Wireless Target Recognition and Counter Attacking Robot with Laser Gun Activation

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Abstract

This paper mainly aims in designing completely an automated target recognition and counter attacking robot with laser gun using Zigbee wireless technology. It majorly aims in detection of bombs using metal detection sensor and to know the location of the robot using GPS module. The system also uses joystick module to control the robot and automatic counter attacking using laser gun when the missile is detected using ultrasonic distance sensor. The system uses ultrasonic distance finder sensor to estimate the target distance and displays on LCD. The robot also uses wireless camera you can view both audio and video on the TV.

Key words: *Zig bee, metal detection sensor, ultrasonic distance sensor, wireless camera, GPS module.*

1.HARDWARE DESCRIPTION

1.1 Microcontroller:

A Microcontroller is a programmable digital processor with necessary peripherals. Both microcontrollers and microprocessors are complex sequential digital circuits meant to carry out job according to the program / instructions. Sometimes analog input/output interface makes a part of microcontroller circuit of mixed mode (both analog and digital nature). The microcontroller used in this project is PIC16F877A. The PIC families of microcontrollers are developed by Microchip Technology Inc. Currently they are some of the most popular microcontrollers, selling over 120 million devices each year. There are basically four families of PIC microcontrollers:

PIC12CXXX 12/14-bit program word
PIC 16C5X 12-bit program word
PIC16CXXX and PIC16FXXX 14-bit program word
PIC17CXXX and PIC18CXXX 16-bit program word.

Pic16f877 is a 40 pin microcontroller. It has 5 ports port A, port B, port C, port D, port E. All the pins of the ports are for interfacing input output devices.

Port A: It consists of 6 pins from A0 to A5
Port B: It consists of 8 pins from B0 to B7
Port C: It consists of 8 pins from C0 to C7
Port D: It consists of 8 pins from D0 to D7
Port E: It consists of 3 pins from E0 to E2

The rest of the pins are mandatory pins these should not be used to connect input/output devices. Pin 1 is MCLR (master clear pin) pin also referred as reset pin. Pin 13, 14 are used for crystal oscillator to connect to generate a frequency of about 20MHz.Pin 11, 12 and31, 32 are used for voltage supply Vdd(+)and Vss(-)

PIC 16F877A Specification:

RAM	368 bytes
EEPROM	256 bytes
Flash Program Memory	8k words
Operating Frequency	DC to 20MHz
I/O port	Port A,B,C,D,E

1.2 REGULATED POWER SUPPLY:

Every electronic system requires DC voltage and it will be 5V supply, basicall, we get 230V, 50Hz in our household applications which can be used to operate the home appliances like TV, cooler, fans, etc but digital electronic devices needs DC voltage which we can get from regulated power supply. The circuit diagram of a regulated power supply with led connection is shown in fig: 1.

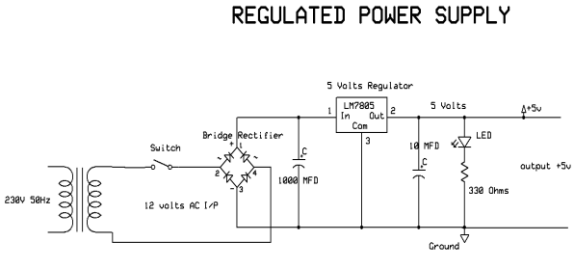

Fig 1: circuit diagram of a regulated power supply with led connection

1.3. ZIGBEE:

When we hold the TV remote and wish to use it we have to necessarily point our control at the device. This one-way,line-of-sight, short-range communication uses infrared (IR) sensors to enable communication and control and it is possible to operate the TV remotely only with its control unit.

. Add other home theatre modules, an air-conditioner and remotely enabled fans and lights to our room, and we become a juggler who has to handle not only these remotes, but also more numbers that will accompany other home appliances we are likely to use.

Some remotes do serve to control more than one device after 'memorizing' access codes, but this interoperability is restricted to LOS, that too only for a set of related equipment, like the different units of a home entertainment system.

Now picture a home with entertainment units, security systems including fire alarm, smoke detector and burglar alarm, air-conditioners and kitchen appliances all within whispering distance from each other and imagine a single unit that talks with all the devices, no longer depending on line-of-sight, and traffic no longer being one-way.

This means that the devices and the control unit would all need a common standard to enable intelligible communication. ZigBee is such a standard for embedded application software and has been ratified in late 2004 under IEEE 802.15.4 Wireless Networking Standards.

ZigBee is an established set of specifications for wireless personal area networking (WPAN), i.e., digital radio connections between computers and related devices. This kind of network eliminates use of physical data buses like USB and Ethernet cables. The devices could include telephones, hand-held digital assistants, sensors and controls located within a few meters of each other.

ZigBee is one of the global standards of communication protocol formulated by the relevant task force under the IEEE 802.15 working group. The fourth in the series, WPAN Low Rate/ZigBee is the newest and provides specifications for devices that have low data rates, consume very low power and are thus characterized by long battery life.

1.4. D.C. Motor:

A DC motor uses electrical energy to produce mechanical energy, very typically through the interaction of magnetic fields and current-carrying conducters. The reverse process of producing electrical energy from mechanical energy is accomplished by an alternator, generator or dynamo. Many types of electric motors can be run as generators, and vice versa. The input of a DC motor is current/voltage and its output is torque (speed).

The DC motor has two basic parts: the rotating part that is called the armature and the stationary part that includes coils of wire called the field coils. The stationary part is also called the stator. Figure shows a picture of a typical DC motor, Figure shows a picture of a DC armature, and Fig shows a picture of a typical stator. From the picture you can see the armature is made of coils of wire wrapped around the core, and the core has an extended shaft that rotates on bearings. You should also notice that the ends of each coil of wire on the armature are terminated at one end of the armature. The termination points are called the commutator, and this is where the brushes make electrical contact to bring electrical current from the stationary part to the rotating part of the machine.

1.4 Metal Detection Sensor :

A metal detection sensor detects metallic objects which are at a distance up to 7 cm. The sensor gives an active low output when detecting a metal and also indicates through a LED.

The heart of this sensor is the inductive oscillator circuit which monitors high frequency current loss in coil. The circuit is designed for any metallic body detection by detecting the variations in the high frequency Eddy current losses. With an external tuned circuit they act as oscillators. Output signal level is altered by an approaching metallic object.

Output signal is determined by supply current changes. Independent of supply voltage, this current is high or low according to the presence or the absence of a close metallic object. If the metal object is near the searching coil, the output current will flow more. On the other hand, the current will be decrease when the object is far from the searching coil.

1.5 Global Positioning System (GPS) :

The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS.

The GPS is made up of three parts: satellites orbiting the Earth; control and monitoring stations on Earth; and the GPS receivers owned by users. GPS satellites broadcast signals from space that are picked up and identified by GPS receivers. Each GPS receiver then provides three-dimensional location (latitude, longitude, and altitude) plus the time.

Individuals may purchase GPS handsets that are readily available through commercial retailers. Equipped with these GPS receivers, users can accurately locate where they are and easily navigate to where they want to go, whether walking, driving, flying, or boating. GPS has become a mainstay of transportation systems worldwide, providing navigation for aviation, ground, and maritime operations. Disaster relief

and emergency services depend upon GPS for location and timing capabilities in their life-saving missions. Everyday activities such as banking, mobile phone operations, and even the control of power grids, are facilitated by the accurate timing provided by GPS. Farmers, surveyors, geologists and countless others perform their work more efficiently, safely, economically, and accurately using the free and open GPS signals.

1.6 Ultrasonic Distance Sensor :
SRF04 - Ultra-Sonic Ranger

The SRF04 requires a short 10us pulse to the trigger input to start ranging. The module then sends out an 8 cycle burst of ultrasound at 40 kHz and raises its echo line high. It then listens for an echo, and as soon as it detects one it lowers the echo line again. The echo line is therefore a pulse whose width is proportional to the distance to the object. By timing this pulse with your controller it is possible to calculate the range.

This is a fantastic ultrasonic ranger that has an approximate range of 3" to 10'. This ranger has a logic line used to trigger a pulse and the echo is returned on a second line. Minimal power requirements and a compact, self contained design make this one of our most popular detectors. A low cost ultrasonic rangefinder for measuring distances between 3cm and 3m.

This ranger is a perfect for your robot, or any other projects requiring accurate ranging information. This sensor connects to the digital I/O lines of your microcontroller.

Specifications

1. Voltage: 5.0V
2. Current: 30mA Typ. 50mA Max
3. Frequency: 40 kHz
4. Max Range: 3 meters
5. Min Range: 3 centimeters
6. Input Trigger: 10uSec minimum, TTL level pulse
7. Echo Pulse: Positive TTL level signal, proportional to range
8. Weight: 0.4 oz
9. Sensitivity: Detect a 3cm diameter stick at > 2 m

This work started after I looked at the Polaroid Ultrasonic Ranging module. It has a number of disadvantages for use in small robots etc.

1. The maximum range of 10.7 meter is far more than is normally required, and as a result
2. The current consumption, at 2.5 Amps during the sonic burst is truly horrendous.
3. The 150mA quiescent current is also far too high.
4. The minimum range of 26cm is useless. 1-2cm is more like it.
5. The module is quite large to fit into small systems, and
6. It's EXPENSIVE.

1.7 LCD :

One of the most common devices attached to a micro controller is an LCD display. Some of the most common LCD's connected to the many microcontrollers are 16x2 and 20x2 displays. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.

The LCD requires 3 control lines as well as either 4 or 8 I/O lines for the data bus. The user may select whether the LCD is to operate with a 4-bit data bus or an 8-bit data bus. If a 4-bit data bus is used the LCD will require a total of 7 data lines (3 control lines plus the 4 lines for the data bus). If an 8-bit data bus is used the LCD will require a total of 11 data lines (3 control lines plus the 8 lines for the data bus).

1.8 RS 232 and MAX232 cable:
1.8.1 RS 232

it is a cable in which serial communications can be done. Information being transferred between data processing equipment and peripherals is in the form of digital data which is transferred in either a serial or parallel mode. Parallel communications are used mainly for connections between test instruments or computers and printers, while serial is often used between computer and other peripherals.

The RS-232 interface is the Electronic Industries Association (EIA) standard for the interchange of serial binary data between two devices. It was initially developed by the EIA to standardize the connection of computers with telephone line modems. The standard allows as many as 20 signals to be defined, but gives complete freedom to the user. Three wires are sufficient: send data, receive data, and signal ground. The remaining lines can be hardwired on or off permanently. The signal transmission is bipolar, requiring two voltages, from 5 to 25 volts, of opposite polarity. Fig 2 shows the type of RS232 cable.

Fig 2 : RS232 cable

1.8.2 MAX232 cable

The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-

232-F voltage levels from a single 5-V supply. Each receiver converts TIA/EIA-232-F inputs to 5-V TTL/CMOS levels. These receivers have a typical threshold of 1.3 V, a typical hysteresis of 0.5 V, and can accept 30-V inputs. Each driver converts TTL/CMOS input levels into TIA/EIA-232-F levels. The driver, receiver, and
Voltage-generator functions are available as cells in the Texas Instruments

Serial RS-232 (V.24) communication works with voltages (between -15V ... -3V are used to transmit a binary '1' and +3V ... +15V to transmit a binary '0') which are not compatible with today's computer logic voltages. On the other hand, classic TTL computer logic operates between 0V ... +5V (roughly 0V ... +0.8V referred to as low for binary '0', +2V ... +5V for high binary '1'). Modern low-power logic operates in the range of 0V ... +3.3V or even lower. So, the maximum RS-232 signal levels are far too high for today's computer logic electronics, and the negative RS-232 voltage can't be grokked at all by the computer logic. Therefore, to receive serial data from an RS-232 interface the voltage has to be reduced, and the 0 and 1 voltage levels inverted. In the other direction (sending data from some logic over RS-232) the low logic voltage has to be "bumped up", and a negative voltage has to be generated, too.

RS-232	TTL	Logic
-15V ... -3V	<-> +2V ... +5V	<-> 1
+3V ... +15V	<-> 0V ... +0.8V	<-> 0

All this can be done with conventional analog electronics, e.g. a particular power supply and a couple of transistors or the once popular 1488 (transmitter) and 1489 (receiver) ICs. However, since more than a decade it has become standard in amateur electronics to do the necessary signal level conversion with an integrated circuit (IC) from the MAX232 family (typically a MAX232A or some clone). In fact, it is hard to find some RS-232 circuitry in amateur electronics without a MAX232A or some clone. Fig 3 shows the schematic diagram of pc interfacing with micro-controller.

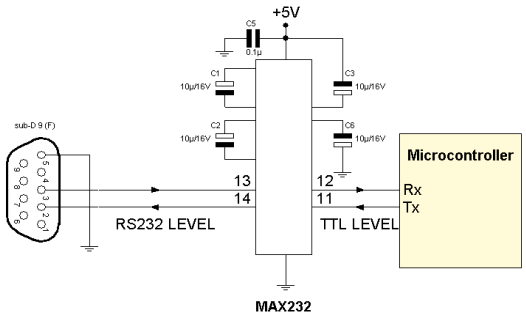

Fig 3: schematic diagram of pc interfacing with microcontroller

1.9 Joystick

The basic idea of a joystick is to translate the movement of a plastic stick into electronic information a computer can process. Joysticks are used in all kinds of machines, including F-15 fighter jets, backhoes and wheelchairs. In this article, we'll be focusing on computer joysticks, but the same principles apply to other sorts of joysticks. The various joystick technologies differ mainly in how much information they pass on. The simplest joystick design, used in many early game consoles, is just a specialized electrical switch. This basic design consists of a stick that is attached to a plastic base with a flexible rubber sheath. The base houses a circuit board that sits directly underneath the stick. The circuit board is made up of several "printed wires," which connect to several contact terminals**.** Ordinary wires extend from these contact points to the computer.

The printed wires form a simple electrical circuit made up of several smaller circuits. The circuits just carry electricity from one contact point to another. When the joystick is in the neutral position -- when you're not pushing one way or another -- all but one of the individual circuits is broken. The conductive material in each wire doesn't quite connect, so the circuit can't conduct electricity.

Each broken section is covered with a simple plastic button containing a tiny metal disc. When you move the stick in any direction, it pushes down on one of these buttons, pressing the conductive metal disc against the circuit board. This closes the circuit -- it completes the connection between the two wire sections. When the circuit is closed, electricity can flow down a wire from the computer (or game console), through the printed wire, and to another wire leading back to the computer. Fig 4 and fig 5 shows the pin diagram and simple design of joystick

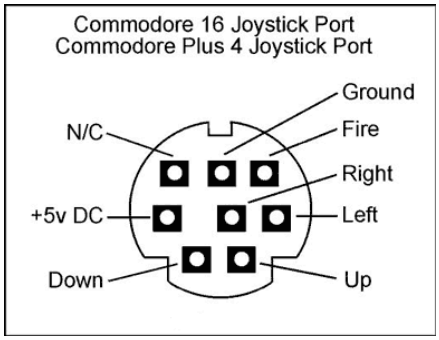

Fig 4 : Pin Diagram of Joystick

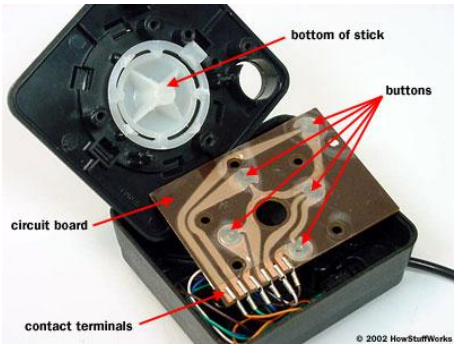

Fig 5 : Design of joystick

1.10 WIRELESS A/V CAMERA:

The camera is with 1.2GHZ, with Audio and CMOS and receiver unit with manual frequency adjustment. This wholesale product is already popular with ChinaTronic customers because of consistent high quality.

- Linear Transmission Distance: 50-100m
- Transmission Signal: Audio, Video
- Receiving Signal: Audio, Video

Technical parameters of transmitting unit:

1. Video Camera Parts: 1/3CMOS, 1/4 Image Sensors
2. System: PAL/CCIR NTSC/EIA
3. Effective Pixel: PAL: 628 x 582, NTSC: 510 x 492
4. Image Area: PAL: 5.78 x 4.19mm, NTSC: 4.69 x 3.45mm
5. Horizontal Definition: 380 Lines
6. Scanning Frequency: PAL/CCIR: 50Hz, NTSC/EIA: 60Hz
7. Minimum Illumination: 3 LUX
8. Sensitivity: +18DB-AGL On-Off
9. Electrical Level Output: 50mW
10. Frequency Output: 1.2Ghz
11. Transmission Signal: Audio, Video
12. Linear Transmission Distance: 50-100m
13. Voltage: DC+9V
14. Current: 300mA
15. Power Dissipation: 640mW

Technical parameters of receiving unit:

1. Wireless Audio/Video Receiver
2. Receiving Method: CPU Phase-Locked Loop Locking Frequency Points
3. 4-Band Automatic Reception Switch
4. Reception Sensitivity: +18dB
5. Receiving Frequency: 1.2Ghz
6. Receiving Signal: Audio, Video
7. Voltage: DC+12V
8. Current: 500mA

Fig 6 : wireless A/V camera

2. SOFTWARE DESCRIPTION

This workt is implemented using following software's:

- Express PCB – for designing circuit
- PIC C compiler - for compilation part
- Proteus 7 (Embedded C) – for simulation part

2.1 Express PCB:

Breadboards are great for prototyping equipment as it allows great flexibility to modify a design when needed; however the final product of a project, ideally should have a neat PCB, few cables, and survive a shake test. Not only is a proper PCB neater but it is also more durable as there are no cables which can yank loose.

Express PCB is a software tool to design PCBs specifically for manufacture by the company Express PCB (no other PCB maker accepts Express PCB files). It is very easy to use, but it does have several limitations.

1. It can be likened to more of a toy then a professional CAD program.
2. It has a poor part library (which we can work around)
3. It cannot import or export files in different formats .
4. It cannot be used to make prepare boards for DIY production

Express PCB has been used to design many PCBs (some layered and with surface-mount parts. Print out PCB patterns and use the toner transfer method with an Etch Resistant Pen to make boards. However, Express PCB does not have a nice print layout. Here is the procedure to design in Express PCB and clean up the patterns so they print nicely.

2.2 PIC Compiler:

PIC compiler is software used where the machine 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. PIC compiler also supports C language code.

It's important that you know C language for microcontroller which is commonly known as Embedded C. As we are going to use PIC Compiler, hence we also call it PIC C. The PCB, PCM, and PCH are separate compilers. PCB is for 12-bit opcodes, PCM is for 14-bitopcodes, and PCH is for 16-bit opcode PIC microcontrollers. Due to many similarities, all three compilers are covered in this reference manual. Features and limitations that apply to only specific microcontrollers are indicated within. These compilers are specifically designed to meet the unique needs of the PIC microcontroller. This allows developers to quickly design applications software in a more readable, high-level language. When compared to a more traditional C compiler, PCB, PCM, and PCH have some limitations. As an example of the limitations, function recursion is not allowed.

This is due to the fact that the PIC has no stack to push variables onto, and also because of the way the compilers optimize the code. The compilers can efficiently implement normal C constructs, input/output operations, and bit twiddling operations. All normal C data types are supported along with pointers to constant arrays, fixed point decimal, and arrays of bits.

2.3Proteus

Proteus is software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller and this is done by the Proteus. Proteus is a programmer which itself contains a microcontroller in it other than the one which is to be programmed. This microcontroller has a program in it written in such a way that it accepts the hex file from the pic compiler and dumps this hex file into the microcontroller which is to be programmed. As the Proteus programmer requires power supply to be operated, this power supply is given from the power supply circuit designed and connected to the microcontroller in proteus. The program which is to be dumped in to the microcontroller is edited in proteus and is compiled and executed to check any errors and hence after the successful compilation of the program the program is dumped in to the microcontroller using a dumper.

3. PROJECT DESCRIPTION

In this work schematic diagram and interfacing of PIC16F877A microcontroller with each module is considered**.**

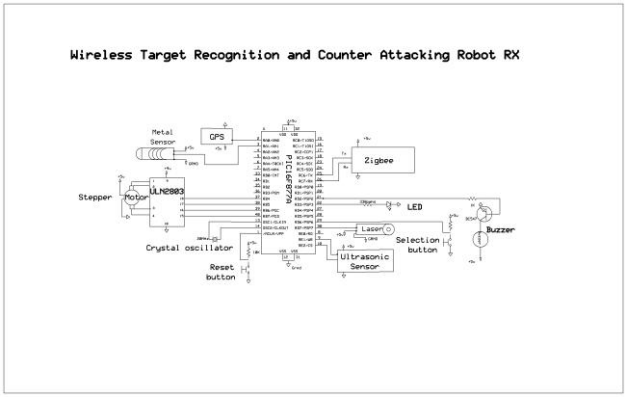

Fig 7: schematic diagram of robot section of Wireless Target Recognition and Counter Attacking Robot with Laser Gun Activation

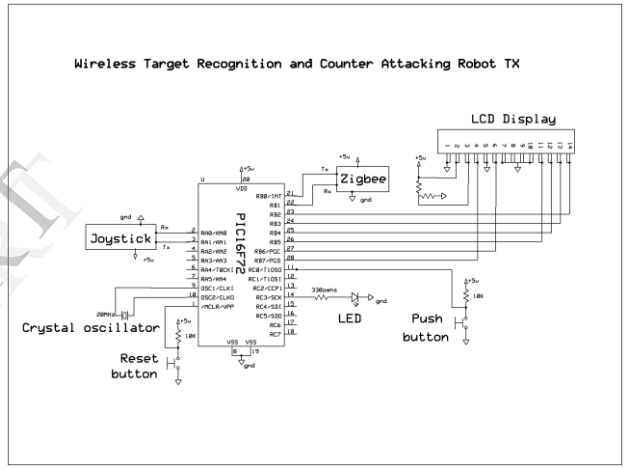

Fig 8: schematic diagram of transmitter section of Wireless Target Recognition and Counter Attacking Robot with Laser Gun Activation

The above schematic diagrams of **Wireless Target Recognition and Counter Attacking Robot with Laser Gun Activation** explains the interfacing section of each component with micro controller and RF. Crystal oscillator connected to 13th and 14th pins of micro controller and regulated power supply is also connected to micro controller and LED's also connected to micro controller through resistors.

The detailed explanation of each module interfacing with microcontroller is as follows:

Interfacing crystal oscillator and reset button with micro controller. Fig 9: explains crystal oscillator and reset button which are connected to micro controller. The two pins of oscillator are connected to the 13th and 14th pins of micro controller; the purpose of external crystal oscillator is to speed up the execution part of instructions per cycle and here the crystal oscillator

having 20 MHz frequency. The 1st pin of the microcontroller is referred as MCLR ie.., master clear pin or reset input pin is connected to reset button or power-on-reset.

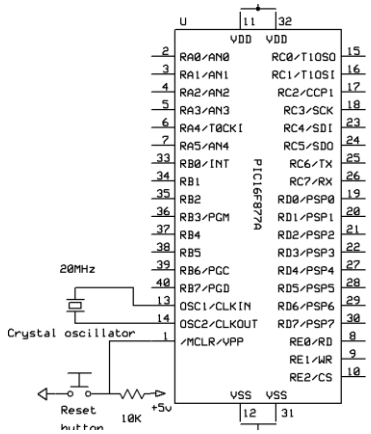

Fig 9: crystal oscillator and reset input interfacing with micro controller

4. Conclusion

It majorly used in detection of bombs using metal detection sensor and to know the location of the robot using GPS module. The system also uses joystick module to control the robot and automatic counter attacking using laser gun when the missile is detected using ultrasonic distance sensor. The system uses ultrasonic distance finder sensor to estimate the target distance and displays on LCD. The robot also uses wireless camera you can view both audio and video on the TV.

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the work has been successfully implemented. Thus the work has been successfully designed and tested.

The paper mainly aims in designing completely an automated target recognition and counter attacking robot with laser gun using Zigbee wireless technology. It majorly aims in detection of bombs using metal detection sensor and to know the location of the robot using GPS module. The system also uses joystick module to control the robot and automatic counter attacking using laser gun when the missile is detected using ultrasonic distance sensor. The system uses ultrasonic distance finder sensor to estimate the target distance and displays on LCD. The robot also uses wireless camera you can view both audio and video on the TV.

5. Future Scope

This project can be extended by introducing a GSM module through which the robot can be controlled from anywhere in the world. The project can also extended using GPRS technology which can send the alerting message to the predefined web link. The robot can also extend using other sensors like temperature for fire detection regions, gas sensor, smoke sensor etc.,. The robot can also be operated using 3G technology through which capture of video can also be extended.

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