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A SURVEY ON IMPROVISED EXPLOSIVE ORDNANCE DISPOSAL DEVICE

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Abstract: The paper gives the importance of the unmanned vehicles in the defense by enhancing emergency preparedness and security for all risks, gives the use of wireless application that could devices for transfer of data over a long distance without any cables and wires. The main aim is how robot can safety remove bomb with minimum risk. Here we can lift small bombs like C4, small IED's and an EMP (Electro-Magnetic Pulse) device is used which has the propensity to destroy all electrical devices within its set range, causing malfunctioning of electronic devices. In order to disable the covert nuclear weapons, we can also employ this technology in military defense which are triggered electronically. Here, the device able to detect land mines with the most basic type of metal detector has an oscillator that transmits magnetic field and current through a coil. The device is controlled using RF signal, here two radio wave beams that use the same frequency but distinct radio channels for encoding. This opens the door for novel radio-science approaches and advancements in radio communication protocols that could provide a solution to the issue of radio-band interference obstruction. Here the device able with stand electromagnetic interference with the help of composite materials with polymer, cement and carbon matrices. One of the technologies used in manufacturing that is intended to carry out pick-and-place activities is the pick-and-place robot. Because of how it is built, the system gets more accurate results by doing away with human interference and mistake.

Keywords: IED (Improvised Explosive Device), EOD (Explosive Ordnance Device), EMP (Electro Magnetic Pulse), IB (Induction Balance), Passive Infrared Resistor (PIR), RF (Radio Frequency), Worm Gear, Gripper, Electromagnetic Relay, Electromagnetic Interference, Marx Generator, Electromagnetic Orbital Angular Momentum, DOF (Degrees of Freedom), HT Encoder, HT Decoder, IC (Integrated Circuit).

1. INTRODUCTION:

Bomb disposal engineering is the highly risk job even though all the safety precaution taken by the experts, if any mistake done by the diffuser it leads to death of many lives even his life will be in risk. So, to overcome this problem, we are presenting the idea of improvised explosive ordnance disposal device which can help in the bomb diffusion and the landmine detection, without using human resource, where rover

can go instead of the human to diffuse bomb and detection of landmines. Basically, our project is of two phases, 1st phase is of drive controlling of the rover, landmine detection and the arm base controlling. The 2nd phase of the project is arm controlling, bomb diffusion and the vision controlling of the rover. The bomb diffuser is controlled by the remote using Radio frequency signals which can increase the range of the remote control, by range of 100m between the controller and the rover.

Threat Assessment: EOD teams assess the threat posed by the device, gathering intelligence, and evaluating the potential impact and risks associated with it. This information helps them determine the appropriate approach and resources needed for the disposal operation.

Render Safe Procedures: EOD technicians employ a variety of techniques and tools to safely render the device inert. These procedures may include disrupting the explosive components, cutting or disabling triggering mechanisms, or physically removing the device from the area.

Remote Handling: EOD teams often use specialized robotic systems or remotely controlled tools to handle and manipulate the device. This approach minimizes the risk to EOD technicians by allowing them to maintain a safe distance from the explosive device.

Controlled Detonation: In some cases, it may be necessary to conduct a controlled detonation of the device. This involves carefully placing the device in a designated area and initiating a controlled explosion to neutralize the threat. The area is typically cordoned off to ensure the safety of surrounding personnel and the public.

Evidence Collection: After the device is rendered safe or detonated, EOD teams collect evidence and forensic materials for further investigation and analysis. This helps in identifying the perpetrators and gathering intelligence on the manufacturing and deployment of such devices.

It's important to note that Improvised Explosive

Ordnance Disposal is a highly specialized field that requires extensive training, expertise, and adherence to strict safety protocols. EOD technicians undergo rigorous training programs to develop the necessary skills and knowledge to effectively handle these dangerous situations.

If you encounter a suspected explosive device or suspicious package, it is vital to immediately contact the appropriate authorities and follow their instructions. Do not attempt to handle or disturb the device yourself, as it can pose a significant risk to your safety and the safety of others.

2. METHADOLOGY

1) In this system, we have created device which is able to detect and defuse of Improvised Explosive Device (IED's) and landmines.[8]

2) Using suitable sensors and mechanism to detect IED's and able to diffuse with the help of gesture control technique.[11]

3) Human detection

The PIR (passive infrared) sensor able to detect the presence of human beings by emitting the infrared rays.

4) Metal detector

The basic design of metal detector is a Induction Balance (IB) design. The main device in a IB detector is the coils switch. IB detector detect the landmines by emitting electromagnetic waves.[9]

5) Device Control

The device is controlled by 433MHz transmitter and receiver module with the help of the HT 12 Encoder and Decoder IC's.[6]

6) Encoding Channels with Same Frequency

The device will able to control many operations with the use of two radio wave beams that use the same frequency but distinct radio channels for encoding. [6]

7) Electro-Magnetic Pulse Generator

The Electromagnetic pulse generator is fitted on the tip of robotic arm which can able to permanently damage or reduce its efficiency lay 30%.[13]

8) Camera Operation

The camera is able to transfer the live video coverage to the controller.[8]

9) Gripper

The robotic arm is having a 2-claw holding system to hold the IED's and dispose in a safe place.[14]

10) 3-DOF

The robotic arm is able to rotate and perform the critical operations and place in a desired location with help of 3-DOF (degrees of freedom).[14]

11) Worm Gear Alignment

The arm with the 3-DOF each having a worm gear alignment which is able to provide high speed reduction and increased in the torque helps in lifting the objects without offering back torque.[3]

12) Relay Operation

The relay is used in switching between the motor terminals in order to perform the operation like forward, backward, right turn and left turn. Relay is also used to directly provide the motor with the 12v supply which is triggered by radio operation.[10]

13) Gesture Control

The accelerometer sensor is used at the controller, so that the controller will able to perform the operation with precision and with a limited controlling system.[11]

3.WORKING

The robot is intended for use by the soldiers in EOD missions, including detection, identification, recovery and disposal of explosive ordnance and improvised explosive devices (IEDs)."

The haptic controller system enables the operator to create preset sequences of tasks for the robot manipulator. It can perform intuitive spatial control with pistol grip over the actuated object. It can also operate the manipulator in motion / rewind modes.

As a result of a task space-controlled motion mechanism, the operator only controls the position of the end point of the manipulator arm where the gripper is attached and the angular and linear change rates at joints to reach that desired position are calculated by computer.

Therefore, the operator can concentrate on the position of end point, instead of dealing with relative changes of joints and corresponding links.

Once the device has been examined, the robot can then render the bomb.

3.1 TRANSMISSION CIRCUIT

Transmission block consists of 4 units

- Power supply
- Transmitter
- Antenna
- Controller

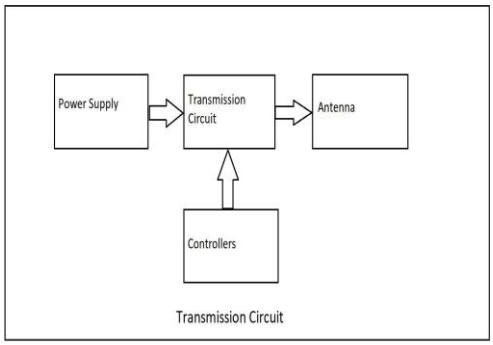


Fig.4.1 Transmission circuit block diagram

3.1.1 POWER SUPPLY

It consists of two cells each of 1.5v. It is used to trigger transmitter to ON state.

3.1.2 TRANSMITTE

We are using eight channels transmitter fetch. The function of the transmitter is to data from controller and transmit into antenna.

3.1.3 CONTROLLER

It contains 8-push buttons. Out of which 5-buttons are used for movement. The movement is controlled as follows.

• A push button number ‘8’ is used to switch between TO-FRO motion and rotation motion.

• When push button ‘8’ is in TO-FRO mode push button 1 and 2 should be pressed simultaneously to move forward. Similarly, 3 and 4 should be pressed for backward motion.

• Push button ‘8’ should be pressed to switch into rotation mode

• When button ‘8’ is in rotation mode 1 and 2 be pressed to turn right. Similarly, 3 and 4 are used to turn left

3.1.4 ANTENNA

Antenna receives signals and process it to produce output.

3.2 RECIEVER CIRCUIT

Whenever data is transmitted from the transmitter than the receiver circuit receives the data from the antenna. Then the control circuit triggers the appropriate relay. Whenever 1,2 relay is triggered it can be able to move in forward direction, when 3,4 relay is triggered it can move in reverse direction.

For changing the direction, the terminal changing circuit is triggered. By this way when 1,2 relay triggered it can move in right direction and when 3,4 relay are triggered it can move in left direction.

The control circuit will be able to detect the land mines using metal detector and then it also able to control arm base of the diffuser robot.

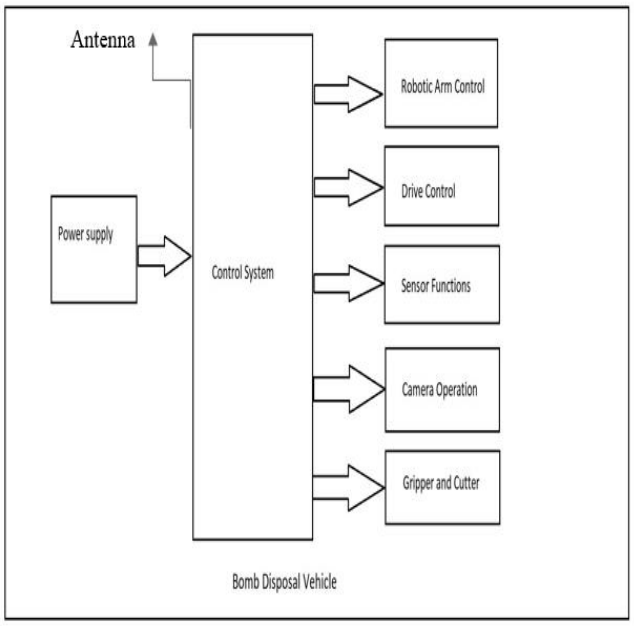
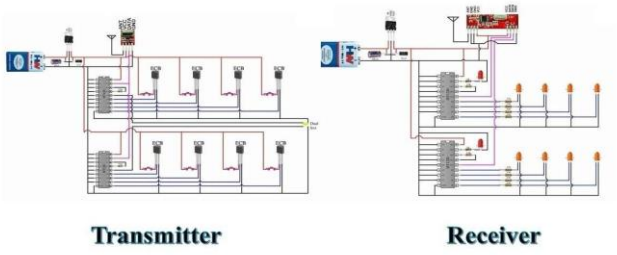


Fig.4.2 Receiver circuit block diagram



3.3 RELAY CIRCUIT

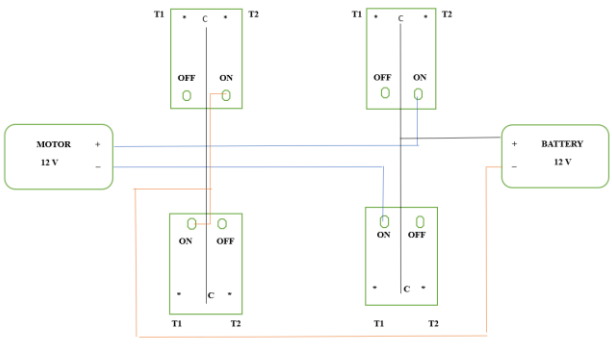


Fig.4.3 Relay circuit

- It consists of 4-relays, one motors and power supply.
- Relay R1 and R2 are connected parallelly. Similarly relay R3 and R4 are connected parallelly.
- Power supply of 12v is given to metal through relays.
- R3 and R4 are connected to receiver circuit.
- When receiver circuit produces command to R4 both, R4 and R1 are triggered and power supply flows through motor and motor starts to rotate in clockwise direction.
- Similarly, when receiver circuit produces command to R3 both R3 and R2 are triggered and power supply flows through motor and motor starts to rotate in anticlockwise.

3.4 TERMINAL CHANGING CIRCUIT

1. It consists of two metals and 2 relays.

2. When relays are not triggered motors will be connected parallelly (motor positive terminal is connected to other motor positive terminal and negative terminal to other negative terminal of motor).

3. Once relay is triggered motors will get cross connected (positive terminal of one motor to negative terminal of other motor vice versa).

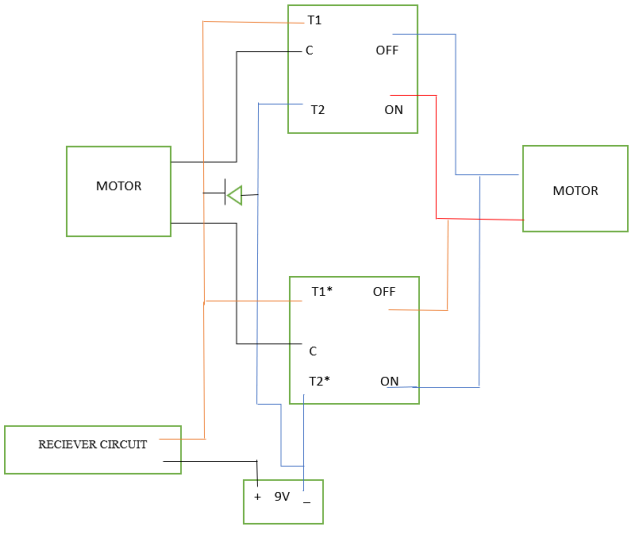


Fig.4.4 Terminal changing circuit

3.5 PIR Sensor

A Passive Infrared (PIR) sensor is an electronic device that detects infrared radiation emitted by objects in its field of view. PIR sensors are commonly used in motion detection systems, such as security alarms, automatic lighting systems, and occupancy detection systems. Here's how a typical PIR sensor works:

Detection Principle: PIR sensors are based on the principle that all objects with a temperature above absolute zero (-273.15°C or -459.67°F) emit infrared radiation. PIR sensors detect changes in the infrared radiation pattern within their detection range.

Sensor Construction: A PIR sensor consists of a pyroelectric sensor, which is a crystal material that generates an electric charge when exposed to infrared radiation. The pyroelectric sensor is divided into two halves, each connected to an amplifier circuit.

Signal Processing: The amplifier circuit processes the voltage variation and converts it into a digital signal. The digital signal is then analyzed by an onboard microcontroller or external circuitry to determine if there is motion detected.

Output: The PIR sensor typically provides a digital output signal, which can be in the form of a voltage level change or a logic signal (high/low). This output signal is used to trigger an action, such as activating an alarm, turning on lights, or sending a signal to a control system.

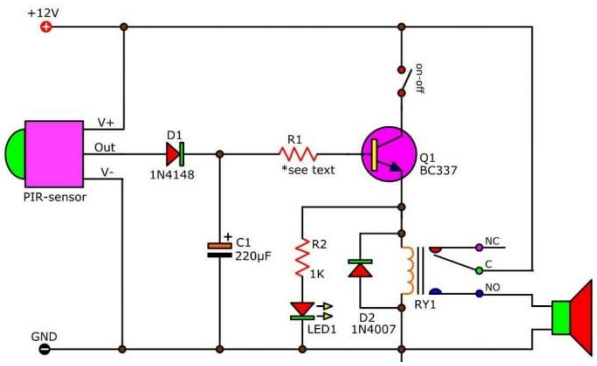


Fig.4.5 PIR Sensor

Lens: The sensor is covered with a Fresnel lens that focuses the infrared radiation onto the pyroelectric sensor. The lens divides the detection area into multiple zones, enhancing the detection accuracy and sensitivity.

Detection Range: The detection range of a PIR sensor depends on various factors such as the lens design, sensitivity adjustments, and placement of the sensor. Typically, PIR sensors have a range of a few meters.

Detection Algorithm: The PIR sensor's amplifier circuit measures the electric charge generated by the pyroelectric sensor. When a person or object moves within the sensor's field of view, it causes a change in the infrared radiation pattern. This change in radiation is detected by the pyroelectric sensor, resulting in a voltage variation.

Table 4.1 PIR Sensor Specification

SPECIFICATION	DESCRIPTION
Operating Current	Current consumption of the sensor during operation
Relay Output	Ability to trigger an external relay for switching devices
Delay Time	Adjustable delay time after detecting motion
Trigger Modes	Options like retriggerable, non-retriggerable, or pulse

Environmental Rating	Indoor or outdoor use, temperature, and humidity ranges
Dimensions	Physical size and dimensions of the sensor
Mounting Options	Different mounting options such as PCB, bracket, or casing
Applications	Common uses include security systems, occupancy detection, lighting control, and automation

4.RESULTS

The results of an Improvised Explosive Ordnance Disposal (EOD) operation can vary depending on the specific situation, device, and response of the EOD team. The ultimate goal of an EOD operation is to neutralize the threat posed by the improvised explosive device (IED) and ensure the safety of people and property in the vicinity.

Successful Disposal: The EOD team successfully identifies, renders safe, and disposes of the IED without any incidents or harm. This can involve techniques such as disabling the explosive components, removing triggering mechanisms, or conducting a controlled detonation in a safe location.

Controlled Detonation: In situations where it is not feasible to safely remove or disable the IED, a controlled detonation may be carried out. The device is carefully placed in a designated area, and a controlled explosion is initiated to neutralize the threat. The explosion is carefully controlled to minimize damage and protect surrounding areas.

Remote Handling: The EOD team may utilize specialized robotic systems or remotely controlled tools to safely handle and neutralize the IED. This approach allows them to maintain a safe distance and mitigate the risk to personnel.

Evacuation and Public Safety: In some cases, the EOD team may need to evacuate the area and establish a safe perimeter to protect the public. This ensures that everyone is at a safe distance from the potential blast zone during the EOD operation.

Forensic Analysis: Following the disposal or neutralization of the IED, evidence and forensic materials are collected for further analysis. This information can aid in identifying the individuals responsible for the device and gathering intelligence to prevent future incidents.

5.CONCLUSION

In conclusion, Improvised Explosive Ordnance Disposal (EOD) plays a critical role in mitigating the threat posed by improvised explosive devices (IEDs). EOD technicians are highly trained professionals who employ specialized techniques and equipment to safely identify, render safe, and dispose of these dangerous devices. The primary goal of EOD operations is to protect lives and property by neutralizing the threat and preventing harm.

Safety: The safety of EOD technicians and the general public is of paramount importance during EOD operations. Strict adherence to safety protocols and procedures is essential to minimize risks and prevent accidents.

Expertise and Training: EOD technicians undergo rigorous training to develop the necessary skills, knowledge, and experience required to handle IEDs safely. They are equipped with specialized tools, equipment, and protective gear to carry out their tasks effectively.

Threat Assessment: EOD teams conduct thorough threat assessments to evaluate the potential risks and impact associated with the device. This information helps them determine the appropriate approach and resources needed for safe disposal.

Render Safe Procedures: EOD technicians employ various techniques to render the device safe, such as disrupting explosive components, disabling triggering mechanisms, or conducting controlled detonations when necessary.

Collaboration: EOD operations often involve collaboration and coordination with other law enforcement agencies, military units, and first responders to ensure a comprehensive and effective response.

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