Design of Remote controlled Car

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Abstract— This paper presents the remote-controlled vehicle using RF, implementation of smart logic and control system using a microcontroller, the vehicle is controlled by the RF based remote control, in which user interface is developed to give instructions to vehicle for movements. Few instructions are added to enable or disable the functionality on robot side. Vehicle consists of obstacle sensor, temperature sensor & light sensor, vehicle moves with the help of asynchronous H bridge, the vehicle is interfaced with the intellectual device called microcontroller. Microcontroller controls the movement of the robot by decoding the signals received from the RF based remote controller, and performs the programmed tasks as per received signal. In this project, we implemented a password authentication so that the vehicle can't be used by wrong persons for wrong purposes. Based on the commands given by user at the RF remote side vehicle takes it direction, in its path if it finds any obstacle or if any light falls on its path the vehicle gives alert to user, so that the user can controls the vehicle successfully. This RF based vehicle is used for military security purpose such as spy robot, in industrial security. This paper describes the design of a model of wireless remote control car using radio frequency. This remote correspondence framework can be utilized to transmit distinctive sorts of signs from transmitting end to accepting end. The control motion from the transmitter is sent to the beneficiary which is associated with a vehicle that will be remotely controlled. The authors have first design the transmitter section and then they have design the receiver section. In this research work, authors will try to construct a car that has the ability to be controlled using the remote through the wireless transmission.

Keywords: ***Radio Frequency; RF Transmitter; RF Receiver; HT12E; HT12D; Wireless Communication; DC motor.***

1.0 INTRODUCTION

Nowadays the radio controlled cars have developed to a high level and are used in many cases. Depending on their use, they vary in properties, design and special features. There are two major types of radio controlled cars, one that uses as energy source a conventional battery and the other type of radio-controlled car utilizes a small internal combustion engine as an energy converter, which uses fossil fuel as energy source]. Depending on its use a radio controlled car can be: I. an army robot to detonate a buried bomb, II. an android robot to do a human job, III. a mobile robot to move around the environment like an automatic guided vehicle (AGV), IV. children's toy car or an RC car that can be operated with a radio wave, and V. a radio controlled car with the purpose to detect fault on equipment with restricted access. These are some examples where a radio controlled car can. Radio control (regularly shortened to R/C or basically RC) is the utilization of radio signals to remotely control gadget. Mechanical, military, and logical research associations make utilization of radio-controlled vehicles also. A remote control vehicle (RCV) is characterized as any cell phone that is controlled by an implies that does not confine its movement with a starting point outside to the gadget. K. V. Alexander (1983) proposed the high speed wheeled vehicle ideal for land operation [1]. Othman et al. (2012) also proposed the wireless controlled omnidirectional monitoring robot [2]. Lucky Gautam et al. (2013) discussed in detail about manual control robot [3]. S. Banerji (2014) also proposed the design of an unmanned vehicle [4]. Recently, Nichat et al. (2015) proposed the wireless speed control of dc motor [9]. This research work incorporates a robotic car consisting of an RF receiver, Decoder, Motor driver and dc motor. The principle of operation and flow chart, transmitter section and receiver section are *explained* in section 2. The outcome and conclusion are examined in the areas 3 and 4.ms—RF vehicle, remote controlled, sensors, microcontroller, and password authentication.

2. THE PRINCIPLE OF OPERATION AND DESIGNING THE SYSTEM

In this mechanism, there is a tactile switch (push button) which is pressed to power the circuit. After this, there is an encoder. The address lines of the Encoder are connected to the switch. So when the switch is ON then the transmission is enabled. This sends the signal to the RF transmitter and the transmitter sends the signal wirelessly to the receiver. In the receiver section, the message received by the RF receiver is sent to the decoder, where the signals are decoded. This decoded data gives the input signals of Motor Driver which drives the Motor. The block diagram of the system is shown in Fig. 1. Transmitter Section: This section of the model is used to generate signals and transmit it to the receiver using RF transmitter of 434MHz via an antenna.

Receiver section: This section of the model receives the signal via the antenna using an RF receiver of 434MHz. The data is decoded here using a decoder which drives the motor according to the input.

Here we will use a couple of ICs and a motor fixed to a chassis to make a remote control car. The brief idea is to transmit control signals through radio frequency and receive it through a receiver module in the car. We will have two switches in our remote control to power each motor of the car. The state of the switches (ON/OFF) is the control data. This data from the remote control is encoded before transmission, received back, and decoded again to be sent to the motor drivers. This is achieved using an RF module and an encoder (HT12E) decoder (HT12D) pair.

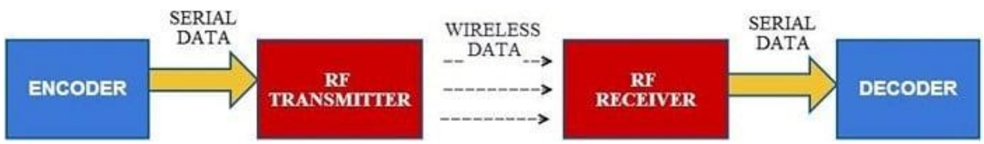

Figure 1. Working block diagram

Using the combination of different states of the two switches, you can control the direction of motion of your remote control car. If both switches are off, both motors will be off, and the car will not move. If both are on, the car will move straight ahead. And to turn the car, switch on only the motor on the side you want the car to turn to.
Here is a flowchart to help you understand the working logic of the robot car. First we will go over the basic idea of the RC car and the working logic that is involved in the car. There are two blocks, the Transmitter (remote control) and the Receiver (robot car).

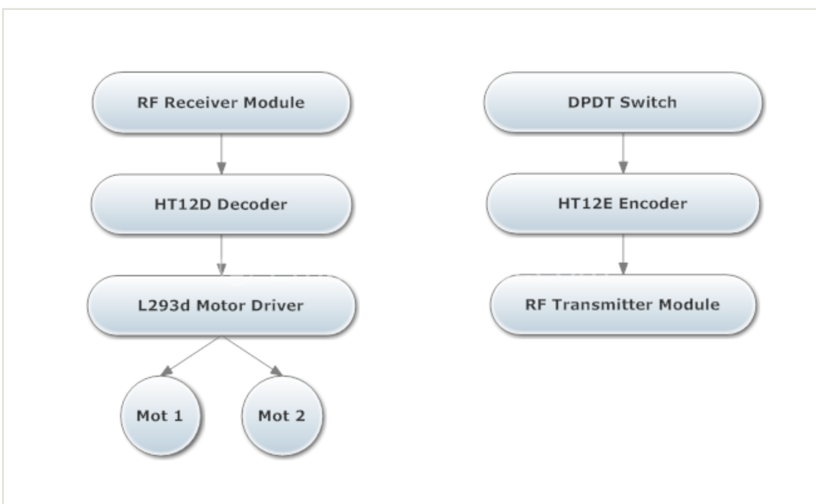

Figure 2. Flow Diagram of working model

On the transmitter side, we have the switches to give the digital inputs to the encoder IC. The encoder then encodes this data and sends it to the RF Transmitter module.

On the receiver side, we will have the RF Receiver which receives the encoded data and passes it on to the decoder. The decoder decodes the data and sends it to the motor driver IC to drive the motors.

There are a lot of different types of drive algorithms for driving robotic cars. One such method is the differential drive method. We will be using only one pair of motors to drive the car.. We will just have one castor wheel asides from the two motors and it will be used to give mechanical stability to the robot car. Now the obvious question is how the car will change direction if it has only two wheels. That is when the differential drive algorithm comes in the picture. The direction control is achieved by rotating one of the wheels in one direction and the other in another direction. The following table might give you a better understanding. The car will go front or back if both the pair of motors operates in one direction and left or right if they operate in different directions.

Table: 2 Differential Drive Algorithm

Left Motor	Right Motor	Direction
Front	Front	Front
Front	Back	Right
Back	Front	Left
Back	Back	Back

3. DESIGN OF RF TRANSMITTER (REMOTE CONTROL)

Now for the transmitter circuit, you will have to bear in mind that this is your remote. So try to make it as handy as possible (in case you are making one). Trust me, the last thing you want is a remote that is too big/heavy to carry around. Make a good closure for this circuit.The HT12E encoder are 12 bit encoders that is they have 8 address bits and 4 data bits. The address bits can be left open or pulled low. In the circuit below, you will see that each of the address pins (A0 to A7) are connected to a switch. So if the switch is ON then that line is connected to GND (VSS) otherwise the pin is left floating.

The TE (transmit enable) is an active low input to the IC. This enables the transmission. So when the switch connected to pin 14 is pressed, the 8 address bits along with the 4 data bits (AD8 to AD11) are serially encoded and sent out at the DOUT pin.

For our application (RC robot car) we will connect TE directly to GND as we have to keep sending the data as and when they arrive to the rc car.

Unlike the receiver circuit, this does not need to have a beefy battery. You could power this circuit with a 9V battery.

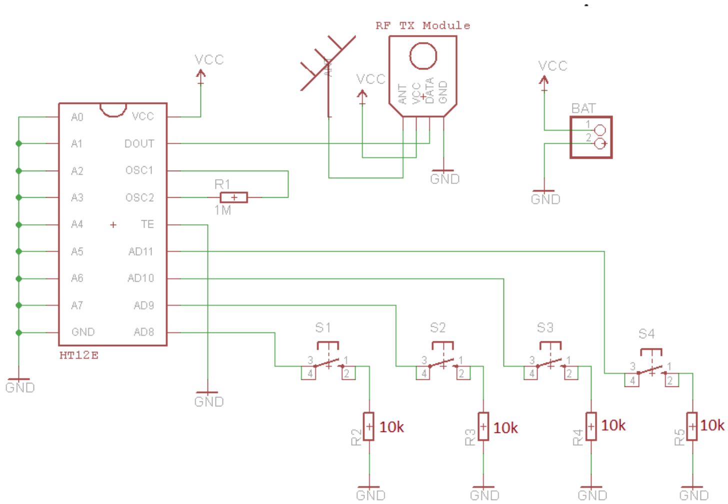

Figure 3.RF Transmitter Circuit design

Figure 4. RF Transmitter

4. DESIGN OF RF RECEIVER CIRCUIT WITH MOTOR DRIVER

This is the circuit diagram for the receiver. It handles the RF reception as well as the motor drive.
The address pin in the decoder (HT12D) behaves just like that of the encoder. The data is received at the DIN pin from the RF receiver circuit and then this data is checked 3 times (according to the datasheet the data is transmitted 3 times and received 3 times and only if all 3 times the data is same it is decoded) and then decoded and the IC checks if the address pin connection of the encoder is same as that of the decoder. If the address configuration of the decoder matches that in in the received data (from encoder) the data is decoded and latched on to the data pins (D8 to D11).
This decoded data is then sent as control signals to the motor driver IC. L293d is a dual H-bridge motor driver to be short. It is used to drive the motor in both forward and back ward direction. Read about the basics of DC motor drive and their speed control to get a better understanding of this concept.

The VT (valid transmit) pin is used to indicate if there is a valid transmission between the encoder and decoder. This pin can be left open or like in the circuit below, an LED with series resistance can be used to give a visual indication.

The transmitter circuit consists of

1. HT12E encoder (Pin Out)
2. RF transmitter module (Pin Out)
3. 2 DPDT switches
4. Power supply circuit
5. 1M resistor

You can see I have marked A, B, C, D in the transmitter circuit after the switch. The same has been marked on the DPDT switch diagram. Connect the A,B,C,D on the transmitter circuit to the A,B,C,D on the two DPDT switches.

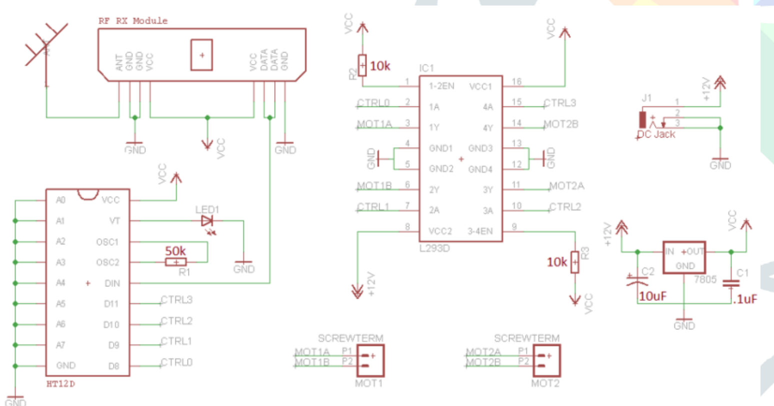

Figure 5.RF Receiver Circuit design Figure 6 . RF Receiver

The receiver circuit consists of three ICs:

1. HT12D decoder (Pin Out)
2. L293D motor driver (Pin Out)
3. RF receiver module (Pin Out)

Figure 7. Encoder & Decoder

Wire the circuit as per the above receiver schematic. There are two LEDs in the receiver board. One lights up when power supply is given to the receiver. The other one near the IC HT12D should light up when power supply is given to transmitter circuit. This provides you with a valid transmission (VT) when power is given at the transmitter. If not, there is something wrong with your connection or your RF TX RX module.

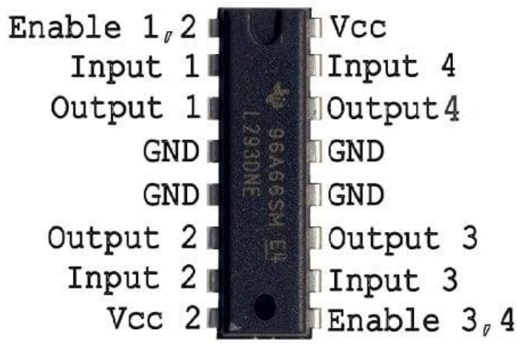

Figure 8.Motor Driver IC

5. 0 SELECTION OF DC MOTOR

Choosing a motor is very important, and totally depends on the type of robot (car) you are making. If you are making a smaller one, use 6V Bo motor. If you are making a larger one, which will need to carry heavy load, then use a 12V DC motor. I have used a 12V 300RPM (revolutions per minute) motor. RPM is the number of times the shaft of a DC motor completes a full spin cycle per minute. A full spin cycle is when the shaft turns a full 360°. The amount of 360° turns, or revolutions, a motor does in a minute is its RPM value. You should be careful not to choose motors of higher RPM because it will be difficult to control. And remember, speed is inversely proportional to torque.

6.0 LIGHT WEIGHT LIPO BATTERY

Turnigy 5000mAh 2S 20C Lipo Pack Another important decision was to select the type of power supply to power our design. We needed to find a solution that we could integrate with the DRV8301 kit, the motor and the platform. Some of the battery considerations that we factored in our decision were power, size, capacity and constant discharge rating. The DRV8301 typically runs on a voltage of anywhere from 12- 24 volts. In addition the DRV8301 can handle up to 60A during operation. Another factor we considered was that the platform that we selected has room to house 2 separate battery packs. We made the decision to order 2 Lithium Polymer batteries that each supply 7.4 volts at a 20C rating. When connected in series the output voltage from the batteries should be read as about 15 volts which is in line with the DRV requirement. An advantage of the 20 C rating of the batteries is that they can consistently provide more than enough current (100A) to support our DRV8301 kit. These batteries also have a high capacity (5000mAh) for their price and weight (>1lb). An added benefit of selecting this type of battery is that it was designed for use in a RC car. A picture of the type of battery that we will use is shown below.

Figure 9: Battery Selection - Turnigy 5000mAh 2S 20C Lipo Pack

Table 2: The switch input combinations

Switch S4	Switch S3	Switch S2	Switch S1	Function
0	0	0	0	No Operation
0	0	0	1	Move Right
0	0	1	0	Move Left
0	0	1	1	Forward
0	1	0	0	Move Reverse Right
0	1	1	0	Move Quick Left
1	0	0	0	Move Reverse Left
1	0	0	1	Move Quick Right
1	1	0	0	Move Backward

Figure 10. Designed RC Car model

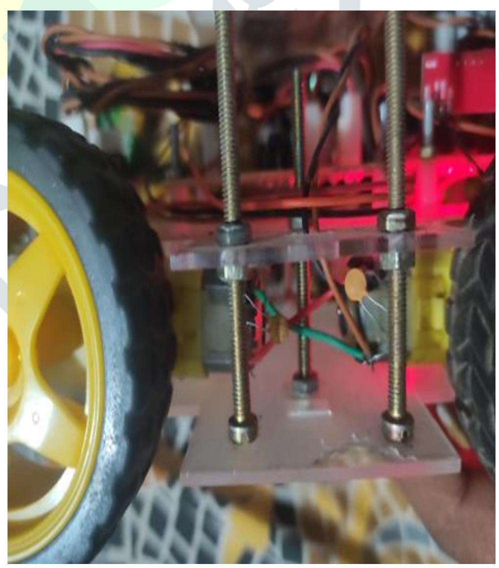

Figure 11. 12v DC motor connected to car wheel

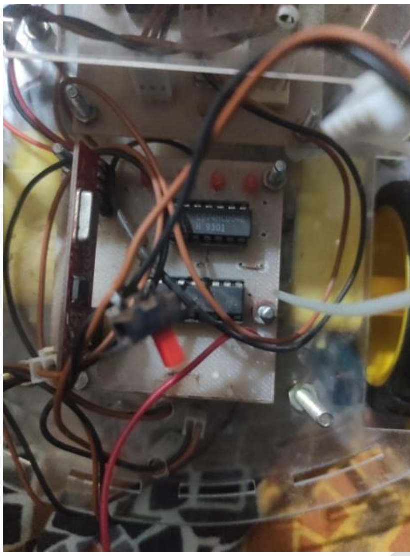

Figure 12. Receiving Circuit

Figure13. Transmitting Circuit

7. RESULTS

These authors control the motion of car through the radio frequency application. The movement towards of the car using the transmitter is shown in Fig. 11. The complete model of a transmitter and receiver are shown in Fig. 12,fig 13.

8. CONCLUSION

In this paper, it has been shown that it is possible to perform communication between the transmitter and receiver using radio frequency. The car can be moved forward and backward and can be turned left and right. The circuit can be modified and transformed into an amphibious mechanism which is work run both on land and water efficiently. This technique may also be implemented for other purposes. The feasibility of proposed technique has been shown.

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