

## Line Follower Robot using Radio Frequency (RF) Technology

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**ABSTRACT :** This work demonstrates prototype development of a Line Follower Robot (LFR) using Radio Frequency (RF) Technology. The main objective of this Robot is to follow a path provided by the user through a PC. The robot traces the path with the use of a Radio Frequency transmitter and receiver.

**Keywords** -Line following robot, Encoder & decoder IC, Radio frequency, RF transmitters, RF Receivers.

### I. INTRODUCTION

Wireless communication nowadays is becoming increasingly popular for factory and process control automation systems. Part of this growth is due to the emergence of very reliable radio frequency technologies capable of handling the extreme conditions present in industrial plants. The other factor driving growth is the realized benefits that wireless presents including reduced installation costs, elimination of phone line charges for remote sites, reduced mechanical wear to moving platforms (thus improving performance of material handling systems) and providing crucial information for production and maintenance workers wherever needed. Industrial applications involving mobile systems can benefit from the use of wireless communication technologies. LFR is a tool or machine that can follow a specified path. Historically the most LFRs are built using microcontroller chips. The chip is preprogrammed and embedded within the robot. One of the basic problems with microcontroller based designs is the acceptance of commands from the user in real time from outside world. The second problem with LFR is wired connections, and the length of wire is the main constraint. As the length of a wire increases, the signal strength attenuates and along with signal strength attenuation delay in timings also increases. To overcome these problems, RF is used as it provides a convenient way of transmitting signals without conductors and hence eliminating the attenuation and time delay. The current approach solves the problem of controlling LFR with the added functionality of command mode. The significance of the study is in the contribution in the field of wireless control of automated guided vehicle systems and robotics. Through this project, a simpler approach and algorithm is designed for using low cost and an in house available RF transceiver with low processing requirements but with effective results.

### II. HARDWARE DESIGN

#### 2.1 Block Schematic

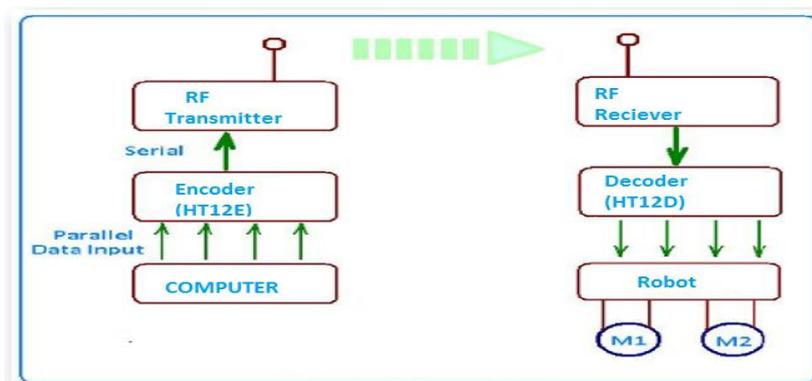


Fig. 1 Block Diagram of the System

The parallel port of the PC is connected to the encoder. This encoder is further connected to the RF transmitter module. The signals from the parallel port of the PC are interfaced to the RF transmitter through an encoder. The encoder encodes the data and passes it to the RF transmitter and the transmitter transmits the data. At the

receiving end, the RF receiver receives this data and gives it to the decoder. The decoder converts single bit data into four bit data and presents to the DC motor. Now the driver performs the corresponding action, i.e., it rotates the dc motor clockwise or anticlockwise. For remote control, we have used the HOLTEK encoder and decoder pair of HT12E and HT12D. Both of these are 18 pin DIP ICs. HT12D and HT12E are CMOS ICs with a working voltage range of 2.4V to 12V. Encoder HT12E has 8 address lines & another 4 data line. The data set on these 12 lines is serially transmitted when transmit enable pin TE is taken low. The data output appears serially on D out pin. It is transmitted four times in succession. The HT12D receiver the data on A0-A7 pins four times in succession, the valid transmission pin is taken high. The data on pins AD8 through AD11 of HT12E appears on pins D8 of HT12D thus the device acts a receiver of 4 bit data with 8 bit addressing. Once the frequency of a pair is aligned, then on ground of any data pin of the encoder, LED1 of the decoder should glow. You can also check the transfer of data on pins AD8-AD11, which is latched to D8 through D11 pins of the decoder, once TE pins is momentarily taken low by grounding it through diodes D1 through D4. Fig. 1 shows the block Diagram of the System.

## 2.2 RF Transmitter and Receiver

This 434 MHz transmitter is a ASK hybrid transmitter module. It uses saw resonator for frequency stability. The receiver is an ASK super heterodyne receiver with PLL synthesizer and crystal oscillator. This transmitter and receiver in conjunction with HT12E and HT12D ICs can be used to build remote control.

## 2.3 Circuit Diagram at TX

Fig. 2 shows the Circuit Diagram at TX.

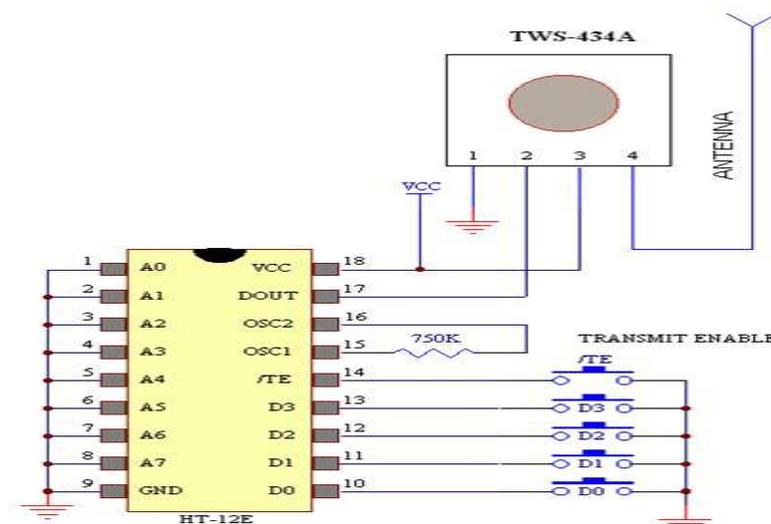


Fig. 2

## 2.4 Circuit Diagram at RX

Fig. 3 shows the Circuit Diagram at RX.

## 2.5 Receiver and Decoder

Assuming that identical address is selected on the encoder and decoder, when any of the data pins of the PC's parallel port on the transmitter side is low, the corresponding data pin of the decoder will go low. The data outputs of HT12D are fed to inverters N1 through N4, which are given to microcontroller. It processes the data and gives required data to motor driver. When any data is received, valid transmission (Vt) goes high to drive transistor T5 into saturation and LED1 lights up.

## 2.6 Motor Driver IC L293D

The device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoids, DC and stepping motors) and switching power transistors. This device is suitable for use in switching applications at frequencies up to 5 kHz.

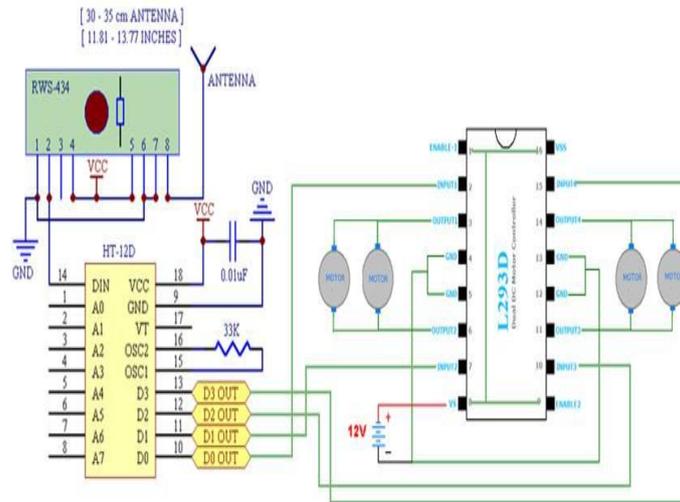


Fig. 3

## 2.7 Voltage Regulator IC7805

The 78xx (sometimes LM78xx) is a family of self-contained fixed linear voltage regulator integrated circuits. The 78xx family is commonly used in electronic circuits requiring a regulated power supply due to their ease-of-use and low cost. For ICs within the family, the xx is replaced with two digits, indicating the output voltage (for example, the 7805 has a 5 volt output). The 78xx lines are positive voltage regulators: they produce a voltage that is positive relative to a common ground.

## III. SOFTWARE DESIGN

Fig. 4 shows the flow chart of software design.

## IV. CONCLUSION

### 4.1 Application:

We can implement this technique in surveillance system. A camera mounted on the robot can give you live data from any desired location. This can also be used in industrial automation. Say a machine has to transfer goods from one location to other, so in this case we can use this robot which will be pre-programmed for tracing that location. Further this can be used for data acquisition from any extreme condition where it is not practically feasible for human being to reach. The application can be summarized in following areas as:

1. Surveillance systems.
2. It can be used as a house-hold robot in processes like cleaning of floors , offices.
3. It can also be used in industrial applications.

### 4.2 Limitations:

Obstacle avoidance has not been incorporated.

### 4.3 Future Scope:

1. This technology can be implemented in advance space research programs, where such autonomous robots are used.

2. Advancement in this technology can help to build the next generation of intelligent cars which can track their own way back to the destination with the help of this technology and GPS.

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3.1 Flow Chart:

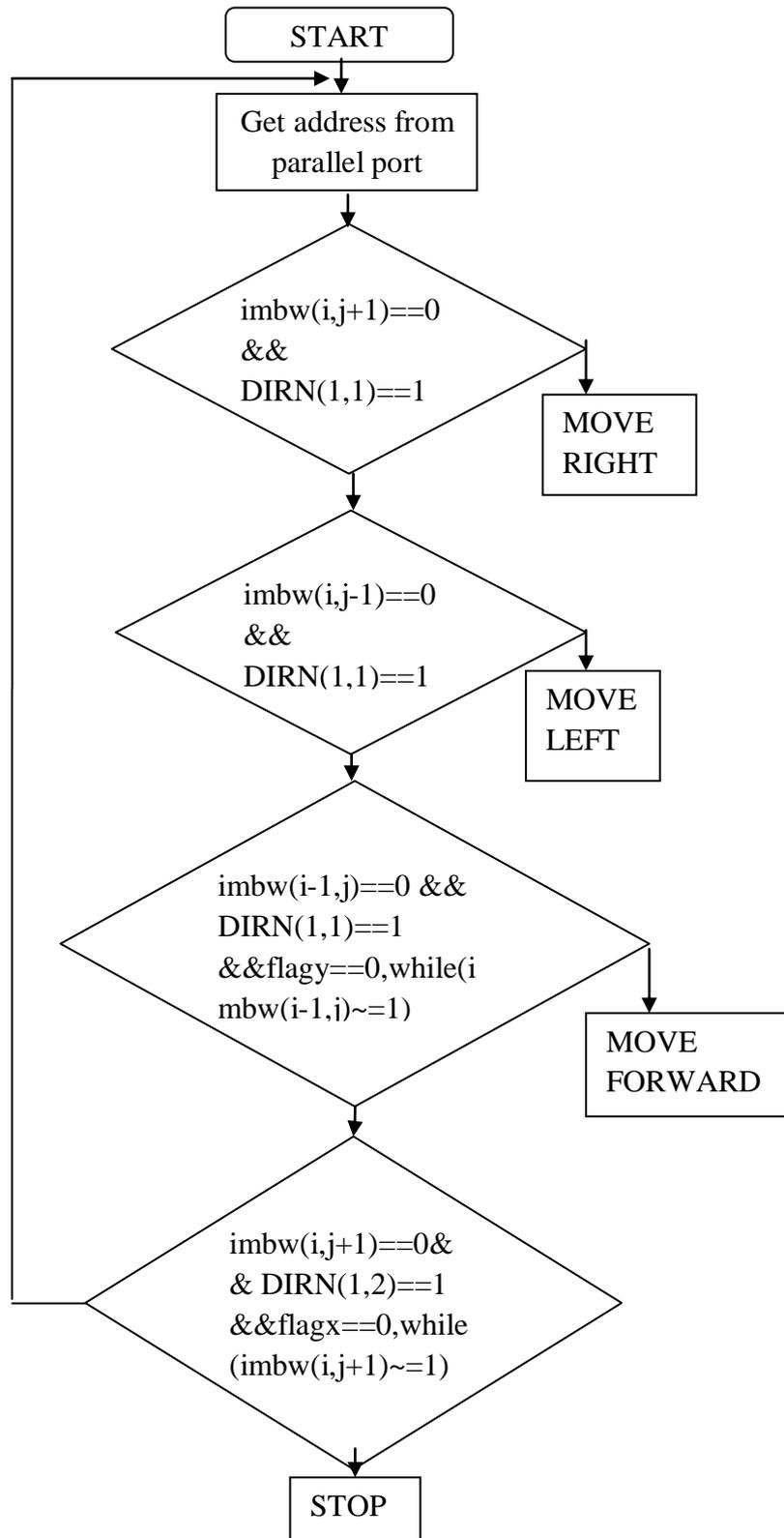


Fig. 4 Flow chart of software design