

Wireless PC Control Robot Using 8051 Micro Controller & RF Module

Yogendra Sahu, Sumit Sharma, Vaibhav Kumar, Tameshwar Kumar

Abstract— This project is intended to control the robot path using PC. The control unit in receiver section controls the robot direction according to the commands given from PC which is send through the transmitter section by means of RF wireless communication. 8051 microcontroller is used as control unit. There are two sections in microcontroller. One is transmitter and the second one is receiver section. Transmitter section consists of PC, microcontroller and RF transmitter. Microcontroller is interfaced with PC through serial communication using UART TTL converter. Different directions of the robot are controlled through instructions to the robot with the help of data given to the PC using keypad. Data will be given to microcontroller and controller will transmit that data to receiver module by using RF transmitter.

Index Terms— PC, RF module, UART, TTL, Transmitter, Receiver, 8051 microcontroller, wireless communication.

I. INTRODUCTION

In defense field many times it is not affordable in many situations to put human life in danger in case of rescue operations and emergencies. Requirement of such a situation is to take the inside view of situation without risking any lives. For this reason a non-living system should be build a robot that does more than just move in a maze. Intelligent portable robots and cooperative multi-agent robotic systems can be very proficient tools to speed up search and rescue operations. Robots are also useful to do rescuing jobs in circumstances that are risky for human rescuers. It can enter be employed. Therefore, we developed an idea to into gaps and move through small holes that is impossible for humans and even for trained dogs. Robots should explore in collapsed structure, extract the map, hunt for victims and report the location of victims in map, so that rescue team can reach that place. It can also place a communication device near the victim. Our preliminary objective in this project is to build an self-sufficient robot which could be able to hang around in an unstructured environment and search for victims.

II. PROJECT GOAL

Our objective for the design of our project was originally developed from the idea of creating a micro-robot, a robot

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that finds its way in a maze. This Robot is going to be controlled via computer with a different range of functions that we are going to be discussed below. The robot will be controlled from a computer terminal. The user can use the computer to control robot by using different keys on PC. The keys on the computer tell the robot to move forward or backward, turn right or left, or stop. The on-board RF receiver is sensitive enough for a control range of up to 50 meter.

• Possible Approaches:

In a procedure to design the PC-Controlled-Robot, we have considered some Possibilities in designing approaches. There are three major parts:

1. The microcontroller (for robot).
2. The wireless transmitter-receiver (between robot and computer terminal).
3. Sensors (LM35 temperature sensor and MQ 6 gas sensor).

III. RF TRANS-RECEPTION AND MICROCONTROLLER

This project is based on RF Trans-reception and microcontroller which includes:

- A. PC
- B. SERIAL PORT
- C. Encoder
- D. Decoder
- E. RF module
- F. Microcontroller
- G. Motor Driver Unit
- H. Power Supply

A. PC:

Personal Computer is basically used for monitoring the robotic assembly. It is interfaced to RF transmitter with the help of serial port UART .It is also used for giving the command to robot .Thus PC is used to position the robot in different direction.

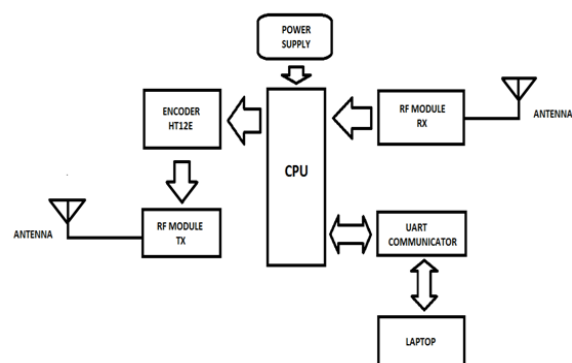


Fig. 1 Block Diagram of Transmitter Circuit PC Controlled Robot

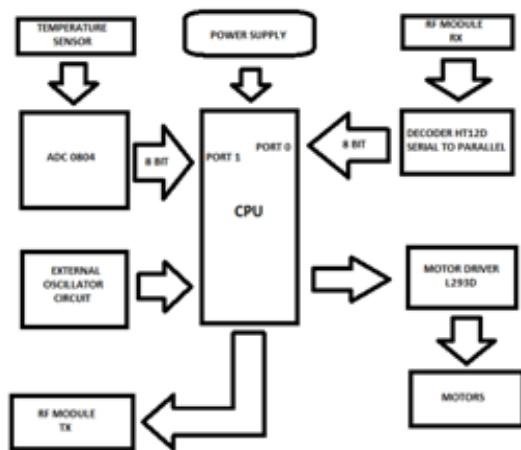


Fig. 2 Block Diagram of Receiver Circuit PC Controlled Robot

B. PC:

Personal Computer is basically used for monitoring the robotic assembly. It is interfaced to RF transmitter with the help of serial port UART. It is also used for giving the command to robot. Thus PC is used to position the robot in different direction.

C. Serial Port:

a. UART

Universal Asynchronous Receiver/Transmitter (UART) is a standard serial communication protocol for exchanging data between two devices. In this communication protocol, data is transferred sequentially, one bit at one time. This implementation uses a frame consisting of 8 data bits, one start bit, one optional parity bit, and one or more stop bits. A parity bit is a bit, containing a value of 0 or 1 that is added to a block of data for security and error detection functions. This bit is optional; it may or may not be extra to the data payload. It can also be set either to odd or even. These bits are frequently used in data transmission to make sure that data is not corrupted during the transfer process. If the data transmission protocol is set to an odd parity, each data packet should have an odd parity. If it is set to even, each packet must have an even parity. If a packet is received with the wrong parity, an error will be produced and the data will need to be retransmitted.



Fig.3 UART

D. Encoder

An encoder is a device, circuit, transducer, algorithm or person that converts information from one format or code to another. The purpose of encoder is speed, standardization, secrecy, security, or saving space through shrinking size. Encoders are combinational logic circuits and they are exactly opposite of decoders. They accept one or more inputs and generate a multi bit output code.

Encoder's functions exactly reverse operation than decoder. An encoder has M input and N output lines. Out of M input lines only one is activated at a time and produces equivalent code on N output lines. If a device output has fewer bits than the input code has, the device is usually called an encoder.

E. Decoder

In digital electronics, a decoder can take multiple-input and produces multiple outputs. Decoder is logic circuit that converts coded inputs into coded outputs, where the input and output codes are different e.g. n-to-3n, BCD decoders. Decoding is important in applications such as data multiplexing, 7 segment display and memory address decoding. The example of decoder would be an AND gate since the output of an AND gate is "High" (1) only when all its inputs are "High." Such output is called as "active High output". On the other hand, if the NAND gate is connected the output will be "Low" (0) when only all its inputs are "High". Such output is called as "active low output".

F. RF module:

It is a trans-receiver module used for both receiving and transmitting purpose. RF module of 433 MHz is used for this application. It uses AM modulation for transfer of signal. Its coverage area is almost 80m.

The cheapest way to remotely control a device for a wide range is via Modulation Technique Now-a-days due to this wide-spread use the required components are quite cheap, thus making it ideal for us to use modulation technique for our project.

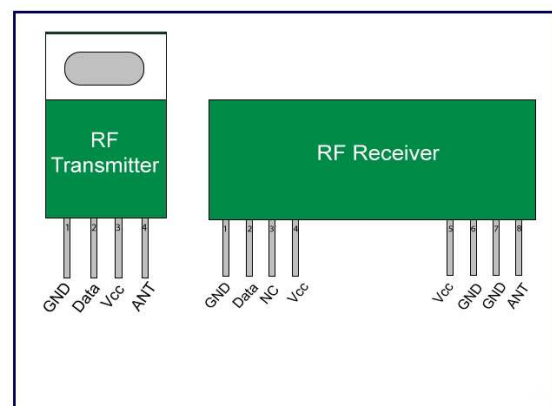


Fig.4 RF Module

G. Microcontroller:

Microcontroller of 8-bit (89C2051) is used in this project. The control signals are received by microcontroller and accordingly will generate control signals to drive the motors. It is programmed so as to get forward, reverse, right, left direction of motor and to receive signals from sensors. The AT89C2051 is a low-voltage, high-performance CMOS 8-bit microcomputer with 2 Kbytes of Flash memory available in 20 pin dual in line package. The device is compatible with the industry standard MCS-51 instruction set. By combining a versatile 8-bit CPU with Flash memory on a monolithic chip, the Atmel AT89C2051 is a powerful microcontroller which provides a highly flexible and cost effective solution to many embedded control applications.

H. Motor Driver Unit:

A modern drift in the field of automation is the use of wireless supervision and feedback processes. This fact became the reason behind the decision to design and build for this project, Wireless control of DC motor using RF. The first step in the designing process was to be able to switch direction of motor rotation (clockwise and anti-clockwise rotation) and vary speed of motor and in order to achieve the required effects we used L-bow configuration which reverses the voltage on motor leads. Pulse amplitude Modulation was employed so as to drive the DC motor at the required speed, which was measured by observing, in set periods of time, the pulses produced by the pulse generator of motor. Assembly code is used to enumerate the pulses and to transform the calculation into revolutions per minute. Also to make the system much user friendly a Human Machine Interface program was made so that it would be possible to supervise the motor's speed as well as create a control unit to change those parameters.

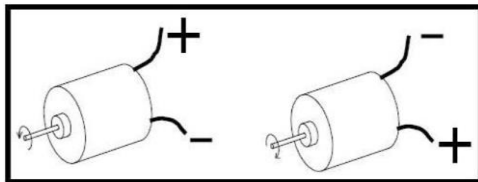


Fig.5 Motor driver unit

I. Power Supply:

Since the robot is wireless, power supply requirement is fulfilled from DC battery. Battery of 6V is used in this project which can work for long duration, while at transmitter side ac power supply of 230V, 50Hz is used.

IV. SENSOR

1. MQ-6 gas sensor
2. LM35 temperature sensor

A. MQ-6 gas sensor:

The system is outfitted with an MQ sensor which can sense the presence of LPG. The sensor observe the presence of LPG and alerts the microcontroller. The microcontroller then perform the plant shutdown option when its necessary. The system is equipped with a relay which is meant to shut down the plant if gas is present. Necessary warnings are displayed on the LCD or PC. The user can set the desired trigger level, that is, the intensity of gas at which the shutdown should take place by adjusting the potentiometer in the system.



Fig.6 MQ 6 gas sensor

B. LM35 temperature sensor:

Temperature sensor is a device which is designed specially to determine the hotness or coldness of an object. LM35 is a IC which is precision temperature sensor with its output proportional to the temperature (in °C). With LM35, the temperature can be measured more accurately as compared to thermistor. It also possess low self heating and does not cause more than 0.1 °C temperature rise in still air. The operating temperature range is from -55°C to 150°C. The LM35 has low output impedance, linear output.

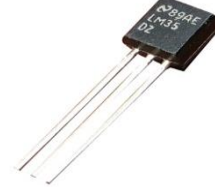


Fig.7 LM35 temperature sensor

V. WORKING PROCESS OF THE DESIGN

The theme of the project is wireless controlled pc robot. Hence the pc (keys of keyboard) is used for controlling the direction of robot. When a key is pressed, signals are converted in RF form through RF Transmitter using AM modulation via serial port of PC via USART. This signal are further received by RF receiver at receiver section, where it is demodulated and decoded .This RF signal act as a control signal for microcontroller which controls the direction of motor. Such robots are useful in hazardous condition, since it is wireless and controller is away from field of action. It is also highly efficient.

➤ Software Development Tools

- ❖ Keil Microcontroller Development kit
- ❖ Proteus
- ❖ Prog ISP

❖ Keil Microcontroller Development kit:

The keil is a complete software development environment for the wide range of 8051, ARM, cortexes microcontroller devices.

❖ Proteus:

ISIS is the software used to draw schematics and simulate the circuits in real time. The simulation allows human access during run time, thus providing real time simulation. **ARES** is used for PCB designing. It has the feature of viewing output in 3D view of the designed PCB along with components. The designer can also develop 2D drawings for the product. The designed layout with the help of this software is shown in below fig.

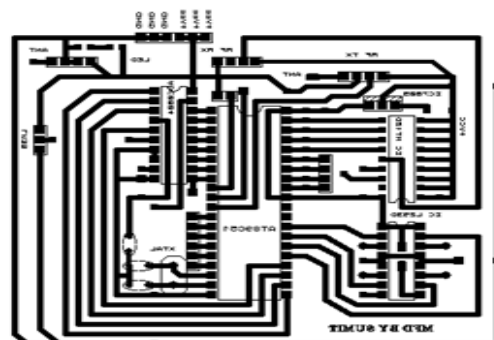


Fig.8 PCB Layout at transmitter side

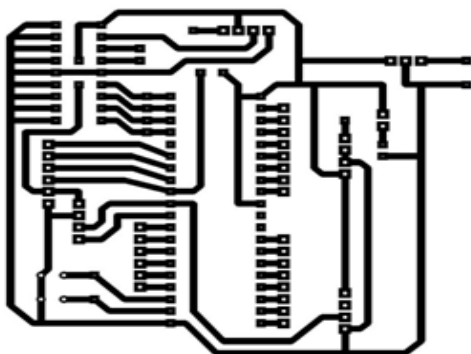


Fig.9 PCB Layout at receiver side

❖ Prog ISP:

The Prog ISP is a software used to program the microcontrollers and other embedded devices while installed in a complete system rather than requiring the chip to be programmed prior to installing it into the system.

At the end of this project we get the output shown in Fig. 10.

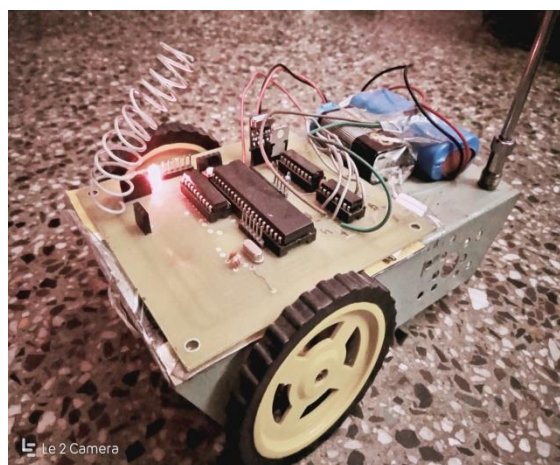


Fig.10 Final design

VI. FUTURE DEVELOPMENTS

The speed of vehicle can be increased using high torque dc motors and reducing the weight of assembly with the help of nickel-cadmium batteries. Our system employs analog video transmission techniques and can be received by any ordinary receiver. Therefore for security reason we have to switch over to digital transmission along with encryption. For wide range of application GPS (Global Positioning System) technology can be used effectively in place of RF module. This project is further implemented on platform like AVR, ARM, and Microcontrollers etc. More can be done in the process of UART communication control and many challenges will be carry out to increase reliability and efficiency. This system also can be developed by using GSM technology.

VII. CONCLUSION

Our effort to design the pathfinder robot system results in a versatile robot that has demonstrated several surveillance applications successfully. Since the mechanical assembly is robust. It can work well in the critical conditions. It is useful in military application, Geographical survey. The different sensors mounted on the robot provide better survey of site at PC receiver. Due to the use of only two motors robot can be moved in all direction. Since it uses 6V, 4.5AH battery it can

work for longer duration. The presented robot control system can be used for different sophisticated robot applications. The control system consists of a PC, a microcontroller that collects data from the PC and control the robot. It can be used for many applications like rescue operation in disasters such as earthquake

REFERENCES

- [1] Ayala, K.J., "The 8051 Microcontroller", Penram Int. Publications, (2nd Edition).
- [2] Bhurchandi, K.M., & Ray, A.K., "Advanced Microprocessors and Peripherals", TMH Publications.
- [3] George Kennedy, "Electronics communication system", third edition McGraw-Hill Book Company.
- [4] Muhammad Ali Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearson Education.
- [5] Douglas Hall, "Microprocessor and interfacing"
- [6] Sampath K. Venkatesh, "8051 Microcontroller & Embedded System"
- [7] Kenneth J. Ayala & Dhananjay V. Gadre, "8051 Microcontroller using Assembly and C"
- [8] Hsu, George "Modular RF communication module for automated home and vehicle systems." U.S. Patent No. 6,374,079. 16 Apr. 2002.
- [9] LM35 Datasheet – National Semiconductor <http://pdf1.alldatasheet.com/datasheetpdf/view/886/NSC/LM35.html>
- [10] T.G.Giallorenzi et al, "sensors challenge the competition," IEEE Spectrum, 2006.
- [11] www.engineersgarage.com
- [12] www.atmel.com
- [13] www.CCTP.com
- [14] www.datasheetcatalog.com
- [15] www.intel.com
- [16] www.nationalsemiconductor.com
- [17] www.sbprojects.com
- [18] www.microchip.com