DESIGN OF ARMY FIELDED COMBAT ROBOT

Apoorva Srivastava[1], Arpita Tiwari[2], Ashi Sinha[3]

[1, 2, 3] UG, Department of Electronics and Communication Engineering

Raj Kumar Goel Institute of Technology for Women, Ghaziabad, (India)

ABSTRACT

The objective of this paper is to minimize human calamities in terrorist attacks such as 26/11. This combat robot has been designed to face such an atrocious terror attacks. The robot is radio operated, self- powered, and has all the controls of a car. A wireless camera has been installed on it, so that enemy can be monitored remotely when required. This robot can silently enter into enemy area and send us all the data through its camera eyes. This robot can be used in star hotels, shopping malls, jewellery show rooms, etc. where there can be danger from intruders.. Since human life is precious, these robots are the reinstatement of fighters against terrorist in war areas.

Keywords: Combat Robot, Wireless Camera, Terror Attack, Radio Operated, Self-Powered, Intruders.

I INTRODUCTION

The global focus on terrorism and immunity may have geared up following the 9/11 attacks in the USA. The danger of terrorist attack can perhaps never be wiped out, but sensible steps can be taken to dwindle the risk. The word "robot" was first coined in a 1921 play titled as R.U.R. Rossum's universal robots, by writer Karel Capek. Robot is a Czech word which means "worker."

Merriam-Webster defines robot [1] as a machine that resembles human being and perform various complex acts; a device that automatically performs complicated and often repetitive tasks; a mechanism which has automatic controls.

We get a rough idea about what comprises a robot, which needs to observe the outside world and act accordingly, by these definitions. We have motors, pulleys, levers, gear, gearbox, chains, and many more mechanical systems, which helps in locomotion. There are sound, light, magnetic field and many other sensors that guide the robot to collect information about its surroundings. There are processors powered by powerful software that help the robot make feel environmental data captured and tell it what to do next and also provides microphones, speakers, displays, etc. that help the robot to interact with human.

1.1 The objectives of using robot are

(a) Where man dares not venture, robots have been put to use in environments that are hazardous for man.

(b) To rescue, pronto, robots work under dangerous conditions, for search and rescue after disasters. A hosts of robot built by the University of South Florida's Centre for robot guided search and rescue were in action at the World Trade Centre site within hours after the disaster to delve into the rubble and rescue lives. Similarly, robots also work in underground mines. Many researches today is focused on improving rescue functions of robots.

(c) We even make them during war. The faithful robots do not hesitate to tread the dreaded terrain of battlefields [2]. Battle robots of different shapes and sizes were employed to defuse landmines, look for criminals hiding in caves, search for bombs beneath cars and in buildings. These robots were solely controlled by human. As interest in robotics continues to widen, robots are increasingly being integrated into everyday life. The integrations results in end users who possess limited technical knowledge [3]. Currently, the primary mode for robot communication uses RF. RF is a choice for communication as it allows more information to be transferred at high speed and over long distance. This paper seeks the use of readymade RF networks for communication and device control.

II HARDWARE IMPLEMENTATION

The block diagram of the hardware implementation of the system is as shown in the figure 1 [7]. This robot is self-powered; radio operated and has all the controls like a car. A pair of laser guns is installed, so that it can attack enemy remotely when required. Wireless camera is required to send real time video and audio signals, which could be viewed on a remote monitor, and action can be performed accordingly.

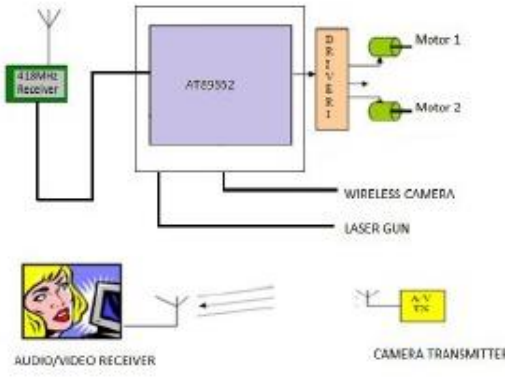

Figure 1: Block Diagram of Combat Robot

Microcontroller acts as master controller which decodes all the commands received from the transmitter and give commands to slave microcontroller. It also works as slave microcontroller which is responsible for executing all the commands received from the master and also generating PWM pulses for the speed control. Based on the input codes master will command slave microcontroller and robot will behave as follows:

- movement in forward direction
- movement in reverse direction
- speed controls in all the direction
- it can turn left or right while moving forward or in reverse direction
- instant reverse or forward running without halt

2.1Transmitting unit

A variable frequency oscillator 1 is used here, for modulating the frequency i.e. to be transmitted and provides its output to a high frequency oscillator 2 to generate a carrier signal. The carrier wave is radiated into space by an antenna.

2.2 Receiving unit

The receiving antenna is connected to a tuned wave detector for detecting the waves transmitted by the transmitter antenna .the output of the tuned wave detector is connected to amplifier which has its output connected to the input of the high pass frequency as well as a filter to the low pass frequency filter. The output of amplifiers are connected to separate motor and other side of motors are connected to voltage potential .the high pass frequency filter extracts the higher frequency components of the output signals from the amplifier and a low pass frequency filter extracts the lower frequency components of the output signal from the amplifier .

III COMPONENTS OR SUBSYSTEMS DESCRIPTION

3.1 Microcontroller Circuit (AT89S52)

It is the heart of this system that controls all the activities of transmitting and receiving. The IC which is used is AT89S52. The AT89S52 microcontroller [4] is an 8-bit microcontroller which consists of 8k bytes of in-system programming flash memory. The device is manufactured by using ATMEL'S high-density non-volatile memory technology and is appropriate with the industry standard 80C51 instruction set and pin out. The on-chip flash permits the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By connecting a versatile 8-bit CPU with in-system programmable flash on a chip (monolithic), a powerful microcontroller (ATMEL AT89S52) that gives a highly-flexible and cost-effective solution to embedded control applications. The idle mode halts the CPU while permitting the timer/counter, RAM, serial port, and interrupt system to continue to function. The power-down mode retains the ram contents but freezes the oscillator, which disables all other chip functions until the consequent chip interrupt or hardware reset.

3.2 Power Supply Circuit

The prime building block of an electronic system is power supply. For the microcontroller, the keyboard, LCD, RTC, GSM, +5V are used & for driving buzzer +12V is required. The power supply [5] gives regulated output of +5V & non-regulated output of +12V. Three terminal IC7805 meets the requirement of +5V regulated supply. And

the secondary voltage from the main transformer is rectified by electronic rectifier & filtered by capacitor. The unregulated DC voltage is then supplied to the input pin of regulator IC. ICs that are used are fixed regulators with internal short circuit current limiting & thermal shutdown ability.

3.3 Decoder HT-12D

The decoders are a series of CMOS LSIs for applications in remote control system. They are paired with Holtek 212 series of encoders. Thus for proper operation, a pair of encoder/decoder with the same number of addresses and data format should be selected. The decoders receive serial addresses and data from a programmed 212 series of encoders that are transmitted by a carrier using an RF or IR transmission medium. Further they compare the serial input data three times continuously with their local addresses. In case no error or unmatched codes are detected, the input data codes are decoded and then transferred to the output pins.

3.4 Encoder HT-12E

The 212 encoders are a series of CMOS LSIs for remote control system uses. These encoders are capable of encoding information which consists of N address bits and 12_N data bits. Every address/data input can be set to one of the two logic states. All the programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal. HT12E's ability to select a TE trigger further enhances the application flexibility of the 212 series of encoders.

3.5 DC Motors

For the movement of our robot, we are using DC motors [6]. Motor is operated by 12V DC power supply. The operation of electric motor is based on the principle of electromagnetism which states that a magnetic field is generated by a current carrying conductor and when this is placed in an external magnetic field, it experiences a force proportional to the current in the conductor, as well as to the strength of the external magnetic field.

3.6 Motor Driver L293D

The Device is a monolithic integrated high current, high voltage four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads and switching of power transistors. For simplifying use as two bridges each pair of channels is equipped with an enable input.

A separate supply input is provided for the logic, that allows operation at a lower voltage and internal clamp diodes are included. The device is suitable for use in switching applications at frequencies up to 5 kHz. This motor driver L293D is assembled in a 16 lead plastic package which has 4 center pins connected together and used for heat sinking. And the chip is designed to control 2 DC motors. For each motor there are 2 Input and 2 output pins. Motor's behavior for various input is shown in Table 1[7].

Operation	A	B
Stop	Low	Low
Clockwise	Low	High
Anticlockwise	High	Low
Stop	High	High

Table 1: Motor Behavior for Various Inputs

3.7 Transmitter for Laser gun

The transmitter is constituted by AT90S2323 microcontroller and TLP434 RF transmitter module at 418MHz frequency. The transmitter is designed for more battery economy and safe transmission of the data/packets. Block diagram for the transmitter of laser gun is as shown in Figure 5 [7].

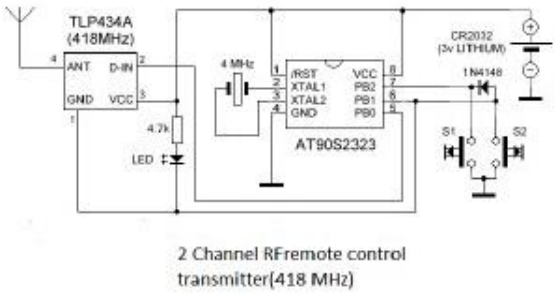

Figure 5: Block Diagram of Transmitter Laser Gun

TLP434A is an Ultra-small Transmitter of range 418MHz with ASK modulation scheme with 2-12 dc voltage operating voltage range. The IC is usually chained with the encoder IC. This transmitter is connected to the 10MHz microcontroller that is AT90S2323. It constitutes the transmitter section of laser gun.

3.8 Receiver for Laser Gun

The receiver consists of RF receiver module RLP434A at 418MHz frequency, microcontroller AT90S2313 and two relays that can handle any electric device up to 10 Amps. The RLP434A is an RF receiver module with receipt frequency of 418MHz with ASK modulation technique. 2 outputs are obtained from this module, first is digital, having levels from 0V to VCC and the analog output which is not used. The transmitter sends 4 bytes with 2400bps 4 times and the receiver RLP-434A collects them and moves them to AT90S2313 to the RxD pin that is PD0. The Block diagram for receiver of the laser gun is depicted in Figure 6 [7].

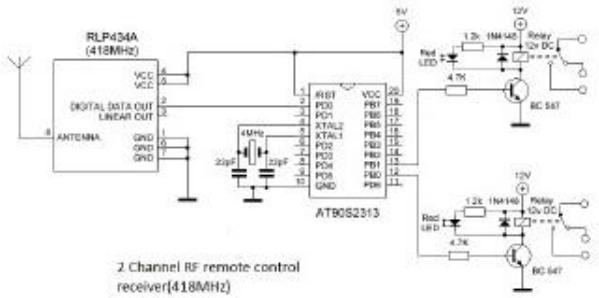

Figure 6: Block Diagram for Receiver Of Laser Gun

RL434A is a surface acoustic wave based receiver having compatibility with 418MHz of frequency having operating range from 3.3-6 dc voltage. It employs ASK modulation technique. As transmitter, we have 8-bit microcontroller AT90S2313 with 2k flash memory with 11 pin DIP.

3.9 RF Communication

Radio frequency is a rate of oscillation in the range of about 3 kHz to 300 GHz that corresponds to the frequency of radio waves. RF usually refers to electrical rather than mechanical oscillations. Energy in an RF current can radiate off a conductor into space as electromagnetic waves, this lays the basis of radio technology.

3.10 JMK AV Receivers with a Wireless Camera

It is mini wireless monitoring video camera and wireless receiver set for home and small business surveillance and is used here for the purpose of demonstration. The wireless camera is installed in the room where we want to monitor and wireless receiver is set in the next room (up to 15 meters away) and is hooked up to a TV or DVR to watch the action or record the footage for the security purpose.

In this wireless camera is placed in the combat robot. AV Receiver wireless camera is as shown in Figure 7.

Figure 7: JMK AV Receiver and Wireless camera

3.11 TV Capture Card

A TV capture card is a computer component that allows computer to receive television signals. This card is a kind of television tuner. TV tuners also function as video capture cards that allow them to record television programs onto a

hard disk. A Digital TV tuner card is as shown in Figure 8.

Figure 8: ATI Digital TV Capture Card

This card contains a tuner, an analog-to-digital converter along with demodulation and interface logic.

3.12 Remote Control Decoder SC2272-T4

Remote Control Decoders are generally used for wireless remote control receivers and its features include:

- Operating voltage DC 4-6V
- Up to 12 tri-state code address pins
- Up to 6 data pins
- Toggle control mode

IV SOFTWARE IMPLEMENTATION

For Software implementation we are using AVR Studio and a Flash Magic simulator. Not only does Atmel's free IDE (Integrated Development Environment) AVR Studio provide the framework for compiling programs and downloading them to the microcontroller, but it also comes with the ability to simulate programs for most of their AVR microcontrollers. This simulator has the ability to not only execute AVR instructions but also to simulate limited digital I/O (input/output).

Simulation helps in understanding hardware configurations and avoids time wastage on setup issues. We can write and test applications before target hardware is available by doing simulation. The system program written in embedded C will be stored in Microcontroller.

The industry-standard AVR C Compilers, Assemblers, Debuggers, Single-board Computers, and Emulators support all 89S52 series. The AVR Development Tools are designed in such a way so as to solve the complex problems facing embedded software development engineers.

AVR studio can also be used with a USB device called an AVR JTAG programmer/debugger to debug real running hardware from the PC using exactly the same interface as the simulator. This AVR JTAG device is an interface between AVR Studio, PC's USB port and a six pin connector on the target hardware board. It allows to view and change any data inside the running microcontroller as well as to control program execution in exactly the same way as done in the AVR simulator.

One of the best things that AVR studio and WinAVR which actually provides the windows version of the compiler

tools is that it is free, performs pretty well, reasonably fast, and does not seem to crash very often.

V RESULTS AND DISCUSSION

The orientation of robot is directed with the help of remote controllers, they are also used to operate the laser gun. The robot moves in two modes i.e., Manual mode and self-mode. In the case of manual mode it is brought under the user's control. While in self-mode, robot starts moving over surface and takes action according to the situation.

The obstacles are detected with the help of Infrared sensors (left sensor and right sensor) in the front portion of the module. Moving on the surface, when the left sensor is detected, the robot steps backwards for a moment and then move towards right. And if the right sensor is detected, robot gets back and moves towards left.

VI APPLICATIONS

- It can be adequately implemented in national defense through military-industrial partnership projects. It is shown in the figure 11.

Figure 11: Top View of Combat Robot

- It can be vastly applied in Resorts, borders of noted buildings and remote boarder areas.
- Combat robots are installed in the stadiums, sacred places, government and non-government organizations assure top security and ease of management.

VII CONCLUSION

We all know, these days India is sick off massive terror attacks, bomb explosions and many other such activities. To avoid such disasters TECHNOLOGICAL power must exceed HUMAN power. Human life and time is priceless. It is our duty to take an initiative to design a model of an apt robot that can meet the combatant needs of the nation. So to avoid terror attacks, to ensure more security at the border and high density areas it's wise to maintain a world class military technology according to the combatant needs. Each nation needs its own defense system for its security and integrity. Construction of these robots will carry nation's name and fame worldwide.

REFERENCES

[1] .K.S.Fu, R.C.Gonzalez, C.S.G..Lee, Tutorials Robotics.

[2] Asaro, P. *How just could a robot war be*? Frontiers in Artificial Intelligence and Applications, 75, 50-64.

[3] S.Y. Harmon & D. W. Gage, "*Current Technical Research Issues of Autonomous Robots Employed In Combat*", 17th Annual Electronics and Aerospace Conference.

[4] www. Atmel.com

[5] Robert L.Boylestad and Louis Nashelsky, "*Electronic Devices and Circuit Theory*", 8th Edition, 2006.

[6] A. Khamis, M. Pérez Vernet, K. Schilling, "*A Remote Experiment on Motor Control of Mobile Robots*", 10thMediterranean Conference on Control and Automation – MED2002.

[7] (IJACSA) *International Journal of Advance Computer Science and Application*, Vol. 2, No.8, 2011