PC BASED TARGET DETECTION AND FIRING USING WI-FI

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Abstract: The aim of this project is to develop a technology that detects the object (obstacle) which is considered as a target and destroys the target from PC at distant control room with the help of serial communication. The detected objects are thus classified into fixed and moving target objects. The fixed targets generally include the targets which are stationary (not movable).The non-fixed targets include the targets which are movable and not stationary.

The problem of motion-based object tracking can be divided into two parts:

1. **Detecting moving objects in each frame**: Detection of moving objects and motion-based tracking are important components of many computer vision applications, including activity recognition, traffic monitoring, and automotive safety.
2. **Associating the detections corresponding to the same object over time**: The association of detections to the same object is based solely on motion. When we use the word target, we refer in the same time at a small ball, at an object like a chair, or even at a human that stay in front of the robot.

I .INTRODUCTION

This invention relates to the military services. It provides a method and system for TARGET DETECTION & FIRING in a war field which is PC based which can be monitored and controlled from a distant secure zone. The compilation is Aurdino based and Microcontroller AVR328P has been used. This helps in reducing human loss to an extent and provides more accurate detection and attack than that of a human.

Principle

The main aim of this project is to develop a technology that detects the object (obstacle) which is considered as a target and a firing system that destroys the target using serial communication.

Detection is done with the help of camera which is mounted parallel to two servo motors. These servo motors cover both vertical & horizontal perspectives by rotating around 180 degrees one in vertical and the other in horizontal directions. If any object is found, its distance from the border is measured using the Ultrasonic sensor. All this information of object location & its distance is displayed on screen/LCD at the control room (or) monitoring station followed by the buzzer alarms.

Firing is supported on a stabilized and orientable platform. Firing system is placed at an appropriate location in the field at the border and firing mission is accomplished from the control room by the personnel at monitor with the help of a Joystick. The compilation is AURDINO based.

Parameters

The DETECTION of the enemy object, MEASUREMENT of range of the target object from the border, FIRING of the target from the monitor at the control room.

TYPES OF OBJECTS:

The objects to be detected may be classified as:

1. Fixed Targets 2. Moving Targets

The detected objects are thus classified into fixed and moving target objects. The fixed targets generally include the targets which are stationary (not movable).The non-fixed targets include the targets which are movable and not stationary. Detection of moving objects and motion-based tracking are important components of many computer vision applications, including activity recognition, traffic monitoring, and automotive safety. The problem of motion-based object tracking can be divided into two parts:

1. detecting moving objects in each frame
2. associating the detections corresponding to the same object over time

The association of detections to the same object is based solely on motion. When we use the word target, we refer in the same time at a small ball, at an object like a chair, or even at a human that stay in front of the robot.

TYPES OF DETECTION

Various methods are implementing detection of objects which mainly include sensors. The sensors are classified as:

Proximity sensors – several sensor technologies are used to build proximity sensors: ultrasonic sensors, capacitive, photoelectric, inductive, or magnetic.

Motion detectors – these sensors are based on infrared light, ultrasound, or microwave/radar technology.

Image sensors – these are digital cameras, camera modules and other imaging devices based on CCD or CMOS technology.

II. ANALYSIS

The thesis presents the results of PC BASED TARGET DETECTION AND FIRING SYSTEM. We have shown how the simplest methods work and how they can be explored. This is a modern detection process related to all War services such as army, navy and air force., which has been implemented using Ultrasonic sensor, surveillance camera that covers 180 degrees horizontal and vertical ranges using servo motors. The analog information obtained is converted into digital data and such information called target data is processed by the micro controller ATmega328Pand sent to the PC. We have used serial communication for this purpose that has played a vital role in processing, monitoring and controlling the field equipment system operation from a Computer system located at a distant secure zone through a serial communication cable RS232. This in turn is used in converting the digital form of commands given by the operator in to analog form and assisting in the accomplishment of firing mission. This system is designed to fire automatically without the need of manual operation for the targets detected within nearer range of about 1m. The computer controlled display provides the information about the tactical environment. The detection & firing were followed by the display of Range measurement and location (in coordinates) of the target on the PC screen.

III. PROBLEM STATEMENT

The project is to develop a technology that detects the object(obstacle) which is considered as a target and destroys the target from PC at distant control room with the help of serial communication. Target DETECTION is done with the help of Ultrasonic wave sensor, camera which is mounted parallel to two servo motors. Information of target detected, its location (in x,y coordinates) & distance(in cms) is displayed on the screen at control room (or) monitoring station followed by the buzzer alarms. Then, the FIRING can be done by the system automatically to certain range and beyond that range, firing mission is accomplished from the control room by the personnel at monitor with the help of a Joystick through serial communication. The compilation is Arduino based and Microcontroller AVR328P has been used. . This information is transmitted to PC using WiFi technology. The person operating the controller will be given two options to choose: Manual Mode and Automatic Mode. The detected object will be fired as per control instructions.

IV. DESIGN METHODOLOGY

Detection is done with the help of camera which is mounted parallel to two servo motors. These servo motors cover both vertical & horizontal perspectives by rotating around 180 degrees one in vertical and the other in horizontal directions. If any object is found, its distance from the border is measured using the Ultrasonic sensor. All this information of object location & its distance is displayed on screen/LCD at the control room (or) monitoring station followed by the buzzer alarms.

Measurements Of Distance And Coordinates Of Objects:

The transmitter of the ultrasonic sensor emits 8 bursts of a directional 40 kHz ultrasonic wave when triggered and starts a timer. Ultrasonic pulses travel outwards until they encounter an object. The object causes the wave to reflect back towards the unit (sensor).The ultrasonic receiver would detect the reflected wave from the object and stop the timer. Based on the number of counts by the timer, the distance can be calculated between the object and the transmitter. ECHO is the output pulse to the microcontroller, its width is the time from last of eight 40 kHz bursts to detect reflected signals.

The distance is obtained in microseconds from the sensor. In order to obtain the distance in cm or inches, the conversion is as follows:

Distance in cm = echo pulse width in microsec/58.

Distance in inch = echo pulse width in microsec/148.

ESP8266 WiFi Module:

ESP8266 is Wi-Fi enabled system on chip (SoC) module developed by Espressif system. It is mostly used for development of IoT (Internet of Things) embedded applications.

Fig.4.1 ESP8266 Wi-Fi Module

2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2),
general-purpose input/output (16 GPIO),
Inter-Integrated Circuit (I²C) serial communication protocol,
analog-to-digital conversion (10-bit ADC)
Serial Peripheral Interface (SPI) serial communication protocol,
pulse-width modulation (PWM).

ESP8266 Module Serial Connection with PC

Note that, to put ESP8266 in flash mode, make connections as per above figure (in between ESP8266 and USB to Serial converter) and then only connect it to PC/laptop. Do not forget to connect GPIO0 pin to ground.

Then click on START tab in ESP8266 DOWNLOAD TOOL, and wait till it finishes. After finishing flash process, disconnect ESP8266 module from PC/laptop and remove ground connection at GPIO0 pin.

After successful downloading of firmware, we can use below AT commands for server and client communication using ESP8266.

BLOCK DIAGRAM*:*

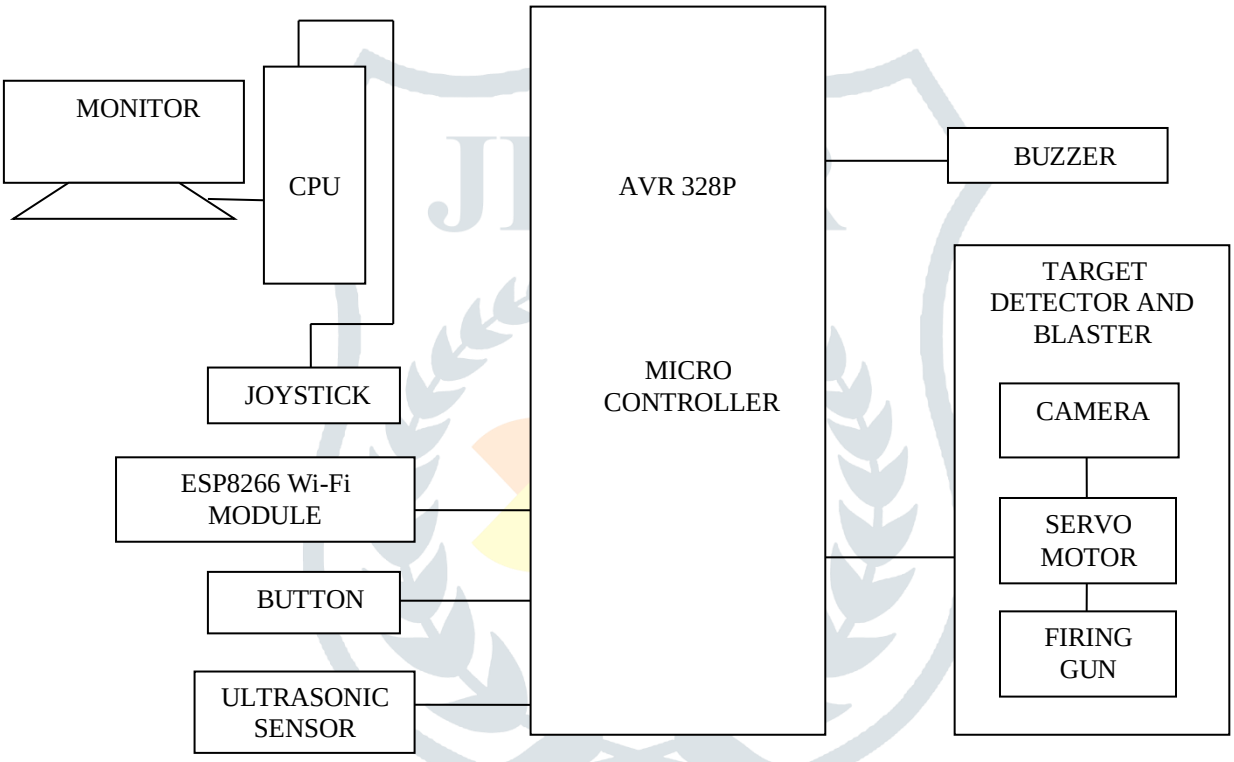


Fig: 4.2 Block Diagram

The various components which are included in the block diagram are:

1. Microcontroller
2. Wi-Fi module
3. Ultrasonic sensor
4. Servomotor
5. Joystick
6. Buzzer
7. Camera
8. Button
9. Laser gun
10. Camera

Microcontroller:

The ATmega328P is a single chip Micro Controller created by Atmel & belongs to the megaAVR series.

MICRO CONTROLLER INTERFACES*:*

There are 5 interfaces associated with the micro controller:

1. **Joystick** Interface:

It moves the cursor which locates & aims at the target detected. The Interfacing IC Pins are generally analog pins which are A0(Pin 23), A1(Pin 24)

2. **Servomotor** Interface: For rotation purpose of field equipment which includes Ultrasonic sensor, Camera, Firing Gun (Laser). Interfacing IC Pins are generally digital Pins which are PB1 (pin15), PB2 (pin16)
3. **ESP8266-01Wi-Fi Module**

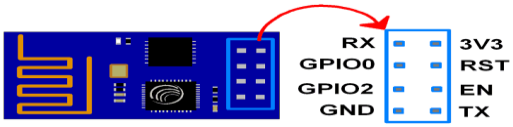


Fig: 4.3 ESP8266-01 Module Pins

3V3: - 3.3 V Power Pin. **GND**: - Ground Pin. **RST**: - Active Low Reset Pin.
EN: - Active High Enable Pin. **TX**: - Serial Transmit Pin of UART.
RX: - Serial Receive Pin of UART.
GPIO0 & GPIO2: - General Purpose I/O Pins. These pins decide what mode (boot or normal) the module starts up in. It also decides whether the TX/RX pins are used for Programming the module or for serial I/O purpose.

4. **Ultrasonic Sensor** Interface: It Senses the obstacle & gives the Distance, Position of the target. Interfacing IC Pins used are digital Pins –PD5 (pin 11), PD6 (pin 12)
5. **Buzzer** Interface: It alerts the operator with alarming sounds about the detection of the obstacle.
   Interfacing IC Pins: Digital Pin - PD3 (Pin 5)

6. **BUTTON** Interface: When pressed by the operator from the control room, the target firing mission is accomplished.
   Interfacing IC Pins: Digital Pin – PD7 (Pin13).

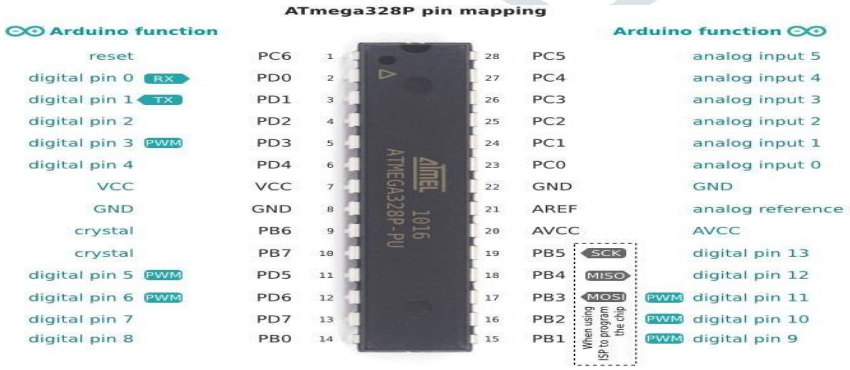


Fig.1.4: MC Configuration and mapping

1. SERVOMOTOR:

Servo motor is chosen because it is small and lightweight with high output power. Servo can rotate 180 degrees approximately (90 in each direction).We can use any servo code, hardware or library to control these servos. The special features of servo motor are its feedback and high torque.

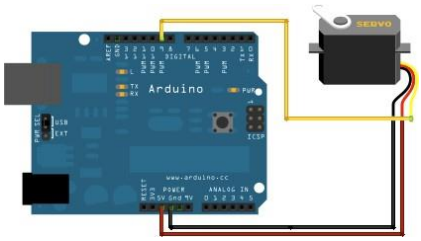


Fig 4.5 Arduino to servo mapping

BLOCK DIAGRAM OF SERVOMOTOR:

Two servo motors are connected across the microcontroller for movement in both the x and y directions. The servomotor is connected across PB1 and PB2 pins of the

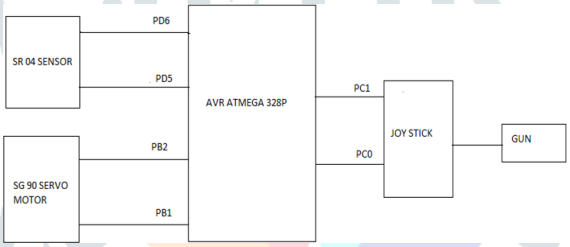


Fig: 4.6 Inputs and outputs of servomotor

microcontroller. This servomotor rotates the ultrasonic sensor and the detection is achieved in this stage followed by the display of the object with the help of the camera and the firing aim is accomplished with the help of laser gun.

2. ULTRASONIC SENSOR:

HC-SR04 is an ultrasonic ranging module that provides 2 cm to 400 cm non- contact measurement function. The ranging accuracy can reach to 3mm and effectual angle is < 15°. It can be powered from a 5V power supply.

Active **ultrasonic sensors** generate high-frequency sound waves and evaluate the echo which is received back by the **sensor**, measuring the time interval between sending the signal and receiving the echo to determine the distance of an object.

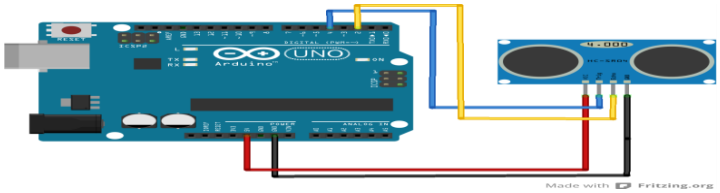


Fig: 4.7 Arduino to Ultrasonic sensor

BLOCK DIAGRAM OF ULTRASONIC SENSOR:

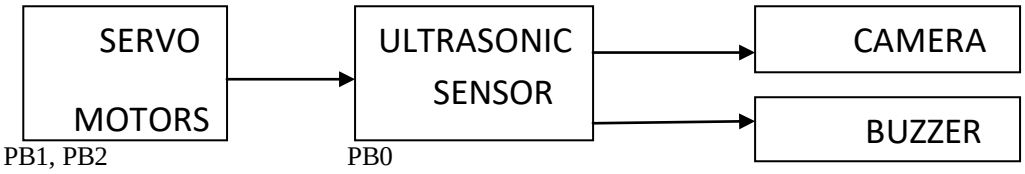


Fig: 4.8 Inputs and outputs of ultrasonic sensor

The servomotors rotate the ultrasonic sensors along both the x and y directions. When the motors rotate the sensor, it detects the presence of any object and determines its range. After detection of the object, buzzer alert is provided to the operator along with a display with the help of a camera.

JOYSTICK CONTROL BUTTON:

The joystick is used is a 2-axis joystick can be used to add input. It contains two independent potentiometers (one per axis) that can be as dual adjustable voltage dividers, providing 2-axis analog input bin a control stick form. It includes spring auto-return to centre and a comfortable cup-type knob which gives the feel of thumb- stick.

This circuit creates two voltage dividers referenced to VDD (in this case 5 V), using a 2-channel ADC (in this case the MCP3202) to read the voltages at the L/R and U/D pins.

Fig:4.9 Arduino to Joystick

BLOCK DIAGRAM OF JOYSTICK:

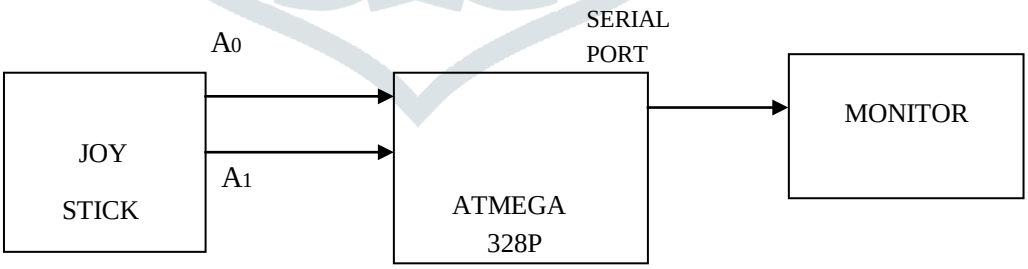


Fig: 4.10 I/O of joystick

Joystick is connected to **PINS**: A0 and A1 of microprocessor. The joystick movement is always relative. It reads two analog inputs that ranges from 0 to 1023 (or

less on either end) and maps into ranges of 0 to 180 degrees for both x and y directions. As soon as the object the detected, the motor stops and an alert is given by buzzer. Now, the object is seen in the monitor, the joystick is moved to adjust the exact position of target.

BUZZER:

A Buzzer is used to alert the person about the detection of any object by making alarming sounds. Different sounds can be made by the buzzer for various operations such as detection of the object and the firing of the object.

The basic circuit of the buzzer consists of Transistor – BC 547, Supply voltage Vcc, Ground, Resistor – 1kohms, Filter – 0.01 uf.

When the transistor is ON, then buzzer receives a voltage and it is in ON condition ad sound can be heard. If it is in OFF condition no sound is heard.

BLOCK DIAGRAM OF BUZZER:

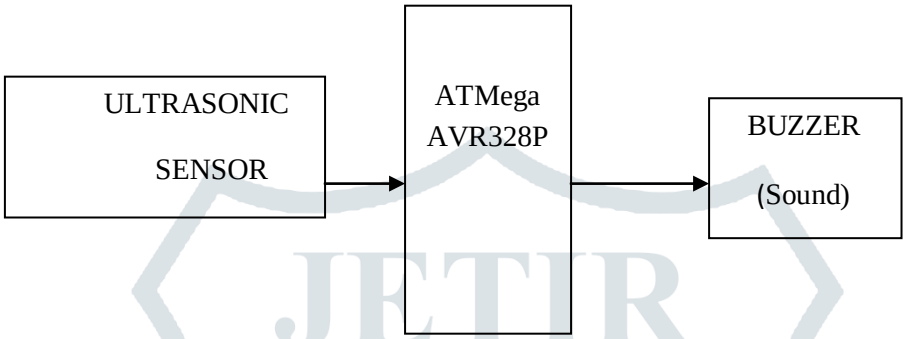


Fig: 4.11 I/O of buzzer

The ultrasonic sensor detects the objects encountered. The alert to the operator about the presence of the object is given with the help of a buzzer. Different buzzer sounds are provided for different cases such as detection of trhe object and firing of the object.

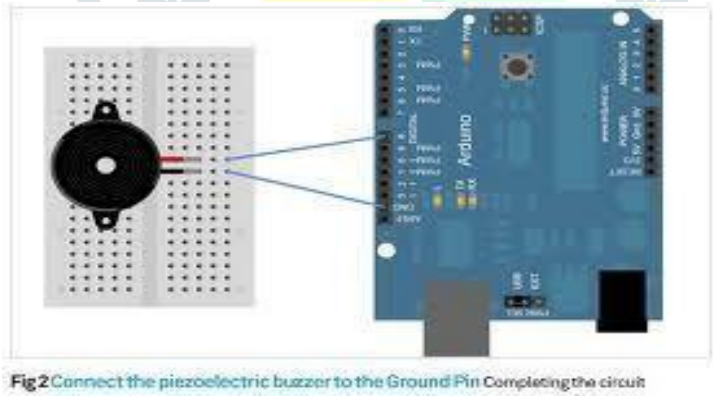


Fig 2 Connect the piezoelectric buzzer to the Ground Pin Completing the circuit

Fig: 4.12 Arduino to buzzer

3. CAMERA:

The display of the object can be viewed in the camera.

A **webcam** is a video camera that feeds or streams its image in real time to or through a computer to computer network. When "captured" by the computer, the video stream may be saved, viewed or sent on to other networks via systems such as the internet, and email as an attachment. When sent to a remote location, the video stream may be saved, viewed or on sent there. Unlike an IP camera (which connects using Ethernet or Wi-Fi), a webcam is generally connected by a USB cable, or similar cable, or built into computer hardware, such as laptops.

4.BUTTON:

The button is useful for accomplishment of firing. When button is switched, the laser gun starts firing.

PUSH BUTTON SWITCHES:

A momentary button is a Biased Switch. Pushing the button changes state. The State is reversed (return to biased position) when button is released

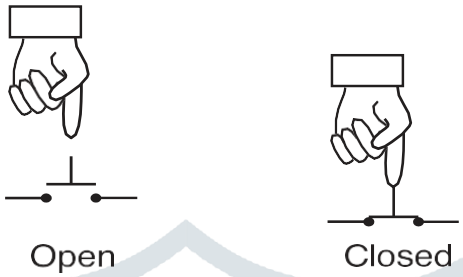


Fig:4.13 Button operation

DC POWER SUPPLY:

The DC Power supply required is a 5V regulated power supply.The basic supply circuit is as follows;

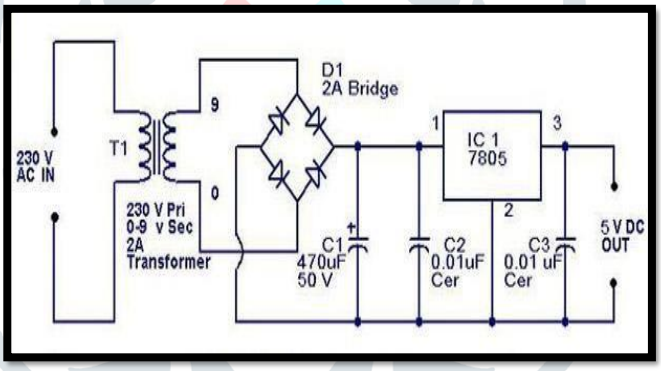


Fig:4.14 Power supply circuit

REQUIREMENTS:

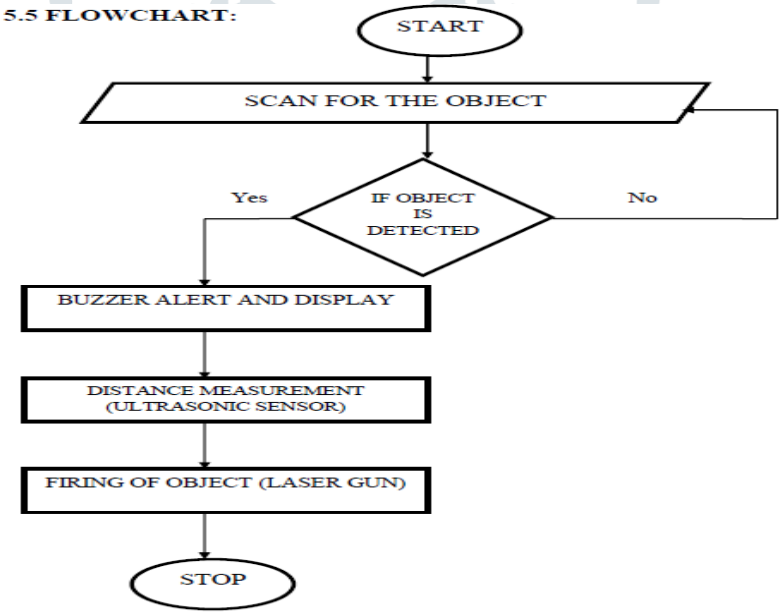
SOFTWARE EQUIPMENT: 1.Proteus&Mikro in C

HARDWARE equipment:

1. Microcontroller - AVR 328P
2. Servo motors - 180 degrees(2)
3. LCD - 16x2
4. Web camera
5. Ultrasonic sensor – SR04
6. PC
7. Joystick
8. Buzzer
9. DC Power supply

The main processes taking place here are:

5.5 FLOWCHART:



1. Rotation
2. Scanning
3. Detection
4. Firing

The servomotor is chosen for its better torque and for rotation purpose. The servomotor is placed in parallel to the camera and the ultrasonic sensor. With the help of the servomotor, the sensor is rotated and the process of scanning takes place. The scanning process occurs until the sensor encounters any object.

When the sensor is rotated with the help of camera, it detects for the presence of any target (object). At this stage, two processes take place which are

- Presence of an object
- Absence of an object

If the ultrasonic sensor detects the presence of an object, it measures the distance of the object and its coordinates. As there is a midway between the ultrasonic sensor and the buzzer due to the interfacing with the help of the microcontroller: a buzzer alert is produced at the operating area indicating the presence of an object.

When the object is detected, the sensor measures its distance in cms and also displays the coordinates of the object. With the help of a web camera interfacing, the arena of the object can be viewed with the help of it. Now the ultimate aim is to fire the object after its detection. Thus an laser gun is used to accomplish the firing aim. The laser bean continuously blinks at the target indicating the process of firing. After the accomplishment of firing, the task is completed and again the sensor is rotated for detection of another object. Thus the process of scanning and takes place step by step by the sensor for detecting the object.

If there is no object in the arena, the ultrasonic sensor does not sense any object any again the process of scanning. The sensor is again rotated with the help of servomotor and scanning process undergoes until it finds an object.

V. RESULTS AND DISCUSSION

Two servomotors installed in the equipment on which the firing gun, sensor, surveillance camera are mounted, rotates the entire field equipment from 0 to 180 degrees, one in horizontal(X) direction and the other in vertical(Y) direction. This figure shows the rotation of sensor along with the camera with the help of servomotors. The sensor thus detects the presence of any object in the corresponding direction. The servomotor rotates the equipment and the sensor mounted parallel to it detects the presence of object within the range limit allotted to the sensor.The sensor continuously scans for detecting an object both horizontally & vertically directions i.e., in both x and y axis rotations. Then, firing is done using a Laser Gun. This figure depicts the Laser gun firing on detection of the object. Real time firing is equivalent to the incidence of laser ray (blinking red light) on the target detected.

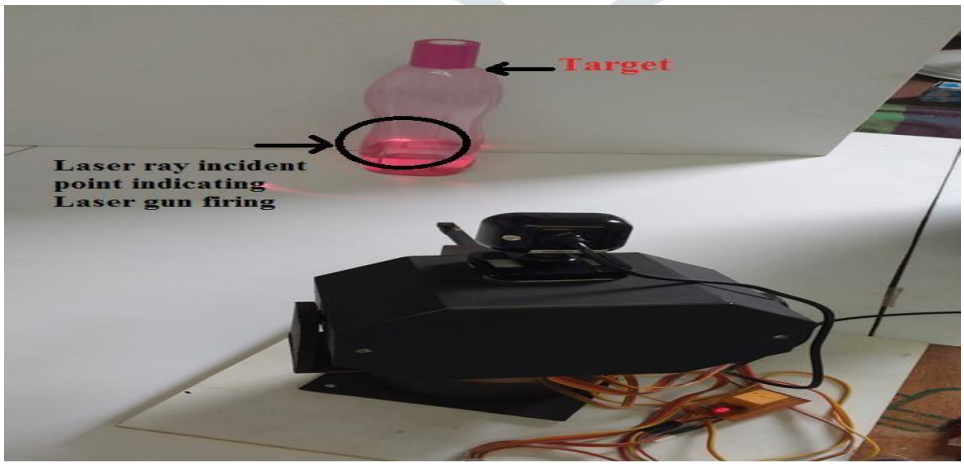


Fig: 5.1 Laser gun firing the target

As soon as the ultrasonic sensor detects a target(here bottle), the laser gun fires the target automatically if it is within 1m of range.

In this figure, the continuously rotating sensor has detected the presence of the object within 1m range ahead which is a bottle and stops rotating immediately pointing the gun in the direction of the object.

Here, this bottle detected is considered as a foreign element and thus, the laser gun started firing the target (bottle) i.e., by shooting a laser ray(blinking red light) to incident on the object as shown.

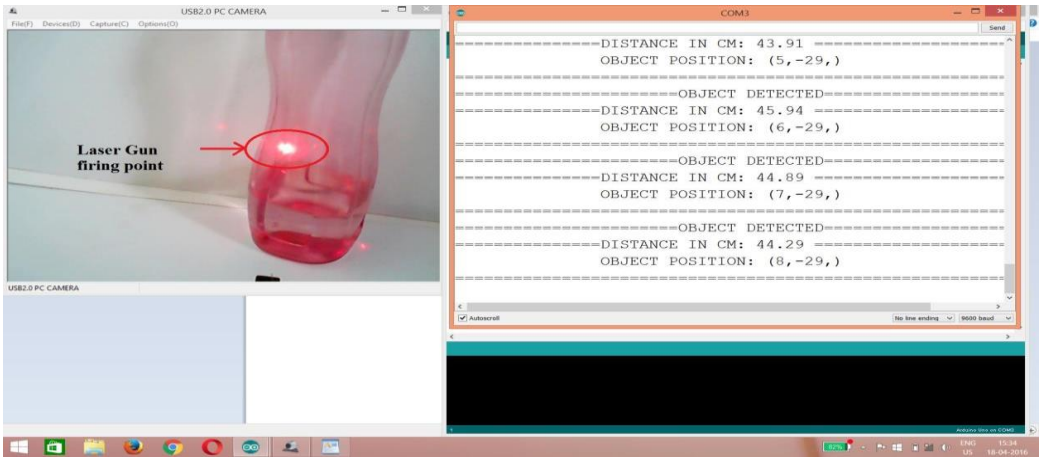


Fig 5.2: PC screen showing camera display & Arduino compiler windows

The target detected is fired and simultaneously, its range and location are displayed on PC screen (here). This figure depicts the display of two windows showing (i) the detection & firing of an object on Left window and (ii) Range measurement and coordinates of location of the object detected from the field equipment on Right window..

Hence, this project can be implemented for detection and firing of a non- moving object i.e., any foreign (enemy) element displaying the outputs of camera and information of target range measurement & its location.

VI.CONCLUSION:

The thesis presents the results of PC BASED TARGET DETECTION AND FIRING SYSTEM. We have shown how the simplest methods work and how they can be explored. This is a modern detection process related to all War services such as army, navy and air force., which has been implemented using Ultrasonic sensor, surveillance camera that covers 180 degrees horizontal and vertical ranges using servo motors. The Analog information obtained is converted into digital data and such information called target data is processed by the micro controller ATmega328Pand sent to the PC. We have used serial communication for this purpose that has played a vital role in processing, monitoring and controlling the field equipment system operation from a Computer system located at a distant secure zone through a serial communication cable RS232. This in turn is used in converting the digital form of commands given by the operator in to Analog form and assisting in the accomplishment of firing mission. This system is designed to fire automatically without the need of manual operation for the targets detected within nearer range of about 1m. The computer controlled display provides the information about the tactical environment. The detection & firing were followed by the display of Range measurement and location (in coordinates) of the target on the PC screen.

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Many papers have been observed and studied has done on the project given. Some of the journals and websites are mentioned below:

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