

GSM based Robot for Unmanned Anti Infiltration using in Remote Securing System

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Abstract— A country which has its borders made by land faces major security threat from enemy infiltrations, with the help of ultra-modern techniques like concertina fencing, Unmanned Aerial Vehicle and advanced imaging devices also fails to reduce the infiltration. The aim of this project is to stop the infiltrators with the help of a simple mechatronic robot with GSM modem. This robot has a nylon sensor shaft mounted with an infrared trans-receiver is placed in a gear disc coupled with dc motor drive scans the area for infiltrators. If the infrared signal is obstructed by any infiltrators, the PIC (16F877A) microcontroller locks the position of the DC motor at the target and simultaneously energizes the solenoid wound on the guns trigger and shoots at the target and then sends a message to the command post by using GSM Modem. After traversing the full surveillance along the sensor shaft returns again into the chassis. The chassis is buried into the soil behind our Line of Control which provides visual stealth to the robot.

Index Terms— Gear disc, GSM Modem, gun with a solenoid, infrared transceiver, Peripheral interface controller, sensor shaft.

I. INTRODUCTION

Now a day's most of the international borders are protected by conventional concertina fencing. This concertina fencing technique and other main ultramodern defensive equipments used as of now is very costly and it needs constant surveillance of the soldiers and effective maintenance and these are being replaced by the UAV at some areas, though they are effective, their cost is very high and needs frequent maintenance and fueling. So these factors leads to the cause for developing an ultimate machine which has a minimum cost and a maximum efficiency which would be able to work on any kind of rough terrains and adverse climatic conditions and defending the borders without any human intervention. Use of this electromechanical robot could minimize or eliminate the human casualties and provide 24/7 surveillance.

II. PROPOSED DESIGN

Block diagram of proposed system is shown in Fig 1. The proposed system has an intellectual structure. When the intruder is identified and the GUN is fixed the controller will send the message to command post through SMS using GSM modem. The continues working procedure of the proposed system is shown in below block diagram with a PIC Microcontroller.

III. COMPONENT INTEGRATED

This machine has a very simple and intelligible construction and the following components are listed below with their constructional details.

A. PIC Microcontroller

In 1989, Microchip Technology Corporation introduced an 8-bit microcontroller called the PIC [2]. PIC stands for Peripherals Interface Controller. PIC16F877A is high performance RISC processor. PIC controller processes the outputs of sensor circuits. The small compact size combined with easy program updates and modifications. PIC16F877A is use in machinery and control system. Its plays a vital role in this project.

Specifications:-

- Clock input required to PIC controller is DC-20MHz.
- ADC is 10 bit, up to 8-channel ADC.
- Flash program memory is up to 8K*14 words.
- Data memory is up to 368*8 bytes.
- EEPROM data memory is up to 256*8 bytes.
- Timers are Timer0- 8 bit timer/counter, Timer1- 16 bit timer/counter, Timer2- 8 bit timer/counter.

B. Gear disc-gun mount arrangement

This robot is provided with single gear disc. In this type of robot the gear discs holds the Gun and the sensor shaft, it's also has limit switch LS 1 at the starting point. The two gear discs are coupled with the DC motor drive [4]. The DC motor has a speed of 60 RPM. And the gear disc has 110 teeth Vs 11 teeth in the pinion attached to the shaft of the DC motor. The gear disc finishes 12 half rotations/ minute along 180⁰ to 180⁰ degrees along enemy LOC. The gear disc is supported by a column and it is placed in a frame holder table is camouflaged. The Frame holder table is lifted by one large pneumatic cylinder attached to its bottom. The gear disc rotates for 1 second and stops for 3 seconds, this continues till limit switch LS 2 is touched.

Module of a gear (M) = reference Diameter/number of teeth
 $M=320/110=2.902mm$

The chassis contains all the components of this mechatronic robot. And the chassis having two main compartments, namely compartment A&B.

The compartment A is inner part of the chassis and has no contact with the outer world. The compartment B has the part

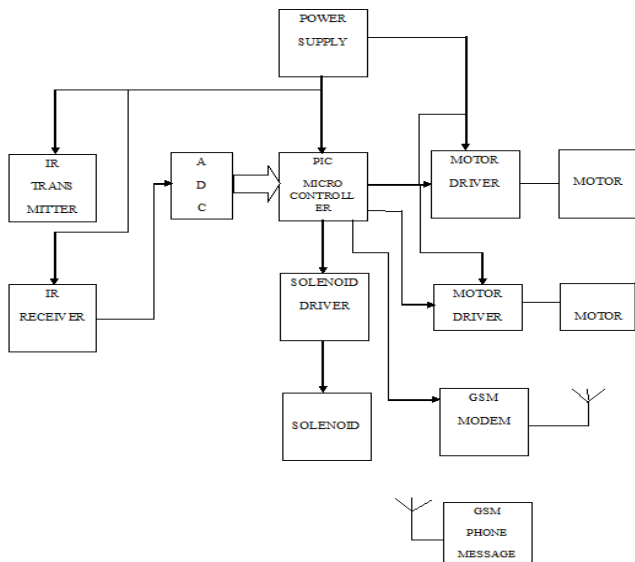


Fig.1 Block diagram of Proposed System

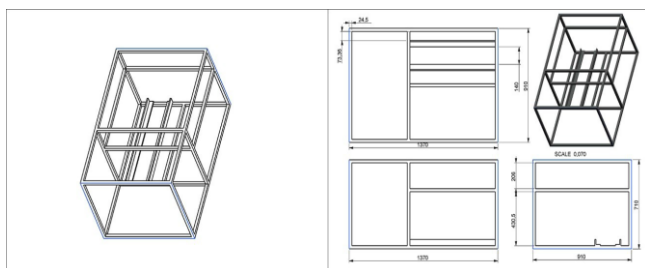


Fig.2 Chassis Showing Its Specifications

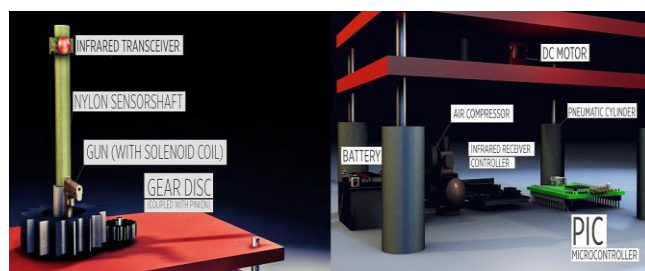


Fig.3 Compartment A and Compartment B

which makes contact with the outer world which has the sensor shaft and the gun. The chassis is made up of 16 GSM mild steel which would be buried under the soil. The chassis has a length of 1370 mm and a width of 900mm and a height of 750 mm.

C. Battery

This power supply for this robot is given by two 80-180 AH/12 volt Tubular batteries connected in series to give an output of 24 volts. Since some of the devices operate in 24 volts this arrangement is made. And this battery suppresses the mechanical vibrations while acts as balancing weight for the chassis. The battery is connected to the contactors through terminal connectors through the forward and zig zag loop for clockwise and anticlockwise rotation.

D. Screw type air compressor

This compressor supplies compressed air to the pneumatic cylinders needed to open the door in the chassis and lift the frame holder table of the gear disc-gun mount. The ratings of the compressor are 24 Volt, 3.5Kg.

E. Peripheral interface controller

The peripheral interface controller acts as the brain of this robot in which it controls and coordinates all the activities of this robot. The PIC microcontroller used in this robot is 16F877A. This PIC microcontroller performs the Function of locking at the target and energizing the solenoid wound, whenever the infrared signal is obstructed by an infiltrator.

F. Infrared Transceiver & Controller

The infrared transceiver performs the function of transmitting the infrared signal which is used for the purpose of ranging and detection of targets within a range of 50 feet and the receiver part of the transceiver senses the received signal and it transmits it to the infrared controller for further processing[3]. The signal received is then processed in the infrared controller for any error, and in case if any changes is found on the signal received then in it send command to the PIC microcontroller for further action.

G. Sensor shaft

The sensor shaft acts as the eye of this robot in which it is fitted with the Infrared transceiver. This sensor shaft is made up of black nylon to avoid its detection from any kind of deep search metal detectors. This sensor shaft is mounted on the gear disc and this shaft is of a length of 4 feet and it is coated with suitable radar absorbent material so that it cannot be detected by any enemy GPR or weapons locating radars.

H. GSM

GSM stands for global system for mobile communication. This is used to establish the communication between GSM modem and mobile device. For communication purpose GSM modem required 12V power supply, communication interface such as RS232, and SIM (Subscriber Identity Module) Card same as mobile phones to activate communication with the network. GSM digitizes and compresses data, then sends it to a down channel with two other streams of user data in its own time slot. It operates at either 900 MHz or 800 MHz frequency band.

I. Additional features

The gun will also be fitted with the muzzle blast suppressor which minimizes the muzzle flash and sound during the fire [6]. This also gives advantage of minimizing the detections from the weapons location radar and the Gun fire locator. The minimum exposure of this robot will also provide us with the feature of the visual stealth. This robot will also be provided with a counter circuit so that the number of targets that have been encountered could be recorded based on the data from the counter, the number of the units (robots) installed could be increased.

IV. PRINCIPLE OF WORKING

When the infrared signal emitted is obstructed by any infiltrator the infrared controller sends command signal to the PIC microcontroller which locks the position of the gear disc at the target and simultaneously the PIC microcontroller energizes the solenoid wound on the trigger thereby firing at the target.

After completion of solenoid triggered the Global System for Mobile System will plays a major role. GSM sends a message to the Command post.

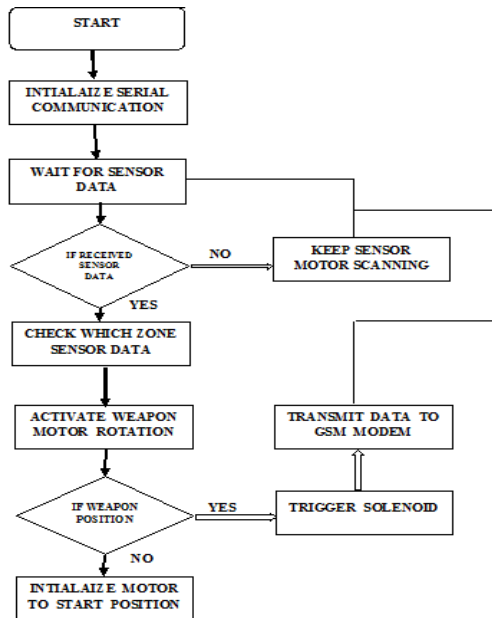


Fig.4 Working Flow Of Proposed System

Let us split the working of this robot into two cases:

Case1:

For a constant interval of time say-90 seconds, the sensor shaft comes up and Infrared transceiver emits infrared radiation and this sensor shaft is rotated 180° to -180° along the enemy LOC, during this time if the infrared signal is obstructed by any infiltrator, then the change in the value of the infrared signal compared with the reference signal in the comparator and the error signal is fed to the PIC microcontroller so that the microcontroller responds by locking the position of the gear disc as soon as the change in signal is received and the PIC microcontroller energizes the solenoid wound on the trigger simultaneously thereby shooting at the target. The sensor shaft resumes its rotation again and only after finishing the full rotation the shaft goes into chassis again. The surveillance is done for about 40 seconds.

Case2:

For a constant interval of time say-90 seconds, the sensor shaft comes up and Infrared transceiver emits infrared radiation. And this sensor shaft is rotated 180° to -180° along the enemy LOC. and during this time if the infrared ray is not obstructed by any object then the shaft completes its rotation either on its side and returns to its original position inside the chassis with the doors closed again.

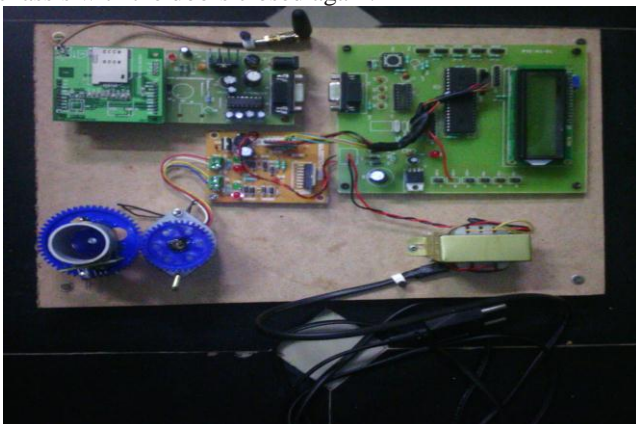


Fig.5 Working Setup of Hardware

V. CONCLUSION

The threat to any country by enemies are increasing day by day, so we have to develop advanced machines which would be eliminate the threat of the enemies without any human intervention and maximize the security at the borders and though this project satisfies all the needs. This mechatronic robot will be modified to tackle any kind of threats from enemies with the help of ultramodern mechanisms. This robot could be further innovated and it could be used for surveillance. Whenever an infiltrator enters the robot will fires and then sends a message to command post by using GSM modem.

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