnetic waves radiated from the transmitting antenna. When these waves impinge upon the receiving antenna, they induce a small voltage in it. This voltage causes a weak current to flow, which contains the same frequency as the original current in the transmitting antenna. That current is amplified to a more useable level and then fed into a device called a mixer. The mixer takes this incoming signal and combines it with an on-board frequency source called a local oscillator. This converts the signal to a new lower frequency called the Intermediate Frequency or IF for short. The detector then strips out the IF frequency and leaves present only the original information. By now you should have a basic, but clear, understanding of how information signals are transmitted and received. With that as a foundation, you are now ready to consider the steps involved in putting RF to work for you.

**COMMON FREQUENCIES WITHIN THE BAND AND THEIR USES:**

The RF frequencies we are using in the project are three standard frequencies within the band from 260 to 470MHz. These frequencies are 315, 418, and 433.92MHz.

- 315MHz is commonly used for gate/garage door openers, security and keyless entry systems.
- 418MHz is a very clean frequency here in the US and also appropriate for operation in the UK.
- 433.92MHz is used throughout all of Europe. While it is appropriate for use here in the US, interference from armature radio and the nearby pager band may sometimes pose a problem.

**RF transmitter section:**

RF transmitters are electronic devices that create continuously varying electric current, encode sine waves, and broadcast radio waves. RF transmitters use oscillators to create sine waves, the simplest and smoothest form of continuously varying waves, which contain information such as audio and video. Modulators
encode these sign wives and antennas broadcast them as radio signals. There are several ways to encode or modulate this information, including amplitude modulation (AM) and frequency modulation (FM). Radio techniques limit localized interference and noise. With direct sequence spread spectrum, signals are spread over a large band by multiplexing the signal with a code or signature that modulates each bit. With frequency hopping spread spectrum, signals move through a narrow set of channels in a sequential, cyclical, and predetermined pattern.

Selecting RF transmitters requires an understanding of modulation methods such as AM and FM. On-off key (OOK), the simplest form of modulation, consists of turning the signal on or off. Amplitude modulation (AM) causes the base band signal to vary the amplitude or height of the carrier wave to create the desired information content. Frequency modulation (FM) causes the instantaneous frequency of a sine wave carrier to depart from the center frequency by an amount proportional to the instantaneous value of the modulating signal. Amplitude shift key (ASK) transmits data by varying the amplitude of the transmitted signal. Frequency shift key (FSK) is a digital modulation scheme using two or more output frequencies. Phase shift key (PSK) is a digital modulation scheme in which the phase of the transmitted signal is varied in accordance with the base band data signal.

Additional considerations when selecting RF transmitters include supply voltage, supply current, RF connectors, special features, and packaging. Some RF transmitters include visual or audible alarms or LED indicators that signal operating modes such as power on or reception. Other devices attach to coaxial cables or include a connector or port to which an antenna can be attached. Typically, RF transmitters that are rated for outdoor use feature a heavy-duty waterproof design. Devices with internal calibration and a frequency range switch are also available. RF transmitters are used in a variety of applications and industries. Often, devices that are used with integrated circuits (ICs) incorporate surface mount technology (SMT), through hole technology (THT), and flat pack. In the telecommunications industry, RF transmitters are designed to fit in a metal rack that can be installed in a cabinet. RF transmitters are also used in radios and in electronic article surveillance systems (EAS) found in retail stores. Inventory management systems use RF transmitters as an alternative to barcodes.

**RF transmitter ST-TX01-ASK:**

**General Description:**

The ST-TX01-ASK is an ASK Hybrid transmitter module. The ST-TX01-ASK is designed by the Saw Resonator, with an effective low cost, small size, and simple-to-use for designing.

- **Frequency Range:** 315 / 433.92 MHZ.
- **Supply Voltage:** 3~12V.
- **Output Power:** 4~16dBm
- **Circuit Shape:** Saw

**Applications:**

- Wireless security systems
- Car Alarm systems
- Remote controls.
- Sensor reporting
- Automation systems

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