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Intelligent Combat Robot

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Abstract: This paper is to describe the development of robotic vehicle using RF technology for communicating between transmitter and receiver. This robot minimizes human causalities [1]. A wireless camera has been installed which can transmit real time video. This robot is very much useful for spying, war fields, Terror attacks, Natural disasters and mining areas. An 8051 series microcontroller is used for the control operation. At transmitting end using command buttons the movement of receiver is controlled either to move forward, backward, left, right or stop. This combat robot is installed with a laser gun where it can fire towards enemies remotely. A stepper motor has been installed for the rotation of camera in clockwise or counter clockwise direction. Camera mechanism is installed where it helps the person at watching station to monitor its direction of movement. Since manpower is always precious, these robots minimize the human risks and replace the humans at dangerous situation.

Keywords: Combat robot, Camera, Radio operated, Terror attacks.

I. INTRODUCTION

The world is seriously focusing on terrorism and security after the 26/11 attack in Mumbai, India. The terror attacks can never be completely stopped but steps can be taken to reduce the risks of attacks [2]. Robot is described as a machine that performs complicated and often repetitive tasks. It is also defined as an automatically controlled, multipurpose manipulator either fixed in a place or mobile for user application.

A robot needs to sense the surrounding environment and act accordingly. There are sound, light, magnetic field and many more to help robot to collect information about its environment. The processor powered by software helps the robot to sense the environmental data and instruct it what to do next and also the visual display helps the robot to interact with humans.

The main objective of using robot is,

A. Where human safety is not assured

Robots have been put to use in environments that are hazardous to humans.

B. To rescue operation

Robots work in unsecured environment for safer search and rescue operation after a disaster. It can also be made to work in mines [3].

C. For spying

The robots can move even in the dreadful terrains in battlefield. It is used to search for enemies hiding in caves, search for bombs placed and also spying without the knowledge of enemies.

D. Self suicide

When the robot is surrounded by number of enemies and situation is too critical the robots can self explode and harm the enemies surrounded by it.

The main aim to develop this project is to reduce terrorist causality. Being able to achieve reliable long distance communication is an important open area of research to robotics as well as other technology areas [4]. As interest in robotics continues to grow, robots are increasingly being integrated into everyday life.

Currently the primary mode for robot communication uses RF. RF is an obvious choice for communication since it allows more information to be transferred at high speed and over long distance. This paper explains the need of RF network for communication and device control. This eliminates the new infrastructure and detailed technical research.

II. PROPOSED BLOCK DIAGRAM

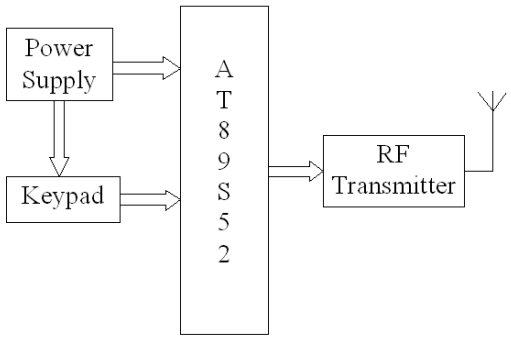

Fig.1 Block diagram of Transmitter Module.

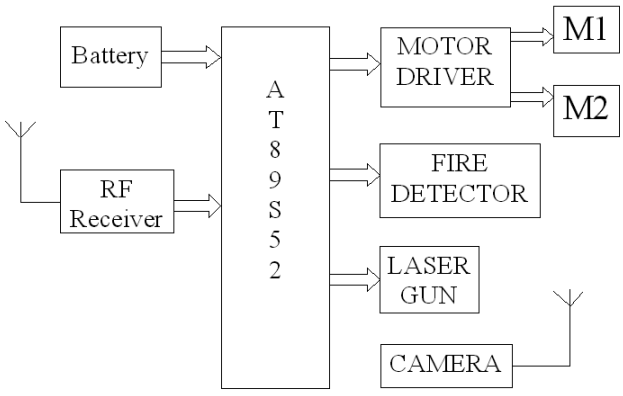

Fig.2 Block diagram of Receiver Module.

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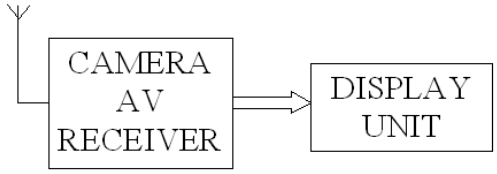

Fig.3 Block diagram of Display unit.

III. IMPLEMENTATION

The above block diagram of the hardware shows the entire system in the Figure1, 2 & 3. This robot is radio operated, Self-powered and has all the controls like a normal car. A laser gun has been installed on it, so that it can fire on enemy remotely when required. Wireless camera will send real time video and audio signals, which could be seen on a remote monitor, and action can be taken accordingly.

Microcontroller AT89S52 acts as master controller, decodes all the commands received from the transmitter and give commands to slave microcontroller [5]. It also acts 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 give command to slave microcontroller and robot will behave as follows.

- moves in forward direction
- moves in reverse direction
- speed controls in both the direction
- it can even turn left or right while moving forward or in reverse direction
- Instant reverse or forward running without stopping.

A. Transmitting unit

Here a variable frequency oscillator1 is used for modulating the frequency i.e. to be transmitted and has its output to a high frequency oscillator 2 for generating a carrier wave. The carrier wave is then radiated into space by the antenna. The transmitter module is shown in Figure 1.

B. Receiving Unit

The receiving antenna is connected to a tuned wave detecting circuit for detecting the waves transmitted by transmitter antenna. The output of the tuned wave detecting circuit is connected to amplifier which in turn has its output connected to the input of the high pass frequency as well as the filter to a low pass frequency filter.

The outputs of amplifiers are connected to separate motors 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 the low pass frequency filter extracts the lower frequency components of the output signal from the amplifier .The receiver module is shown in Figure 2.

IV. HARDWARE USED

A. Microcontroller circuit (AT89S52)

It is the important part of the system which controls all the activities of transmitting and receiving. The IC used is AT89S52. The AT89S52 Microcontroller is an 8-bit microcontroller with 8K Bytes of In-System Programming Flash Memory [6]. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer.

By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

B. Decoder HT-12D

The decoders are a series of CMOS LSIs for remote control system applications [7]. They are paired with Holtek 2^{12} series of encoders. For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen.

The decoders receive serial addresses and data from a programmed 2^{12}series of encoders that are transmitted by a carrier using an RF or an IR transmission medium. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins.

The VT pin also goes high to indicate a valid transmission. The 2^{12}series of decoders are capable of decoding information's that consist of N bits of address and 12_N bits of data. Of this series, the HT12D is arranged to provide 8 address bits and 4 data bits, and HT12F is used to decode 12 bits of address information

C. Encoder HT-12E

The 2^{12}encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding information which consists of N address bits and 12_N data bits. Each address/data input can be set to one of the two logic states. 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. The capability to select a TE trigger on the HT12E further enhances the application flexibility of the 2^{12}series of encoders [7].

D. DC Motors

For the movement of our robot, we are using DC motors [8]. It is operated by 12VDC power supply. In any electric motor, operation is based on simple electromagnetism. A current carrying conductor generates a magnetic field, when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field.

E. Motor Driver L293D

The Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard

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DTL or TTL logic levels and drive inductive load sand switching power transistors.

To simplify use as two bridges each pair of channels is equipped with an enable input.

A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included.

This device is suitable for use in switching applications at frequencies up to 5 kHz. The L293D is assembled in a 16 lead plastic package which has 4 center pins connected together and used for heat sinking.

The chip is designed to control 2 DC motors. There are 2 Input and 2 output pins for each motor. The behavior of motor for various inputs is shown in Table 1.

Operation	A	B
Stop	Low	Low
Clockwise	Low	High
Counter clockwise	High	Low
Move	High	High

Table 1. Movements of motors

F. RF Communication

Radio frequency (RF) is a rate of oscillation in the range between 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals.

RF usually refers to electrical rather than mechanical oscillations. The energy in an RF current can radiate off a conductor into space as electromagnetic waves (radio waves), this is the basis of radio technology.

G. AV Receiver with Wireless Camera

It is mini wireless monitoring video camera and wireless receiver set for home and small business surveillance and is used here for demonstration purpose.

Simply install the wireless camera in the receiver module where we can get a clear view and set the wireless receiver in the base station (up to 15 meters away) and hook it up to a TV or DVR to watch the action or record the footage for the security records.

Here we are placing this wireless camera in the combat robot. Description of AV Receiver wireless camera is as shown in Figure 4.

Fig.4 AV receiver and wireless camera.

V. SOFTWARE USED

For the software implementation, we deploy two software packages. First one is the Keil µVision 3.0, second one is the Flash magic simulator.

The Keil µVision Debugger accurately simulates on-chip peripherals (I²C, CAN, UART, SPI, Interrupts, I/O Ports, A/D Converter, D/A Converter, and PWM Modules) of 89S52device.

Simulation helps to understand hardware configurations and avoids time wasted on setup problems.

With simulation, we can write and test applications before target hardware is available .The system program written in embedded C [6] using KEIL IDE software will be stored in Microcontroller.

Keil development tools for the Microcontroller Architecture support every level of software developer from the professional applications engineer to the student for learning about embedded software development.

The industry-standard Keil C Compilers, Macro Assemblers, Debuggers, Real-time Kernels, Single-board Computers, and Emulators support all 89S52 derivatives.

The Keil Development Tools are designed to solve the complex problems facing embedded software developers.

Flash magic is used to dump the code to microcontroller from PC. Flash Magic is a free, powerful, feature-rich Windows application that allows easy programming of Philips FLASH Microcontrollers.

Build custom applications for Philips Microcontrollers on the Flash Magic platform! Use it to create custom end-user firmware programming applications, or generate an in-house production line programming tool.

The Flash Memory In-System Programmer is a tool that runs under Windows 95/98/NT4/2K. It allows in-circuit programming of FLASH memories via a serial RS232 link. Computer side software called Flash Magic is executed that accepts the Intel HEX format file generated from compiler Keil to be sent to target microcontroller. It detects the hardware connected to the serial port.

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VI. FLOW CHART

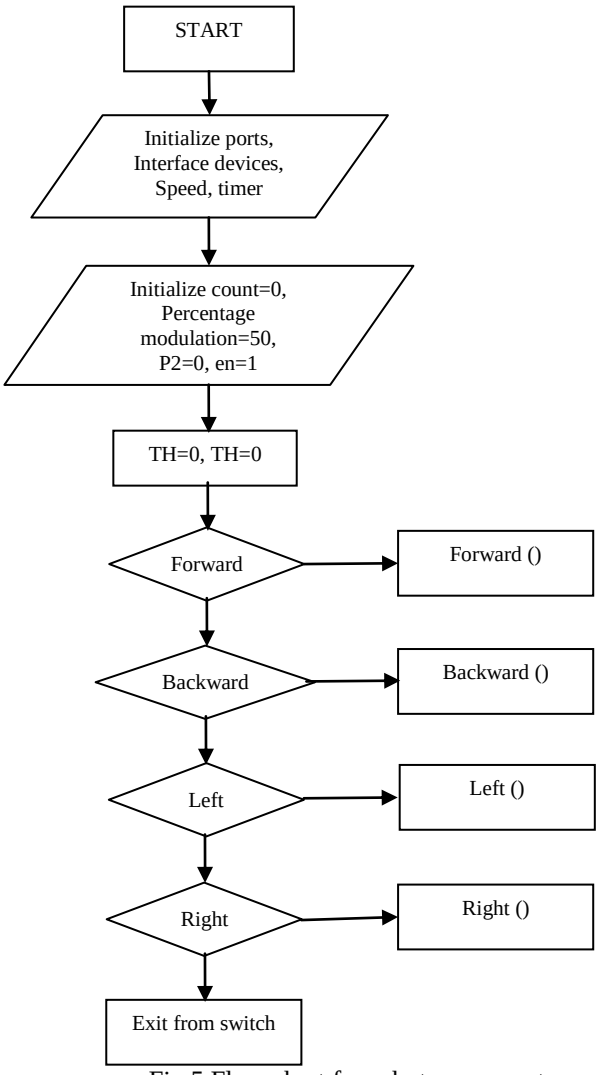

Fig.5 Flow chart for robot movement

VII. RESULT

Remote controllers are designed to direct the orientation of robot and to operate the laser gun. Robot keeps on moving in Manual mode. It's brought under user's control in the manual mode. To detect the obstacles, we have deployed Infrared sensors (left sensor and right sensor) in the front portion of the module. The front view and top view of designed combat robots are shown in the figures 6 & 7.

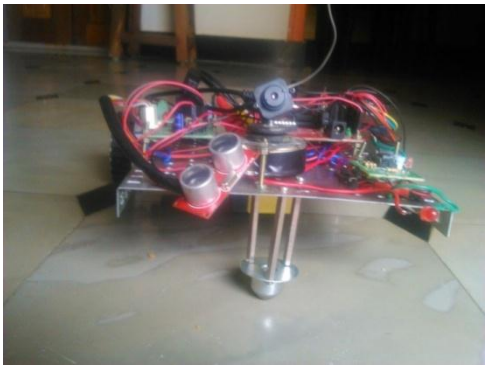

Fig.6 Front view of combat robot

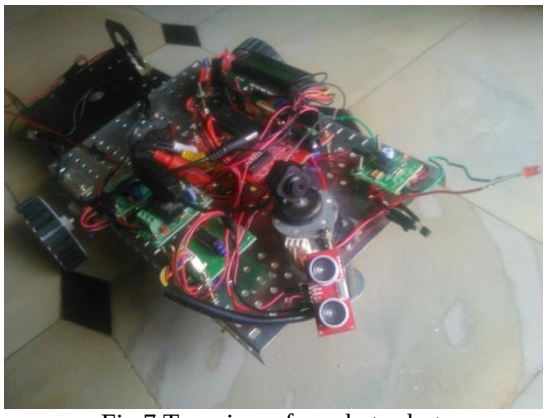

Fig.7 Top view of combat robot

The robot operation is as mentioned below

- When front button is pressed it moves front
- When back button is pressed it moves backwards
- When left button is pressed it moves left
- When right button is pressed it moves right
- Continuous audio and video are received.

VIII. APPLICATIONS

- Can be implemented in national defense purpose in border areas.
- Suicide bomber to destroy enemies
- Terror attacks areas to know the weapons and explosives they are having and to keep track on them.
- Human prohibited areas such as nuclear plant, Petroleum well etc.
- Mining areas to know the environmental conditions such as temperature, humidity etc.

IX. CONCLUSION

As we all know, these day's world is sick off massive terror attacks, bomb explosions. To avoid such disasters technological power must exceed human power. Human life and time are priceless.

It's our responsibilities to take an initiative to design a model of a robot that meets combatant needs. 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 in accordance with combatant needs.

Even every nation needs its own defense system for their integrity and security. In such a way construction of these robots will carry nation's name and fame globally.

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