

# Wireless Technology Based Robot Communication System

B. Rakesh Reddy

Department of Electronics and Communications  
KORM College of Engineering, Kadapa, 516001  
Kadapa, India  
Affiliated to JNTU, Anantapur, 515001  
Anantapur, India

**Abstract-** The wireless communication technologies are rapidly expanding to many new areas, space technology, manufacturing industry including the automation and the importance of the use of wireless technologies in the data acquisition, building control, monitoring systems and automation of manufacturing processes is increasing at a rapid rate. Intelligent mobile robots and cooperative multi- agent robotic systems can be very efficient tools to speed up search and research operations in remote areas. Our preliminary aim in this project is to build a multi robot communication system, in which a slave robot follows the master robot, it is an intelligent communication where master robot controls remaining slave robots, and the master is controlled via voice module through zigbee. It can be a prototype to speed up the work process in industrial management using zigbee communication.

**Keywords—**Atmel Microcontroller, Voice Module, Robot platform, Zigbee Technology.

## I. INTRODUCTION

The System “Wireless Technology Based Robot Communication System” is developed for the purpose of achieving tasks that are almost impossible for the humans and for using them in hazard prone areas. The system consists of a master robot, slave robot, voice module and the communication takes place with the help of a voice module. The signal is transmitted and received by the zigbee networks installed on every wireless module. The commands are given only to the master robot using the voice module and this is transmitted to the master robot via zigbee. The master robot performs the actions commanded to it, transfers the same commands to the slave robot(s) and hence performs the same actions as the master robot does. Here the zigbee in voice module acts as a transmitter, in master robot both a transmitter as well as a receiver and only as a receiver in the slave robot.

## II. EXISTING SYSTEM

Engineering has shown a vast growth compared to any of the field and embedded systems in particular has taken new shapes like never before, helping the mankind in almost all respects of life. Many embedded systems have been developed, implemented for various purposes. There are certain systems used for real time applications finding there

usage in defense and automation sectors. The system existing now a days implements no robotic communication in defense. Many deaths are taking its toll when it comes to the wars, also the countries using automation to an extent doesn't possess effective communication coming to robotic technology i.e. the range used is far less, in general employed for near controlled systems and the response time which is most significant in time demanding situations is ineffective.

## III. PROPOSED SYSTEM

The system proposed here i.e. “Wireless Technology Based Robot Communication System” eliminates all the above problems listed. This system provides the implementation of robotic technology in wars and also provides effective communication in between the robots placed in the war zone and these robots can be controlled by giving the voice commands using the voice module in our system. Our system is proposed with modules viz, a voice module, a master robot and a single slave robot, and as an independent document, please do not revise any of the current designations.

### A. Power supply

This project uses regulated 5V, 750mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/9V step down transformer.

### B. System Units

- **Microprocessors and microcontrollers** are widely used in embedded system products. Microcontroller is a programmable independent device. A microcontroller has a CPU in addition to a fixed amount of RAM, ROM, I/O ports and a timer embedded all on a single chip. The fixed amount of on-chip ROM, RAM and number of I/O ports in microcontrollers makes them ideal for many applications in which cost and space are a critical factor.
- The **AT89s52** is a low-voltage, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable memory. The device is manufactured using Atmel's high density nonvolatile memory

technology and is compatible with the industry-standard MCS-51 instruction set. The on chip flash allows the program memory to be reprogrammed in system or by a conventional non volatile memory programmer. By combining a versatile 8-bit CPU with flash on a monolithic chip, the Atmel AT89S52 is a powerful microcomputer, which provides a highly flexible and cost-effective solution to many embedded control applications.

- The **Voice module** could recognize your voice. It receives configuration commands or responds through serial port interface. With this module, we can control the car or other electrical devices by voice.

### C. Proposed System Design View

This system consists of a microcontroller, voice module, zigbee module and robotic platform.

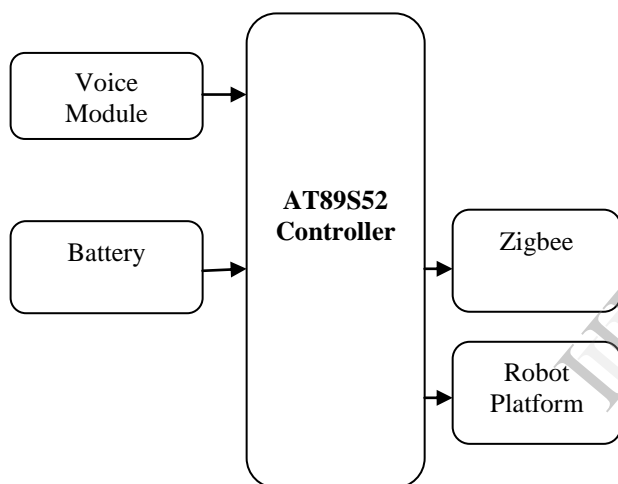


Fig. 1. Master Robot

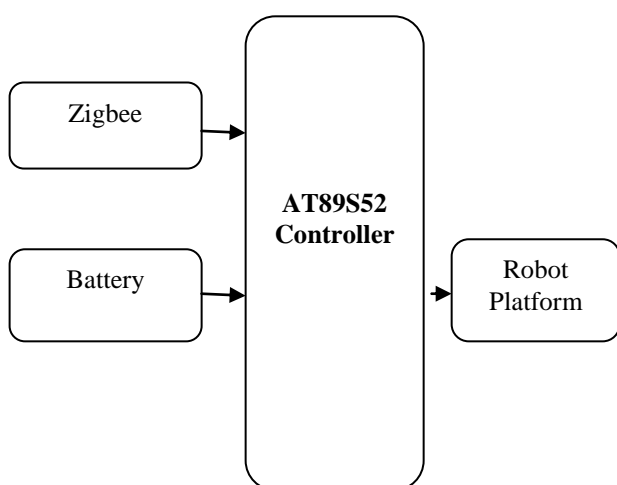


Fig. 2. Slave Robot

Our preliminary aim in this project is to build a multi robot communication system, in which a slave robot follows the master, an intelligent system in which master robot controls remaining slave robots (here proposed only one), and the master is controlled via voice module through zigbee. It serves as a prototype to speed up the work process in industrial management, automation and in defense sectors.

### D. Microcontroller

The Intel 8051 is Harvard's architecture, single chip microcontroller ( $\mu\text{C}$ ) which was developed by the Intel in 1980 for its use in embedded systems. It was popular in the 1980s and early 1990s, but today it has largely been superseded by a vast range of enhanced devices with 8051-compatible processor cores that are manufactured by more than 20 independent manufacturers including Atmel, Infineon Technologies and Maxim Integrated Products. 8051 is an 8-bit processor, meaning that the CPU can work on only 8 bits of data at a time. Data larger than 8 bits has to be broken into 8-bit pieces to be processed by the CPU. 8051 is available in different memory types such as UV-EPROM, Flash and NV-RAM.

### E. Voice Module

The Voice module could recognize your voice. It receives configuration commands or responds through serial port interface. With this module, we can control the proposed system or any device programmed for it.

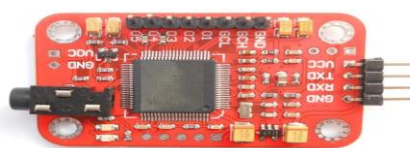


Fig. 3. Voice Module

This Voice module can store up to 15 pieces of voice instruction. These 15 pieces are divided into 3 groups, with 5 in each group. First we should train the module with voice instructions group by group. Thereafter, we should import one group before it could recognize the 5 voice instructions within that group. If we need to implement instructions in other groups, we should import the group first. This module is a speaker dependent. If you are the one who has trained the module, your friend or someone else might not be able to make it work.

### F. Zigbee Technology

Zigbee is the name of a specification that suites high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4 standard for wireless personal area networks (WPANs), such as wireless headphones connecting cell phones via short-range radio. The technology is intended to be simpler and cheaper than other WPANs, such as Bluetooth. Zigbee is targeted at radio-frequency (RF) applications which require a low data rate, long battery life, and secure networking.



Fig. 4. Zigbee Module

Zigbee is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power wireless M2M networks. The Zigbee standard operates on the IEEE 802.15.4 physical radio specification and operates in unlicensed bands including 2.4 GHz, 900 MHz and 868 MHz. Zigbee builds upon the physical layer and medium access control defined in IEEE standard 802.15.4 (2003 version) for low-rate WPAN's. The specification goes on to complete the standard by adding four main components: network layer, application layer, Zigbee device objects (ZDO's) and manufacturer-defined application objects which allow for customization and favor total integration.

### G. Liquid crystal Display

The LCD panel used in this block is interfaced with microcontroller through the output port. This is a 16 character x 2Line LCD module, depending up on the availability of LCD panel 3 lines or 4 lines panels can be used for the purpose, so that more information can be displayed simultaneously. These panels are capable of displaying numbers, characters, and graphics.

The LCD contains 16 pins of which 8 are data pins and 3 are control pins. The LCD is interfaced to the Microcontroller using one of its ports. The microcontroller used in this project has 32 I/O lines and 10 I/O lines that are interfaced with LCD panel, D0 – D7 of LCD panel known as 8 – bit data pins and this panel acquires the information from microcontroller through these data pins.

### H. Robot Platform

The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents to a range of 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications.

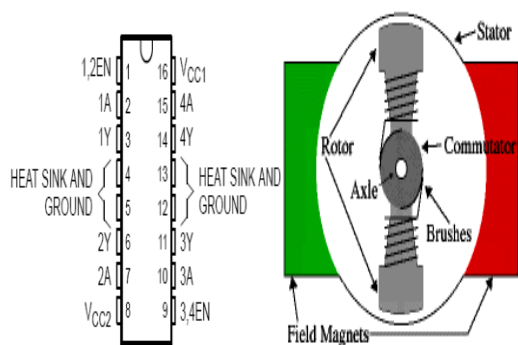


Fig. 5. Pin configuration of Motor driver

### I. Keil Software

Keil Compiler Software is used where the machine's language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. Keil compiler also supports 'C' language code.

Keil Software is the leading vendor for 8/16-bit development tools (ranked at first position in the 2004 Embedded Market Study of the Embedded Systems and EE Times magazine). Keil Software is represented world-wide in more than 40 countries. Since its market introduction in 1988, the Keil C51 Compiler is the de facto industry standard and supports more than 500 current 8051 device variants. Now, Keil Software offers development tools for ARM.

### J. Master robot

The master robot, is the central node of the network where master robot controls remaining slave robots, and the master is controlled via voice module through zigbee. It is the primary robot to be controlled in the process to which the direct commands are sent by the user serving as a prototype to speed up the work process in various sectors using zigbee communication.

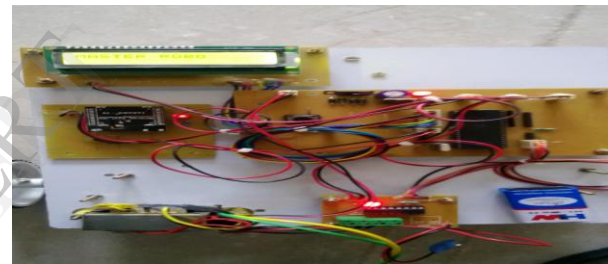


Fig. 6. Master robot

### K. Slave robot

The slave robot(s) is controlled by master robot commands, transmitted through zigbee. The kind of communication is useful in industrial process loading, shifting goods, moving materials. Master robot sends request signal to the slave robot then the slave transmits acknowledgment signals resulting in handshaking, then the master robot send commands, so that slave robot follows the order.

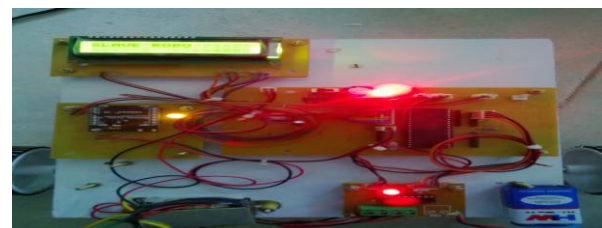


Fig. 7. Slave robot

For the last few decades, robots are becoming very popular and common in military sectors. There are many advantages of these robots compared to a human soldier. One of the most important things about these robots is that they

have the capability to perform missions remotely in the field, without any actual danger that happens to be for humans. This shows its great impact in military sectors, mining etc. These robots are sturdier and more capable of with-standing the damage to natural calamities climatic factors etc. Zigbee normally is chosen for the wireless military robot because of its larger connectivity range and reliability.

For solving the problem of the cooperation between robots, a communication system based on the Zigbee network was designed. In the hardware of the robots, the Zigbee nodes are introduced. The multi-robots form a star network by the Zigbee nodes, and they keep communicating with each other by a central node. The Zigbee network has many characteristics such as low cost, low power-consumption, strong anti-jamming ability and real-time performance etc, it adapts to the application of intelligence. Experiments showed that the communication between the robots is reliable.

#### IV. CONCLUSION

The designed system can be helpful to save the lives of people in war. These systems can be employed in areas where humans are incapable of working, automation, underground mining etc. These can be helpful in detecting land mines serving the defense purpose and also for providing service in situations like earth quakes, volcanic eruptions etc. In specialized areas of defense such as firing and also to provide first aid to the victims in war. The communication in between these robots is too easy as they function on the voice commands transmitted through zigbee. The software code is written in KEIL, can be easily understood and can be changed according to the requirements. Thus, the system can be implemented in the areas as discussed and to a greater extent providing higher reliability.

#### V. FUTURE SCOPE

The proposed system can be extended in various ways implementing various vast devices and complicated structures. Also many sensors can be interfaced in the existing system so that wider range of usage and functionality is achieved in the present robotic technology. Thus there is a lot of scope for its advancements in the proposed system and this plays a very influencing and vital role in saving many valuable lives especially soldiers, our saviors.

#### REFERENCES

- [1] ZigBee Alliance, ZigBee Specification, Version 1.0 ZigBee Document 053474r06, December 14th, 2004
- [2] P. Kinney, ZigBee Technology: Wireless Control that Simply Works, White Paper dated 2 October 2003
- [3] Sheng-Fu Su, The Design and Implementation of the ZigBee Protocol Driver in Linux, White Paper dated 26 July 2005.
- [4] IEEE 802 Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks, IEEE Computer Society, 2003
- [5] Yun Chan Cho and Jae Wook Jeon "Remote Robot control System based on DTMF of Mobile Phone", IEEE International Conference INDIN 2008, July 2008
- [6] R.C. Luo, T.M. Chen, and C.C. Yih, "Intelligent autonomous mobile robot control through the Internet", IEEE International Symposium ISIE 2000, vol. 1, pp. 6-11, December 2000.
- [7] Balch, T. and R. Arkin (1998). Behavior-based formation control for multi-robot teams. IEEE Transaction on Robotics and Automation 14(6), 926{938}.
- [8] Bicho, Estela and Sergio Monteiro (2003). Formation control for multiple mobile robots: a nonlinear attractor dynamics approach. In: Proceedings of IROS 2003. pp. 2016{2022}.
- [9] A. K., R. Fierro, V. Kumar, J. P. Ostrowski, J. Spletzer and C. J. Taylor (2002). A vision based formation control framework. IEEE Transactions on Robotics and Automation 18, 813{825}. S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.
- [10] Hu, X., D. Fuentes and T. Gustavi (2003). Sensor-based navigation coordination for mobile robots. M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.