LOC with Secured Wireless Communication and Tracking Devices

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Abstract— Most of the military organizations now take the help of robots to carry out many risky jobs that cannot be done by the soldiers. These robots used in military are usually employed with the integrated system, including video screens, sensors, gripper and cameras. A new system is proposed with the help of low power IOT wireless sensor network to trace out the intruders and the robot will take the necessary action automatically. Thus the proposed system, an Intelligent Unmanned Robot (IUR) using IOT saves human life and reduces manual error in defense side. Robots are designed for various purposes like military, industry, for home based application. At borders, different tanks, missiles, guns are used by enemy. This causes problem and harm our force or soldiers. For this, a robot is designed and developed for military purpose application to protect the army. Robots are used to detect the obstacle which is found in the path. If any obstacle is found, using gun mechanism, the robot will be able to shoot that obstacle.

Key words: Internet of Things, Microcontroller, Defense, LOC, ZigBee

I. INTRODUCTION

The Kargil war was an armed conflict between India and Pakistan. This war took place between May and July 1999 in the Kargil district of Kashmir along the Line of Control. The conflict is also referred to as Operation Vijay in India which was the name of the Indian operation to clear the Kargil sector. Because of this war, Indian economy decreased by 38%, cost of all commodities increased, taxes increased, and the country had to face tremendous loss. The objective this paper is to design and develop Security operations in the protected area or LOC with wireless secured communication and tracking devices. The proposed system is based on IOT. The system uses an IR and camera based security system for protected areas and borders, which senses intruders, trespassers and transfer video to other end.

A. Wireless Multifunctional Robot for Military Applications

The system presents a modern approach for surveillance at remote and border areas using multifunctional robot based on current 3G technology used in defense and military[3] applications [1][2]. The robotic vehicle has ability to substitute the solider at border areas to provide surveillance. The robotic vehicle works both as autonomous and manually controlled vehicle using internet as communication medium. This multisensory robot used to detect human, bombs, harmful gases and fire at remote and war field areas. The robot functionality is been controlled by PIC18F452 controller. The PIC18F452 controller uses RISC computation, which makes the program lengthy. In the PIC controller program memory is not accessible and only a single accumulator is present for computations.

B. Design and Development of multifunctional Robot for Military purpose Applications

The method involves a biped walking robot using parallel leg mechanism i.e. PLM which includes different functions like capturing real world data using digital image processing used to detect its obstacle which is found in its path. The limitations in the system is that it can move only on plain surfaces, but coming to the system fails to perform the operation effectively.

C. Touch screen controlled Defense Robot

The robot system can be built with the existing economic conditions that can be used for different sophisticated robotic applications. The control system consists of Touch screen and ZigBee modules, a microcontroller [4] that controls the robot. The system provides continuous visual monitoring through the wireless camera attached to the robot and sends continuous data to the control unit. A multifunctional Robot has been designed according to the specifications made above which uses ZigBee Technology. The system uses touch screen controlled defense robot [5]. ZigBee cannot be used to cover very long distance, it can only deal with low complexities and is very slow. Due to their low range coverage the current project uses GSM, which is used in concentrators to transmit data to the main station, or in high end multi-function meters. MQ-3 is used for detection of harmful gases [6].

D. IOT Based Wireless Multifunctional Robot for Military Applications

The project is presenting an IOT Based Wireless multifunctional robot for military application [7] with Raspberry pi 3 using MQTT protocol and it is done by integrating various sensors, Cameras, Grippers and actuators into web application using MQTT and HTTP protocol. The system uses ARDUINO controller.
ARDUINO controller has only 10 bits of resolution which is the disadvantage of it. RASPBERRY PI 3 consumes more power when compared to any other PC using INTEL Pentium 2 processor and also have got limited memory.

E. IOT based Surveillance Robot

The proposed security solution hinges on the novel integration of camera on Raspberry Pi. Raspberry Pi operates and controls video camera for surveillance[8] and records video for future playback. The other major advantage is that it is a simple circuit where particular operating system has to be installed so that the image can be displayed. Raspberry Pi consumes more power when compared to a PC using INTEL Pentium2 processor. The Raspberry Pi's memory is also limited which is been overcome in the current proposed system which uses External EEPROM memory AT24C02/4/8/16/32A having high flexibility in volume. Raspberry Pi uses L293D Driver

chip. The disadvantage of this is, it has a 1.5 voltage drop within the chip. Also, using Raspberry Pi the performance decreases significantly, it also has less Graphical capabilities and can only be programmed on limited number of languages.

II. PROPOSED WORK

The proposed system has an IR Sensor which senses any intruders/trespassers and switch on the guns in that particular place. The robot also shoots the intruder when he cross the border, the bullet is equipped with a GPS facility if the intruder escapes then the system can track him with the help of ARM 11 devices or smartphone. The robot will also activate the Camera, which will start capturing the live video and transmit the same to the receiver end that is the smart phone. The robot would also consist of a Gas sensor, and would immediately intimate the respected guards about the attacks. The system would also consist of a metal sensor, with which it can detect any hidden activated bombs and with the help of GPS facility it would send the exact location of the hidden bomb. When the sensor detects, it will send the audio and normal message to the smart phone. Fig.1 demonstrates the system architecture of this topic.

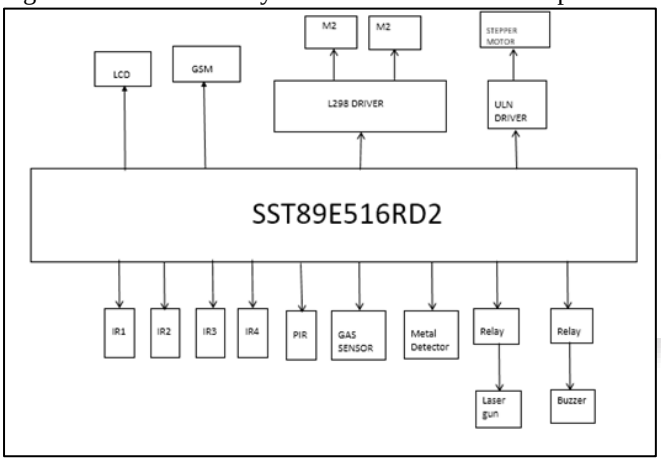

Fig. 1: System Architecture

A. Motors

NR-DC-ECO is high quality low cost DC geared motor. Fig.2 shows a 12v 100 rpm Geared motor that contains Brass gears and steel pinions to ensure longer life and better wear and tear properties. The gears are fixed on hardened steel spindles polished to a mirror finish. These spindles rotate between bronze plates which ensures silent running. The output shaft rotates in a sintered bushing. The whole assembly is covered with a plastic ring. All the bearings are permanently lubricated and therefore require no maintenance. The motor is screwed to the gear box from inside.

Fig. 2: 12v 100 rpm DC Geared Motor

B. Stepper Motor

A stepper motor as shown in Fig.3 is an electromechanical device which converts electrical pulses into discrete mechanical movements. The shaft or spindle of a Stepper motor rotates in discrete step increments when electrical command pulses are applied to it in the proper sequence. The motors rotation has several direct relationships to these applied input pulses. The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly related to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied.

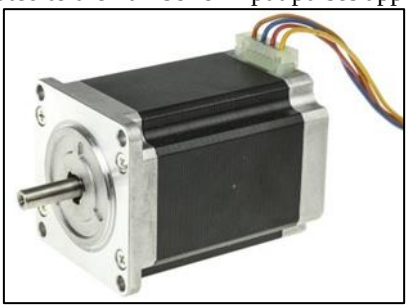

Fig. 3: Stepper Motor

C. Passive Infrared sensor (PIR sensor)

The unit output is high whenever human's motion is detected. PIR is a motion detector as shown in Fig.4. This sensor measures infrared .radiation emanating from objects in the field of view. It has only one output pin and another two pins is connected to 5V and GND separately. Apparent motion is detected when an infrared emitting source with one temperature, such as human body, passes in front of source with another temperature, such as wall. The unit output is high whenever there is motion detected. If the motion is continuous, the output remains high. After motion stops, the output remains high for a few seconds (depend on the variable resistor adjusted). It will remain high for longer if H from the jumper is selected. For this project, the resistant of variable resistor is adjusted to as low as possible so that the output of the sensor would not remain high for long time after motion stops.

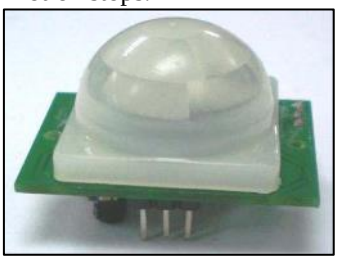

Fig. 4: Passive Infrared Sensor

D. Microcontroller

The main center part of the project is the microcontroller. Here we are using the 8051 based Philips SST89E516RD2 microcontroller. They are SST89E516RD2 80C51 microcontrollers with 64kB flash and 1024 B of data RAM. A key feature of the SST89E516RD2 is its X2 mode option.

The design engineer can choose to run the application with the conventional 80C51 clock rate (12 clocks per machine cycle) or select the X2 mode (six clocks per machine cycle) to achieve twice the throughput at the same clock frequency.

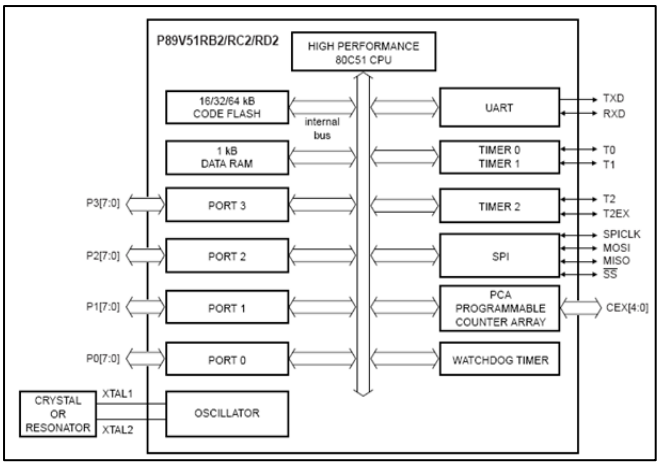

Fig. 5: Block Diagram of Microcontroller

E. Inductive Proximity Sensor

Metal detector is also known as inductive proximity sensors. Inductive proximity sensors operate under the electrical principle of inductance. Inductance is the phenomenon where a fluctuating current, which by definition has a magnetic component, induces an electromotive force (EMF) in a target object. To amplify a device's inductance effect, a sensor manufacturer twists wire into a tight coil and runs a current through it. An inductive proximity sensor has four components; the coil, oscillator, detection circuit and output circuit. The oscillator generates a fluctuating magnetic field the shape of a doughnut around the winding of the coil that locates in the device's sensing face. When a metal object moves into the inductive proximity sensor's field of detection, Eddy circuits build up in the metallic object, magnetically push back, and finally reduce the Inductive sensor's own oscillation field. The sensor's detection circuit monitors the oscillator's strength and triggers an output from the output circuitry when the oscillator becomes reduced to a sufficient level.


Fig. 6: Metal Detector

F. Obstacle Detector (IR Transmitter & Receiver)

To monitor the density of the traffic, we will be keeping a few sets of IR transmitter & receiver sensors on the side of the roads. On side IR transmitter will be placed & right opposite to the IR transmitter, an IR receiver will be kept. This set of IR transmitter & receiver will be kept on roads at different intervals. The IR transmitters are connected to supply, so that they will transmit high signal all the time. The IR receivers are connected to the comparator circuit, to get digital signals. A low power operational amplifier LM324 IC has been used to develop a comparator circuit.

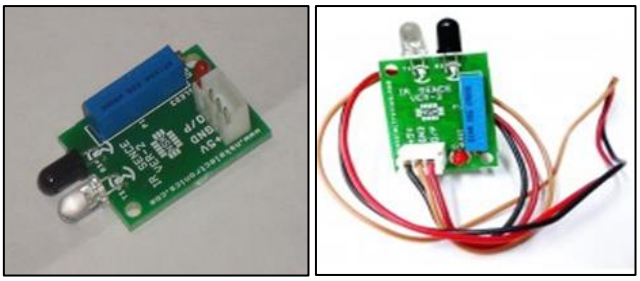
Fig. 7: IR Sensors

G. Alpha-Numeric LC Display

A liquid crystal display is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCs). LCs does not emit light directly. In liquid crystal displays (LCDs) of liquid crystal technology is the most common applications. An advanced VGA computer screen is evolved. It consist of a liquid crystal display, an array of tiny segments (called pixels) and to present the information that can be manipulated. This basic common idea is to all displays, alienate from simple calculators to a full color LCD television. The primary factor was size, an LCD consisting of primarily with some liquid crystal material between them of two glass plates. There is no bulk amount picture tube. This gives LCDs practical for applications where size (as well as weight) is necessary. Fig. 8 show an LCD.

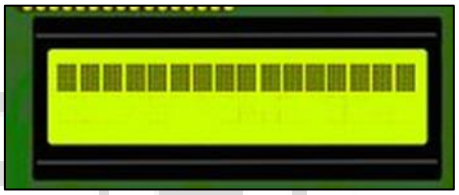
Fig. 8: LCD

H. Gas Sensor

They are used in gas leakage detecting equipments in family and industry, are suitable for detecting of LPG, natural gas, town gas, avoid the noise of alcohol and cooking fumes and cigarette smoke. Resistance value of MQ-5 is difference to various kinds and various concentration gases. So, when using this component, sensitivity adjustment is very necessary. When accurately measuring, the proper alarm point for the gas detector should be determined after considering the temperature and humidity influence.

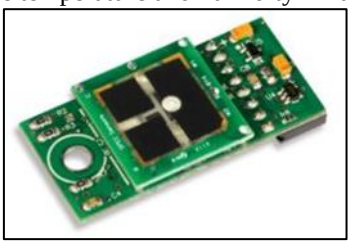
Fig. 9: Gas Sensor

III. IMPLEMENTATION

A. Monitoring of Robot

The Data flow is as shown in the Fig.10. To monitor the robot, connect receiver smartphone to Bluetooth device. Initially when Bluetooth is not connected to smartphone, there will be a continuous blink light on Bluetooth device. To connect to Bluetooth device, Open Guardian app and

press home button and then go to Settings firestop the Bore Bud App and then open the Bore Bud App in receiver smartphone. Click on Add BT device. After scanning of devices, click on HC-05 name. Pair the device with common pair key 1234. After connection is established, there will be a blink of light on Bluetooth device once in 3seconds. Start Monitoring the robot front, back left and right by clicking on the respective buttons. When Bluetooth is connected to smartphone, there will be a blink of light on Bluetooth device once in 3seconds. To disconnect the Bluetooth device, click on disconnect button on HC-05 device name. The working of Robot is as shown in the Fig.11.

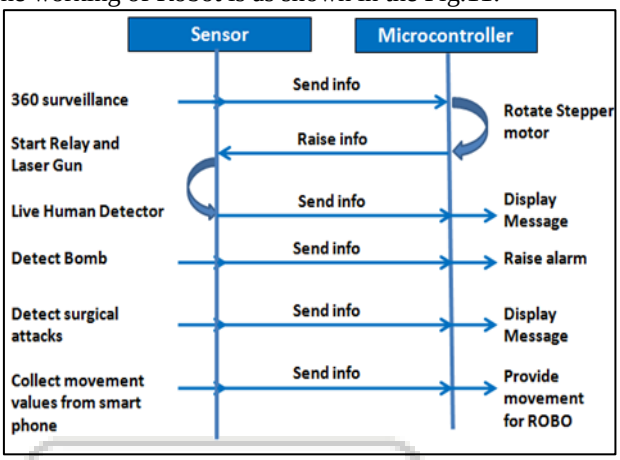

Fig. 10: Data Flow Diagram of the System

Fig. 11: System Implementation

B. Live Video Transmission

To capture the live video, we need two smartphones, sender smartphone to capture the video and receiver smartphone to receive the live video. In Receiver smartphone, Open Guardian app and press home button. Go to settings, force stop the Bore Bud App. Put on the hotspot for connection of both smartphones. In Sender smartphone, open Third Eye App. Click on Send Video. Enter IP address of Receiver smartphone 192.168.43.1 then click on register for the registration purpose. In Receiver smartphone, Open Bore Bud app and then Click on MONITORING to receive the live video. In sender smartphone, click on BROADCAST to send the video as shown in the Fig.12.

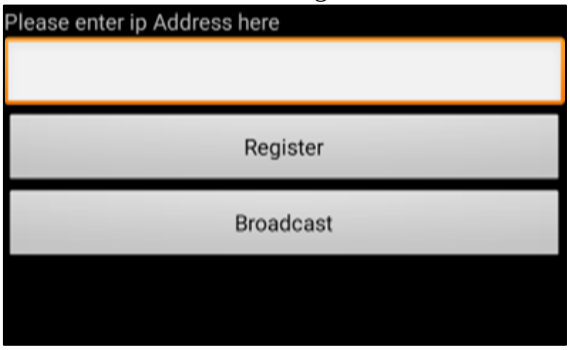

Fig. 12: Live video broadcasting

IV. CONCLUSION

LOC is the current area of research where lots of scope exists. Currently this particular security technique is required by several countries, one such enhancement we are trying to do. The type of communication technique enhance its range of operation, where the user can control the movement of robot from any part of world by getting live video of surrounding as feedback, compared to earlier robots work like WIFI with constraints have limited operational range. Use of renewable source of energy, smart cell phone as video camera makes it cost effective compared to existing robot. This robotic vehicle with different sub modules can widely be used as surveillance robot for security purpose and emergency rescue operations where human cannot footpace and user will be able to alert prior to intruder in his premises.

The proposed system gives an exposure to design a multifunctional defense robot. This robot has a widespread industrial, defense application. The laser gun attached to the robot is an excellent substitute for the weapons carried by the soldiers. The laser gun can be triggered with the help of wireless camera. It can be used in a hostage situation to pinpoint the exact location of terrorists with the help of wireless camera, saving many lives during rescue mission. Another application is border security system to sense movement of intruder through PIR sensor. The current range of operations is up to 10m and can be made more sophisticated. Laser gun found to be very accurate in pointing to the target.

V. FUTURE ENHANCEMENTS

This system can be used for military applications installing suitable sensors. Just by changing the robotic unit design, we can use it in hospitals for patient monitoring. Using some chemical sensors, we can detect harmful gas leakage in the chamber. The time delay which occurs in the execution of commands can be reduced and thus we can have more real time access to the robot. With reduced time delay, we can have faster operation and quick response to any illegal activities in the monitored area. Also it can be used as a spy robot.

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