MULTIPURPOSE MILITARY ROBOT

Kaiwalya Ghundare Patil[1], Vinod Somani[2], Sandeep Disale[3]
S L Chavan[4]

[1, 2, 3] *Student, Department of Electronics and Telecommunication,*
JSPM's Rajarshi Shahu College of Engineering, Savitribai Phule Pune University, M S, (India)
[4]*Associate Professor, Department of Electronics and Telecommunication,*
JSPM's Rajarshi Shahu College of Engineering, Savitribai Phule Pune University, M S, (India)

ABSTRACT

In today's world, every country is concentrating on investing more money to make their defence sector strong. So, there is more research work taking place in the defence sector for upgrading their defence techniques. So, our system is contributing in the multiple fields of defence sector. Our system is capable of detecting landmines, fire and alive humans. Simultaneously, our system is capable of detecting and diffusing bomb marking landmines. The system has camera module and GPS system .Thus, our system is a multipurpose Warfield robot, useful for surveillance and security .The main objective of preventing the loss of lives of soldiers will be achieved.

Keywords: Fire and Alive Human Detection, GPS Modem, Landmine Detection, Surveillance.

I. INTRODUCTION

There are losses of many soldiers due to landmines. There are many hazardous objects in crowded areas .So there is always a threat of bomb being detected. During disastrous situations, it is difficult to determine the presence of alive humans. To tackle these problems, previous research work has focused only on one module. There is research work taking place on landmine detection. There are various techniques used to detect landmines like Ground Penetration Radar (GPR), Thermal image of buried landmines, Metal detector. To place and pick the hazardous objects, robotic arms have been used .The robotic arms also have facility of cutter. For detecting alive humans, different techniques have been introduced .Oxygen sensor have been used to detect the presence of alive human .The purpose of our project is to detect landmines, fires and alive humans. Our main purpose is to develop a multipurpose Warfield robot. .Thus we will be developing a smart, innovative multipurpose Warfield robot.

1.1 Existing System

There is research work done for detecting landmines, fire and alive humans. But, the existing system focuses only on one module.

1.2 Proposed System

Our system is focusing on developing a robot capable of detecting landmine, fire and alive humans. Thus our system will perform multiple functions and hence is an intelligent multipurpose Warfield robot.

II. HARDWARE REQUIREMENTS

Our system comprises of following components:

1. Micro-controller (PIC 18F452)
2. CC2500 transceiver.
3. GPS module
4. Fire sensor
5. Robotic Arm
6. Wireless camera module.
7. Metal detector.
8. PIR sensor.

III. BLOCK DIAGRAM

3.1 On the Robot

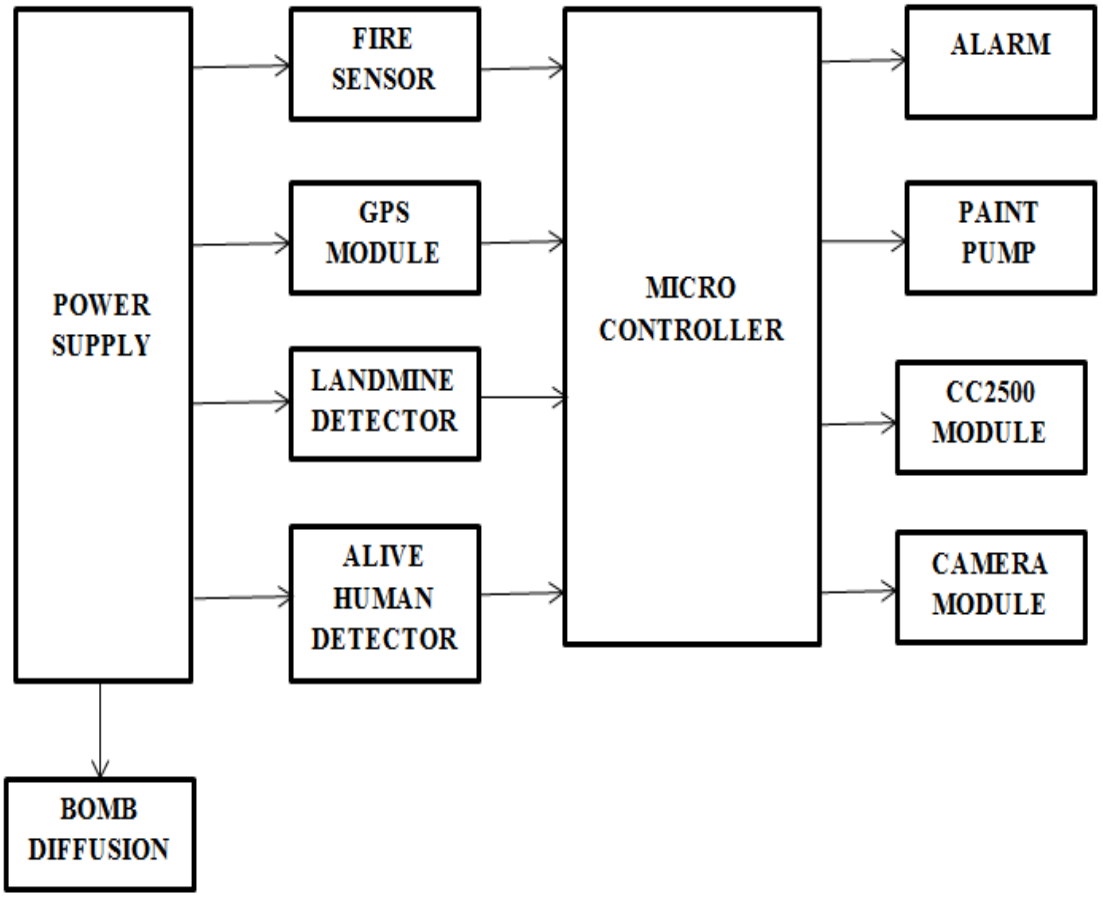

Fig.1

3.2 AT THE CONTROL ROOM

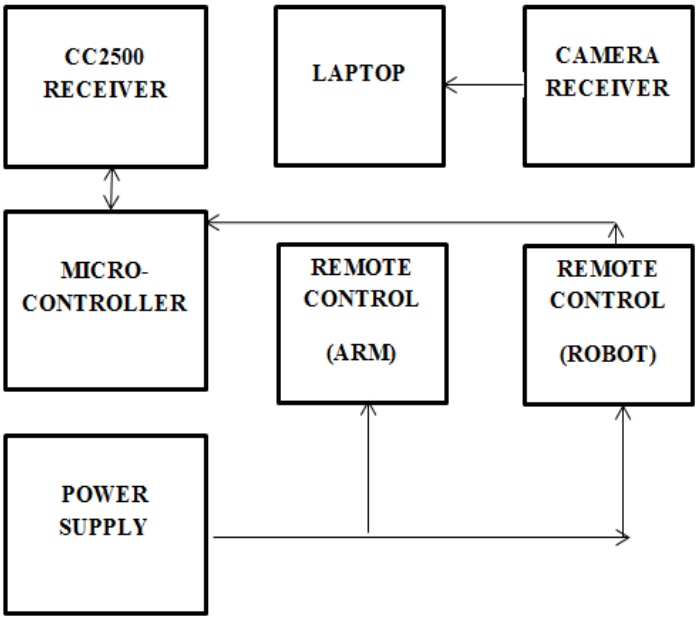

Fig.2

3.3.1 Microcontroller

There are many microcontrollers available in the market which helps in providing highly-flexible and cost-effective solution to many embedded control applications. Our system is using PIC18F452 microcontroller because it has two serial ports. It accepts inputs from the sensors like metal detector, PIR sensor, Fire sensor and GPS module. It sends this information wirelessly using CC2500 transceiver module. It also decodes the controlling instruction received over that wireless module. Ourmicro-controller has high performance RISC CPU.PIC 18F452 has up to 10 MIPs operation: - DC - 40 MHz osc./clock input - 4 MHz - 10 MHz osc./clock input with PLL active. Our micro-controller hashigh current sink/source 25 mA/25 mA. PIC 18F452 has three external interrupt pins - timer0 module: 8-bit/16-bit timer/counter with 8-bit programmable prescaler, timer1 module: 16-bit timer/counter, timer2 module: 8-bit timer/counter with 8-bit period register (time-base for PWM), timer3 module: 16-bit timer/counter. It has CCP pins that can be configured as: - Capture input: capture is 16-bit, max.resolution 6.25 ns (TCY/16) - compare is 16-bit, max resolution 100 ns (TCY) - PWM output: PWM resolution is 1- to 10-bit, max. PWM freq. @: 8-bit resolution = 156 kHz 10-bit resolution = 39 kHz • Master Synchronous Serial Port (MSSP) module, Two modes of operation: - 3-wire SPI™ (supports all 4 SPI modes) -I 2C™ Master and Slave mode. Our microcontroller has addressable USART module that supports RS-485 and RS-232. It is compatible 10-bit analog-to-digital converter module (A/D) with fast sampling rate and conversion available during SLEEP. It supports programmable Brown-out Reset (BOR).Our PIC microcontroller has facility of 100,000 erase/write cycle Enhanced FLASH program memory and 1,000,000 erase/write cycle Data EEPROM memory. It also has facility like self-reprogrammable under software control, power-on Reset (POR), Power-up Timer (PWRT) ,oscillator Start-up Timer (OST) ,watchdog Timer (WDT) with its own On-Chip RC Oscillator for reliable operation, programmable code protection, power saving SLEEP mode selectable oscillator options.

3.3.2 Metal detector

There are different techniques of detecting landmines but the easiest and cost effective way is using Metal detector. It is used to detect landmines beneath the soil. As most of the landmine content is Iron, metal detectors are effective in detecting Iron content. It gives output in the form of logic1 or logic 0 to the opto-coupler which gives it to the microcontroller. Later on the Position of Land mine is sent to control room using GPS module and it is marked with paint using paint pump.We need a metal detector to detect the landmine , we have used a inductive proximity metal sensor because it is one of the basic methods of detecting a presence of a land mine and it is cost effective. 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, we need to twists wire into a tight coil and run 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

3.3.3 PIR Sensor

The Robot will have the PIR sensor, which will help to detect the alive human beings. The human body radiates infrared waves with wavelengths of 8 to 12 micrometres. Whenever any human being comes in the vicinity of the system the IR system gives the Signal.Pyroelectric devices, such as the PIR sensor, have elements made of a crystalline material that generates an electric charge when exposed to infrared radiation. The changes in the amount of infrared striking the element change the voltages generated, which are measured by an on-board amplifier. The device contains a special filter called a Fresnel lens, which focuses the infrared signals onto the element. As the ambient infrared signals change rapidly, the on-board amplifier trips the output to indicate motion.The PIR Sensor requires a 'warm-up' time in order to function properly. This is due to the settling time involved in 'learning' its environment. This could be anywhere from 10-60 seconds. During this time there should be as little motion as possible in the sensors field of view.The PIR Sensor has a range of approximately 20 feet. This can vary with environmental conditions. The sensor is designed to adjust to slowly changing conditions that would happen normally as the day progresses and the environmental conditions change, but responds by making its output high when sudden changes occur, such as when there is motion. The PIR (Passive Infra-Red) Sensor is a pyroelectric device that detects motion by measuring changes in the infrared levels emitted by surrounding objects. This motion can be detected by checking for a high signal on a single I/O pin. The PIR sensor has features like single bit output , small size makes it easy to conceal , compatible with all Parallax microcontrollers and 3.3V & 5V operation with <100uA current draw.

3.3.4 Robotic Arm

Our system will be having a robotic arm to pick and place hazardous object at a safe space. It will have a cutter to diffuse the bomb.Pick-and-place applications comprise both primary handling—putting individual. The type of robot most appropriate for a given pick-and-place application depends on the speed required, the size of the payload and other factors. For most applications, only one type of robot will be appropriate. In our system, the

robotic arm picks hazardous objects, to place them at safe place. The robotic arm is remotely handled from a safe distance. Pick-and-place applications are fertile ground for robotic equipment. Thus pick and place robotic arm is one of the important part of our system. As technology and other developments make such equipment increasingly viable, end users who pick the right machines will find themselves in a good place.

3.3.5 Fire Sensor

Fire sensor is used to sense fire. The temperature is detected to check for fire. If the temperature is exceeded above specified temperature, fire is detected. As the fire is detected, buzzer goes on to alert the soldiers. This module is sensitive to the flame and radiation. It also can detect ordinary light source in the range of a wavelength 760nm-1100 nm. The detection distance is up to 100 cm. The Flame sensor can output digital or analog signal. It can be used as a flame alarm or in fire fighting robots. The sensor detects a flame or a light source of a wavelength in the range of 760nm-1100 nm. It's detection distance is 20cm (4.8V) ~ 100cm (1V) and detection angle is about 60 degrees. It is sensitive to the flame spectrum. A comparator chip LM393 makes module readings stable. Fire sensor has a adjustable detection range and operating voltage is 3.3V-5V. It has a power indicator.A flame detector is a sensor designed to detect and respond to the presence of a flame or fire. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system. When used in applications such as industrial furnaces, their role is to provide confirmation that the furnace is properly lit; in these cases they take no direct action beyond notifying the operator or control system. A flame detector can often respond faster and more accurately than a smoke or heat detector due to the mechanisms it uses to detect the flame.The sensing part of the detector consists of two chambers - an open, outer chamber and a semi-sealed reference chamber within. Mounted in the reference chamber is a low activity radioactive foil of Americium 241 which enables current to flow between the inner and outer chambers when the detector is powered up. As smoke enters the detector, particles become attached to the ions, causing a reduction in current flow in the outer chamber and hence an increase in voltage measured at the junction between the two chambers. The voltage increase is monitored by the electronic circuitry which triggers the detector into the alarm state at a preset threshold. An externally visible red LED lights up when the detector changes to alarm state.

3.3.6 CC2500 Transceiver

CC2500 transceiver module is used for wireless transmission of data. The robot is controlled wirelessly using CC2500 module. The CC2500 is a low-cost 2.4 GHz transceiver designed for very low-power wireless applications. The circuit is intended for the 2400- 2483.5 MHz ISM (Industrial, Scientific and Medical) and SRD (Short Range Device) frequency band. The RF transceiver is integrated with a highly configurable baseband modem. The modem supports various modulation formats and has a configurable data rate up to 500 kBaud. CC2500 provides extensive hardware support for packet handling, data buffering, burst transmissions, clear channel assessment, link quality indication, and wake-on-radio. It has features like high sensitivity (–104 dBm at 2.4 kBaud, 1% packet error rate) ,low current consumption (13.3 mA in RX, 250 kBaud, input well above sensitivity limit) ,programmable output power up to +1 dBm ,excellent receiver selectivity and blocking performance and programmable data rate from 1.2 to 500 kBaud with frequency range: 2400 – 2483.5 MHz. It is supported with OOK, 2-FSK, GFSK, and MSK. CC2500 is suitable for frequency hopping and multi-channel systems due to a fast settling frequency synthesizer with 90 us settling time. Automatic Frequency Compensation (AFC) can be used to align the frequency synthesizer to the received centre frequency. It has

digital features like flexible support for packet oriented systems: On-chip support for sync word detection, address check, flexible packet length, and automatic CRC handling ,efficient SPI interface: All registers can be programmed with one "burst" transfer. CC2500 also has other features like few external components: complete on- chip frequency synthesizer, no external filters or RF switch needed, green package: RoHS compliant and no antimony or bromine, small size (QLP 4x4 mm package, 20 pins) , suited for systems compliant with EN 300 328 and EN 300 440 class 2 (Europe), FCC CFR47 Part 15 (US), and ARIB STD- T66 (Japan), support for asynchronous and synchronous serial receive/transmit mode for backwards compatibility with existing radio communication protocols.

3.3.7 Wireless Camera

Wireless camera will be used for giving live updates and surveillance. Wireless camera will be the 'eyes' of our system. It will be mounted on the front end of the robot. The camera will be connected wirelessly to the laptop. The control room will get live updates of the surroundings. Depending upon the live updates and signals, the control room will take action. The most important advantage is that camera is connected wirelessly to the laptop. Thus, camera plays an important role in our system, especially for diffusion of bomb.

IV. CONCLUSION

The proposed system is aimed towards the welfare infantry and surveillance to minimize the causalities to a great extent. Our system helps to pick and place the object using robotic arm. It also helps to detect the objects using wireless camera. Our system will also be able detect fire and alive humans. Hence, our system is sure to create a revolution in its own field and ensure complete support from people of different societies.

V. ACKNOWLEDGMENT

We would like to express our sincere gratitude towards Prof Mr S.L Chavan for guiding us throughout this paper research and providing us useful information needed for us to make this paper possible.

REFERENCES

[1] Prof.S.Pavithra and Prof. S.A.Siva Sankari, 7TH Sense-A Multipurpose Robot for Military,2013,Saveetha University, Thandalam

[2] NyeinChann, Department of Mechanical Engineering, and National University of Singapore, Landmine Detection and marking robot , 2006-07, Singapore

[3] AdzlyAnuar, Salman Yussof, Ismail Said, Jeffrey Tan Too Chuan, The development of an autonomous personal robot mobile system for landmine detection on uneven terrain: an experience, May 20-21, 2003. Putrajaya

[4] Muhammad Zubair and Mohammad Ahmad Choudhry, Landmine detecting robot capable of path planning, 2010, Second WRI, World Congress on software engineering.