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Hurt Locker-An explosive disposal robot

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***Abstract*—Robots are becoming an essential participant in perimeter security systems, reconnaissance missions and search rescue operations. Premises surveillance of Border is one of the largest potential areas for robotic vehicle requirement. The Robotic vehicle used in these applications saves the Human loss and contributes towards the growth of the country's Technology. Everyone knows that being a soldier is a dangerous as well as risky job, but some of the tasks that soldiers are intended to do are more dangerous than other job. Walking through minefields, deactivating unexploded bombs or clearing out hostile buildings say for example, are some of the most dangerous tasks a person is asked to perform in the line of duty. What if we could use the robots to perform these jobs instead of humans? Then, if something went wrong, we'd only lose the Machine instead of losing a Human life. This was the main reason behind selecting this project. In this project, a remote controlled warfare robot is realized. This is built in with**

***Keywords*—robotic arm, warfare robot, five degree of freedom arm, explosive disposal robot, Spy robot.**

I. INTRODUCTION

Since we all know that these days it's the robotic era and automation era. The every system is getting automated as well as remote controlled. Hurt locker is the Oscar winning movie where this type of robot is shown to carry the explosives. So the name hurt locker for this robot. It's made partially semi autonomous since it has to handle dangerous explosives and harmful chemicals. Here in this system I have created this robot for the safety of the soldiers in war field.

This is built in with, A 5 DOF (degree of freedom) ROBOTIC ARM with the gripper assembly to handle the harmful products such as bombs, explosive materials, nuclear products etc with delicate manner. It can be used to defuse the explosives also. The RF/ASK Communication link for movement and certain other controls of the Robot. An onboard wireless Color Camera with video and audio transmission is built in.

An infrared bared surface depth and irregularities detection which prevents robot from damage. The robot is built in with the automatic turn on lamps and head torch lights.

II. LITERATURE SURVEY

A. History of robots in warfare

Usually people think that military robots belong to science fiction or to the future. People are aware that robots are being used in military nowadays. But there are only some of the people who know the history of robotic devices used in military starts as far back as the end of 19th century. The soviets made a remotely controlled tank so called – teletank. The tank's control system was modified and pneumatics, the electric relays as well as the radio signals were used to control the tank. UAV stands for Unmanned Aerial Vehicle. The UAVs were substantially used for anti- aircraft training as early as 1916. The turning point had come in 1960s when reconnaissance drones were developed. Lightning bug was a US reconnaissance drone used in 60s - 70s. Around 3500 Lightning bug missions were own against different countries. Nowadays there are many UAVs used in military forces around the world for their soldier's security.

B. Features in this robot

In this project, a remote controlled warfare robot is realized. This is built in with the Wireless controllable Robotic arm (5 DOF) with gripper, RF/ASK Communication module. A wireless color camera with video and audio transmission, Infrared based surface depth sensor, an automatic turn on lamps and head torch lights.

III. BLOCK DIAGRAMS

This robot included with 2 main units such as

- Transmitter unit.
- Receiver unit.
- Five axis Robotic arm.

1. *Block diagram of transmitter unit.*

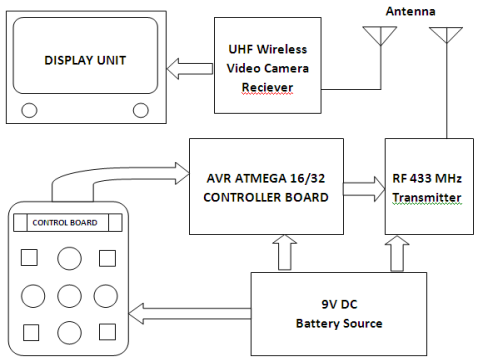

Figure1: Block diagram of transmitter unit.

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2. *Block diagram of receiver Unit.*

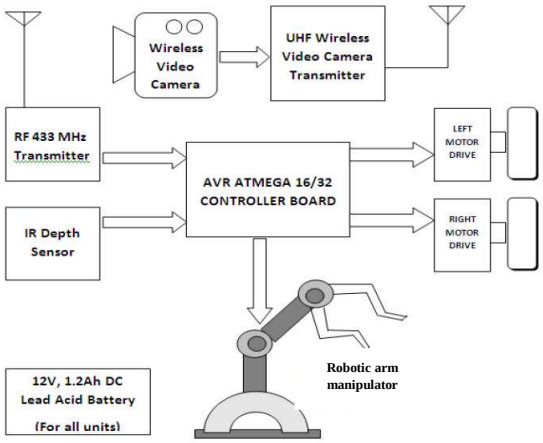

Figure 2: Block diagram of receiver unit.

a. *Five axis robotic arm.*

The arm is having three joints same as human arm (wrist movement, elbow movement, shoulder movements). We have four switches to control the position of the arm along with one supply on/off switch and on/off switch for lamp to glow.

Each control switch is having two functions. If it is operated in one direction then arm will move in one direction and vice versa. Each movement is controlled with a motor through switch. Motor are being supplied with four heavy duty batteries. For understanding operation, let as rename the two motor used here. Let the name motor be M1, now the object which picked is placed, control switch sw1 is operated to control motor in one

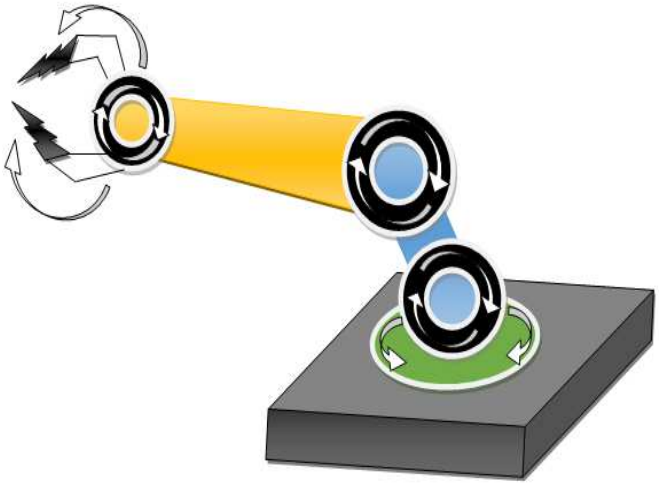

Figure 3: Mechanism of five axis robotic arm.

direction it moves motor M1 in say clockwise direction due to which whole arm moves towards picking platform. As it reaches there, sw1 operation has to be stopped and now the same sw1 is operated in anticlockwise direction to hold the object in closing jaw. In the same way other three control switches are being operated to control the motor speed and arm position.

IV. HARDWARE DESCRIPTION

A. AVR ATMEGA 16/32

The high-performance, low-power Atmel 8-bit AVR RISC-based microcontroller combines 16KB of programmable flash memory is in built, with 1KB SRAM, and 512B EEPROM, an 8-channel 10-bit A/D converter is in built, and a JTAG interface for on-chip debugging. The AVR supports throughput of 16 MIPS at 16 MHz and operates between voltages 4.5-5.5 volts.

By executing instructions in a single clock cycle, this device achieves throughputs by approaching 1 MIPS per MHz

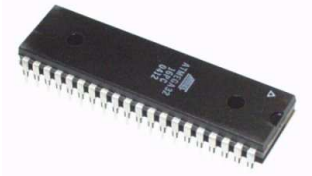

Figure 4: AVR ATMEGA32 IC

Features of AVR

It's is high performance reliable controller, uses low power AVR 8-BIT microcontroller. It has 40-PIN PDIP, 32 programmable I/O lines, it has advanced RISC architecture, and its Operating speed is up to 16 MHZ. It has 4 8-BIT ports, 8 channels, 10-BIT ADC. Its Operating voltages are 4.5 to 5.5 v, AVR operates on currents like when Active it's 1.1 mA and when in idle mode it's 0.35 mA.

B. L293D motor driver

L293D provides the quadruple half H-bridge bidirectional driver. Which needs the supply voltage range up to 4.5V to 36V, the output current per driver is 600 mA, and the total current output is 1.2 Amps.

Figure 5: Picture of IC L293D

C. Wireless camera module

The wireless camera module provides the transmission signal of both pictures as well as sound. The transmission is about 50-100mts. The operating voltage is +9V DC. The current/power is 200mA / 400mW and the modulation for video is AM and for audio is FM

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Figure 6: Wireless camera and receiver module.

D. Five DOF Robotic Arm assembly

This arm is approximately 30cms in length (if joints kept straight) and it has 6 joints. The material used is plastic and fiber. Servo motors which are used for lifting operate on voltage 4.8V - 6V DC and the load capacity the arm can lift is about 3Kg at 4.8V DC.

Figure 7: five axis robotic arm with DOF.

E. Infrared depth and irregularities sensor

Infrared transmitter and receiver modules can range up to 6cms (max.) at the operating voltage of +5v DC.

Figure 8: Transmitter IR sensor(left), Receiver IR sensor (right).

F. Geared motors

Geared motors for the wheels of the robot are sized approximately 40-25cms.the material and shape is of metal and plastic. Each motor weighs 10 - 12kg (approx). and rotates with RPM of 150 rpm at operating voltage of +12V. this robot is a four wheel driven type.

Figure 9: module of single geared motor.

G. Lead acid battery

The +12V lead acid battery is used which can provide current of 1200 mAH. The rechargeable type is used which is of dimensions 10cm x 5cm x 4cm.

Figure 10: lead acid battery

H. RF 433MHz Transmitter and Receiver module

This module can range for about 100mts at the frequency of 433MHz. the modulation used is ASK at the operating voltage of +5V DC.

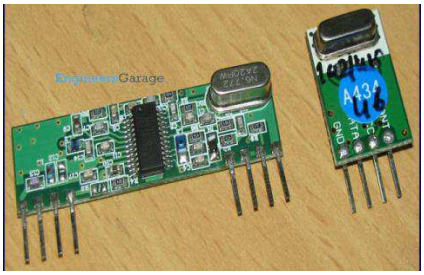

Figure 11: TX and RX modules

I. Portable A/V Screen

Here for the viewing of the video from the wireless camera module fitted over the robotic arm is about 7.8”tft LCD screen. It has multi function remote control, with high quality earphone, with super strong lithium battery for maximum power back up with rechargeable battery. The power adapter used is ac 100-240V.

Figure 12: Portable A/V screen.

J. Timer Bomb Module

This is just a module created to show the demo of bomb with timer. The timer is displayed to show the countdown of blast buzzer. The buzzer which beeps every half of the second and

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is connected to AVR which is built-in pre programmed to create the environment of the planted bomb.

This module is built with features like user has to set the time previously before pressing the countdown button. The last 10 sec. the buzzer beeps very fast. If the green wire is disconnected then the timer stops. If the red wire is disconnected then the timer runs very fast n the buzzer beeps continuously. If the buzzer switch is turned off then only timer can be made beep.

Figure 13: Module of time bomb.

V. APPLICATIONS

This warfare machine can be used as a fighter and a missile launcher in war field. It can be used to pick, move or place hazardous objects (like undiffused bombs or radioactive materials). Hurt locker can be used to gain information regarding a particular terrain. It can be used in land mines detecting applications. This remote controllable robot can also be used in the spy missions in enemy territories. This can be very much helpful in as a search robot in hostile conditions.

VI. ON COMPLETION OF THE PROJECT- THE FINAL PRODUCT

Figure 14: Receiver unit (left) and transmitter unit (right).

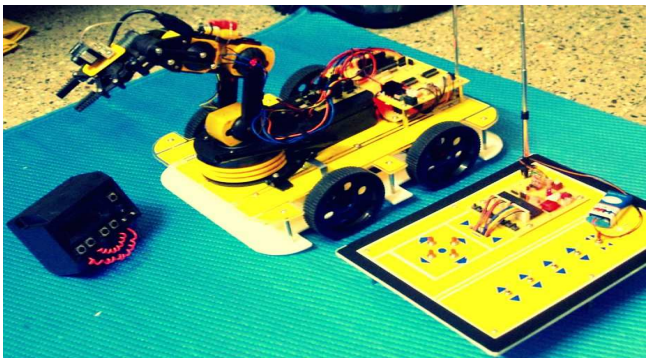

Figure 15: Hurt Locker – An explosive disposal robot

VII. TECHNICAL FEASIABILITY

Technical feasibility centers on the existing system (hardware and software etc) and to what extend it supports the proposed addition. For example, if a computer is operating at 80 percent capacity - an arbitrary ceiling - then running another application could overload the system or require additional hardware. This involves financial considerations too to accommodate technical enhancements. The budget is also serious constraint, so that the project is not feasible in judging. Mechanically speaking the chassis is build to withstand an additional load of 3 Kg, apart from the present load put on it. Even the motors can support the above mentioned addition. This will give the required freedom for additional enhancements in the future for further development without much budget modifications. In terms of electronics, any additional electronic loads could be added depending on the battery ratings. But by replacing the battery used higher loads can be added.

VIII. BEHAVIORAL FEASIBILITY

People are inherently resistant to change, and automation has been known to facilitate change. An estimate should be made that how strong a reaction the user staff is likely to have toward the development of a computerized system. Therefore it is understandable that the candidate to understand the system, so he needs special training to educate and train the staff. The system that is being developed is user friendly and easy to learn. In this way, the developed system is truly efficient and can work on any circumstances, tradition, locales. Behavioral study strives on ensuring that the equilibrium of the organization and status quo in the organization are not disturbed and changes are readily accepted by the users. The behavior of the Robot could be altered with little efforts to suit all circumstances and conditions. The micro controller has the capability of being able to be programmed 10,000 times and this adds to the ease of change. The mechanical aspects are made as rigid as possible to suit a variety of conditions and scenarios. With good technical feasibility as mentioned above, a good behavioral feasibility could be easily established making the system as user friendly as possible.

IX. FUTURE SCOPE

The military forces of the future will use multi-agent robotic workforces for many other purposes such as reconnaissance and surveillance, reinforcement, logistics and support, communications infrastructure and forward-deployed offensive operations. Already several military robots have been developed by various armies with well developed technologies. Many believe that the future of modern warfare will be fought by automated weapons systems and robotized machines. The U.S. Military is investing heavily in research and development towards more sophisticated technology, testing and deploying increasingly automated systems. The most reliable system presently in use is the unmanned aerial vehicle (IAI Pioneer RQ-1 Predator) which can be armed with

Air-to-ground missiles and remotely operated from a command center in reconnaissance roles. Towards this end, there is a clear and definite need for optimal, multi-robot control tactics in the synthesis, design, implementation, and fielding of autonomous and semi-autonomous teams of combat robots for military systems.

X. CONCLUSION

With extensive R & D we intend to make our robot more active and adaptable to mode diverse situations in the near future. However we hope that this module will definitely pave way to the new explorations in this scientific world and enhance the defense capabilities of our country.

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