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A Military Application Robot (Design and Implementation) that Works as a Mine and Gas Detector

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Abstract

(In this paper, the aim of industrial robots is multifaceted, encompassing several key goals for manufacturers: Increased Productivity and Efficiency: Robots can work tirelessly without breaks, performing tasks much faster and more consistently than humans. This translates to higher production output and shorter lead times. Enhanced Precision and Quality: Robots excel at repetitive tasks with pinpoint accuracy, minimizing errors and ensuring consistent product quality. This is crucial for industries like electronics and pharmaceuticals, where precision is paramount. Reduced Costs: While the initial investment in robots can be significant, their long- term cost-effectiveness is undeniable. They reduce labor costs, minimize material waste, and require less maintenance than human workers. Improved Safety: Robots can safely handle hazardous materials and perform dangerous tasks, reducing the risk of injuries and fatalities on the shop floor. Greater Flexibility and Adaptability: Modern robots are becoming increasingly versatile, capable of handling different tasks and adapting to changing production needs. This flexibility allows manufacturers to respond quickly to market demands and customize their products more easily. As a simple introduction to the idea of the project, it works as a mine and gas detector. Due to the impossibility of obtaining a mine sensor, only the metal sensor was added in the experiment, as it was programmed using an Arduino and NRF on both the transmitting and receiving sides to control its movement wireless. To work in forbidden areas between countries to detect mines, in addition to connecting a harmful gas detection circuit to sense if there is a harmful gas to sound a siren, and also connecting a metal detection circuit in case it detects metal, which will also sound a siren).

Keywords: Exploration Robotics; ESP Camera; Industrial Robot; Mine Detection Sensor; Military Application

Introduction

Developing a military industrial robot involves several key steps and considerations. Here is a general outline of the process: Define Requirements: Clearly define the specific requirements and objectives for the military industrial robot. This includes identifying the intended applications, operational environments, necessary capabilities (e.g., mobility, manipulation, sensing, communication), payloads, and desired performance criteria. Conceptual Design: Based on the defined requirements, create a conceptual design for the robot. This involves determining the overall robot architecture, size, mobility mechanism (wheels, tracks, legs, etc.), manipulator type (if needed), sensor integration, and communication systems. Mechanical Design: Develop detailed mechanical designs of the robot, including the chassis, joints, linkages, actuators, power systems, and any necessary protective measures for military applications (e.g., armor, ruggedization). Electrical and Electronic Design: Design the robot's electrical and electronic systems, including power distribution, sensors (cameras, lidar, radar, etc.), data processing units, control systems, communication modules, and human-machine interface components. Software Development: Develop the necessary software infrastructure for controlling the robot. This includes firmware for controlling hardware components (e.g., motors, sensors), operating system software, perception algorithms, navigation and path planning algorithms, autonomous capabilities, and human-robot interaction software. Prototyping and Testing: Build prototype versions of the robot and test them to ensure that they meet the defined requirements. This involves verifying mechanical system performance, sensor accuracy and reliability, control system robustness, and overall system integration.

Iterative Refinement: Incorporate feedback from testing and user evaluations to refine and improve the design. This may involve multiple iterations of the design, testing, and refinement cycle to optimize performance and address any identified issues or limitations. Manufacturing and Production: Once the design is finalized and validated, prepare for large-scale manufacturing or production of the military industrial robots. Deployment and Training: Prepare documentation, user manuals, and any required training materials to ensure proper deployment and use of the military industrial robots. Training operators and maintenance personnel on how to operate, maintain, and troubleshoot the robot is crucial for successful deployment. Ongoing Maintenance and Upgrades: Provide ongoing support, maintenance, and potential upgrades to improve the performance, capabilities, and security of the military industrial robots throughout their operational life cycle. It is important to note that developing a military industrial robot requires expertise in various disciplines such as mechanical engineering, electrical engineering, computer science, and may involve compliance with relevant regulations and standards specific to military applications. Additionally, collaboration with defense organizations, military experts, and industry partners may be necessary for specialized requirements and access to resources. Robotics is the fascinating field of engineering and science focused on designing, constructing, operating, and applying robots. It's a vast and rapidly evolving discipline that encompasses various aspects, from the intricate mechanics of robot bodies to the complex algorithms that govern their behaviour. A Glimpse into the Past: The seeds of robotics were sown centuries ago, with early automatons appearing in ancient civilizations like Greece and China. These intricate machines, often powered by steam or water, showcased a human desire to create artificial beings capable of movement and action. Fast forward to the Industrial Revolution, and we see the emergence of more sophisticated machines specifically designed for industrial tasks. These early robots, though lacking the sophistication of their modern counterparts, laid the groundwork for the automation that transformed manufacturing processes. The Rise of Modern Robotics: The 20th century witnessed a surge in technological advancements, propelling robotics into a new era. The invention of the transistor and the subsequent miniaturization of electronics paved the way for smaller, more efficient robots. The development of computer programming languages gave birth to sophisticated control systems that could govern robot movements with greater precision. a landmark moment arrived in 1954 with the introduction of the Unimate, considered the first true industrial robot. This hydraulic-powered arm, developed by George Devol, could perform repetitive tasks like welding and material handling, marking a significant shift towards automation in factories. A Spectrum of Applications: Today, robots are ubiquitous in our world, venturing far beyond the factory floor. They perform surgery with delicate precision, explore the depths of oceans and the vast expanse of space, and even assist in household chores. Here's a glimpse into the diverse applications of robotics: Industrial Robotics: From car manufacturing to packaging goods, robots handle dangerous and repetitive tasks, ensuring efficiency and productivity. Medical Robotics: Surgical robots provide minimally invasive procedures, while robotic prosthetics restore mobility and independence. Service Robotics: Domestic robot's clean floors, mow lawns, and even interact with us, becoming helpful companions in our daily lives. Exploration Robotics: From underwater drones mapping the ocean floor to rovers traversing the Martian landscape, robots extend our reach beyond human limitations. Robots can work tirelessly without breaks, performing tasks much faster and more consistently than humans. This translates to higher production output and shorter lead times. Enhanced Precision and Quality:

Robots excel at repetitive tasks with pinpoint accuracy, minimizing errors and ensuring consistent product quality. In my research, ground robots were used for several reasons related to submarine robots and flying robots.

- Regulatory and Legal Challenges: The use of flying robots is subject to regulations and restrictions imposed by aviation authorities. Depending on the country or region, obtaining necessary permits, licenses, or certifications can be a complex and time-consuming process. Failure to comply with these regulations can result in legal consequences.
- Limited Flight Time and Range: Most drones have limited battery life, resulting in restricted flight time. This can be a challenge for tasks that require long-duration missions or coverage of vast areas. Additionally, the range of operation is restricted by communication capabilities, which can limit the drone's effectiveness in remote locations.
- Weather Dependency: Weather conditions significantly impact the safe operation of flying robots. Strong winds, rain, fog, or extreme temperatures can affect a drone's stability, control, and flight performance. Adverse weather conditions may render the drone inoperable or increase the risk of accidents.
- Payload and Capacity Limitations: Drones have limitations on payload capacity, meaning they can only carry a limited amount of equipment or supplies. This restricts their usability for heavier or larger tasks that require specialized equipment or significant payload capacity.
- Privacy and Security Concerns: The use of drones equipped with cameras and sensors raises privacy concerns. The ability to capture high-resolution imagery or conduct surveillance from the air can infringe upon people's privacy rights. There is also the potential for drones to be misused for malicious activities, such as unauthorized surveillance or carrying out attacks.
- Technical Challenges and Reliability: Flying robots are complex machines that require regular maintenance and skilled operators. Technical issues or component failures can lead to accidents, crashes, or damage to property. Ensuring the reliability, stability, and performance of drones requires expertise and continuous monitoring.
- Public Perception and Acceptance: Some individuals or communities may have concerns or negative perceptions about the presence of drones. Noise pollution, invasion of privacy, and safety considerations can lead to resistance or objections to the use of flying robots in certain areas or applications.
- Vulnerability to Hacking and Cyberattacks: As drones are connected devices, they are susceptible to cyber threats and hacking. Unauthorized access or control of a drone can lead to dangerous situations or compromised data, particularly in critical operations or sensitive environments.
- Extreme Operating Environment: Operating underwater presents significant challenges due to factors such as high pressure, low visibility, corrosive saltwater, and unpredictable currents. The harsh underwater environment can lead to increased wear and tear on equipment, necessitating regular maintenance and repairs.
- Limited Communication Range: Underwater communication is limited by water's ability to absorb and distort signals. This restricts the range at which the robot can be controlled or transmit data. As a result, real-time control and data acquisition may be challenging, requiring the robot to return to the surface or a certain proximity to a communication network.
- Power and Energy Constraints: Submarine robots rely on batteries or onboard power sources, which have limitations in terms of capacity and duration. This restricts their operational endurance, making it necessary to carefully plan missions that fit within the available power constraints. Long-duration missions or tasks requiring high energy consumption may be challenging or infeasible.
- Limited Maneuverability: Navigating underwater is more complex than flying or ground- based operations. Water's density and resistance limit manoeuvrability and agility. Submarine robots typically have lower speeds and may struggle to navigate through tight spaces or complex underwater terrains.

- Risk of Entanglement or Loss: Submerged objects, debris, or underwater vegetation pose a risk of entangling the robot's propellers or mechanical parts. This can potentially damage the robot or lead to its loss. Recovering or repairing a submarine robot in challenging and inaccessible underwater locations can be challenging and costly.
- Expensive Equipment and Maintenance: Submarine robots often require specialized equipment and technologies, which can be expensive to develop, procure, and maintain. Regular maintenance, replacing damaged parts, and keeping up with advancing technologies can add to the overall cost.
- Lack of Real-Time Human Intervention: AUVs are typically designed to operate autonomously, without real-time human intervention. This can make it difficult to respond to unexpected situations or make critical decisions during missions. While autonomy offers benefits, it may also limit the robot's ability to adapt to changing circumstances.
- Sensitive Ecosystem Impact: Submarine robots can have an impact on sensitive underwater ecosystems. Accidental collisions with marine life or disturbance of underwater habitats can disrupt marine organisms or ecosystems. Careful consideration must be given to minimizing the ecological footprint and potential disruption caused by these robots.

Related Works

In robot world, there are several fields to using such as the Floor robots, also known as ground-based robots or ground robots, are autonomous or semi-autonomous robotic systems designed to operate on flat surfaces, such as floors or roads. These robots are used in various industries and applications, including logistics, manufacturing, healthcare, and cleaning. Floor robots typically consist of a mobile base with wheels or tracks for locomotion and are equipped with sensors, cameras, and other instruments to navigate and perform tasks. They can be either manually controlled or operate autonomously, relying on sensors, algorithms, and AI to navigate, detect obstacles, and fulfill their designated functions. In logistics and warehousing, floor robots are employed to transport goods within facilities, optimizing inventory management and order fulfillment processes. They can navigate through complex environments, avoiding obstacles, and efficiently transporting items from one location to another. In manufacturing, floor robots play a vital role in automation, performing tasks such as material handling, assembly, and quality control. These robots can work alongside human operators or independently, streamlining production processes and enhancing efficiency and accuracy. In the healthcare sector, floor robots are utilized in hospitals and care facilities to assist with tasks like delivery of medication, transportation of medical supplies, or even providing patient assistance. These robots help reduce manual Labor and allow healthcare professionals to focus on critical patient care. Cleaning robots, such as robotic vacuum cleaners, are a popular type of floor robot designed specifically to automate the cleaning process in homes, offices, and public spaces. Equipped with sensors and mapping capabilities, these robots can navigate rooms, detect obstacles, and efficiently clean floors without human intervention. Flying robots, commonly referred to as drones or unmanned aerial vehicles (UAVs), are robotic systems capable of flight. Drones have gained widespread attention due to their diverse range of applications, including aerial photography, surveying, surveillance, search and rescue operations, and package delivery. Flying robots typically consist of a lightweight frame, rotors, and propulsion systems that allow them to achieve vertical take-off, hover, and manoeuvre through the air. They are equipped with various sensors, such as GPS, cameras, LiDAR, and IMU, to navigate, gather data, and maintain stability during flight. The versatility and manoeuvrability of flying robots make them valuable tools in many industries. Aerial photography and videography professionals utilize drones to capture breathtaking aerial shots for films, advertisements, and real estate listings. Drones equipped with specialized cameras or sensors are also used for remote sensing, precision agriculture, and environmental monitoring. In the field of surveying and mapping, drones can quickly and accurately capture high-resolution images or create 3D models of landscapes, construction sites, or disaster areas. These aerial surveys provide valuable data for urban planning, infrastructure development, and disaster response. Security and surveillance applications leverage flying robots to monitor large areas and critical infrastructure. Drones equipped with thermal cameras or facial recognition technology can aid in surveillance and help identify potential security threats or locate missing individuals. Delivery drones, also known as unmanned aerial delivery systems, have emerged as a potential solution for faster and more efficient package delivery. Companies are exploring the use of drones to transport small packages over short distances, aiming to reduce delivery times, traffic congestion, and carbon emissions. Underwater robots, also referred to as autonomous underwater vehicles (AUVs) or underwater drones, are robotic systems designed for operations in underwater environments. These robots have a wide range of applications, including marine research, underwater exploration, environmental monitoring, and offshore inspections. Submarine robots are specifically engineered to operate in challenging underwater conditions, such as high pressures and extreme temperatures. They are equipped with propulsion systems, buoyancy control mechanisms, and sensors to navigate, collect data, and perform tasks in the underwater environment. In marine research, AUVs are employed to collect data on marine ecosystems, oceanography, and underwater biodiversity. These robots can gather information on water temperature, salinity, and currents, aiding scientists in understanding and monitoring the health of oceans and marine life. For underwater exploration, AUVs are used to survey and map submerged areas, such as coral reefs, underwater caves, or archaeological sites. These robots can capture high-resolution images, create 3D maps, and collect samples from underwater environments that are difficult or dangerous for human divers to access. In offshore industries like oil and gas, submarine robots play a crucial role in inspections of underwater structures, pipelines, and equipment. AUVs equipped with cameras and sensors can inspect these assets for potential leaks, damages, or signs of corrosion, ensuring the integrity and safety of offshore installations. Furthermore, submarine robots have applications in underwater search and rescue operations. These robots can navigate underwater environments to locate missing persons or investigate submerged wreckage, aiding in recovery and rescue efforts. Together, floor robots, flying robots, and submarine robots represent different types of robotic systems designed for specific environments and applications. Advancements in these technologies continue to expand their capabilities and enable a variety of industry applications, contributing to increased efficiency, safety, and automation in various sectors. offer a unique set of advantages over traditional robots and even humans in certain situations. Here are some of the key benefits: Access to Difficult-to-Reach Areas: Unmatched mobility: Unlike ground-based robots or humans, drones can easily navigate over obstacles, through tight spaces, and reach remote locations, making them ideal for tasks like: Inspection of dangerous or hard-to-access infrastructure: Drones can inspect wind turbines, bridges, power lines, and other structures without putting human inspectors at risk. Search and rescue: Drones can quickly cover large areas in search of missing people or victims of natural disasters. Emergency response: Drones can deliver vital supplies or assess damage in emergency situations like floods or wildfires. Superior Aerial Viewpoint:

Enhanced situational awareness: Drones provide a bird's-eye view of their surroundings, which can be invaluable for tasks like: Surveillance and security: Drones can monitor large areas for security threats, illegal activities, or wildlife poaching. Traffic monitoring and accident response: Drones can provide real-time traffic updates and help coordinate emergency response efforts. Mapping and surveying: Drones can quickly and efficiently map large areas, creating detailed 3D models of the terrain. Increased Efficiency and Productivity: Automated data collection: Drones can be equipped with various sensors like cameras, LiDAR, and thermal imaging to collect data automatically, saving time and resources compared to traditional methods. Precision delivery: Drones can be used to deliver goods to remote locations or over congested areas, improving delivery efficiency and reducing costs. Agricultural applications: Drones can be used for precision agriculture tasks like crop monitoring, spraying pesticides, and planting seeds, optimizing resource use and increasing yields. Reduced Risks and Costs:

Minimizing human involvement: Drones can perform tasks in hazardous or dangerous environments, protecting human workers from potential harm. Cost-effective solutions: Compared to manned aircraft or helicopters, drones offer a more affordable option for aerial tasks, making them accessible to a wider range of users.

Faster data acquisition: Drones can quickly cover large areas and collect data efficiently, leading to faster decision-making and reduced downtime. Flying robots, also known as drones or unmanned aerial vehicles (UAVs), offer numerous benefits and advantages. However, they do have certain disadvantages that should be considered. Some of the disadvantages of flying robots include: Limited flight time: Most flying robots rely on batteries for power, which results in limited flight durations. The flight time may range from a few minutes to a few hours, depending on the size, payload, and battery capacity of the drone. This limitation can make it challenging to achieve long-duration missions or cover large distances. Regulatory restrictions: Governments and aviation authorities have implemented regulations and restrictions on flying robots to ensure safety and privacy. These regulations restrict the altitude, flight zones, and operating conditions for drones. The compliance with these regulations can be cumbersome, especially for commercial or recreational users, limiting the flexibility of drone operations. Susceptible to weather conditions: Adverse weather conditions, such as strong winds, rain, or snow, can significantly impact the flight capabilities and stability of flying robots. Flying in poor weather conditions can compromise the safety of the drone and hinder its performance, making it challenging to carry out missions during inclement weather. Limited payload capacity: Most consumer and commercial-grade drones have limited payload capacities, which restricts the types and sizes of equipment or sensors that can be carried. This can be a constraint when it comes to conducting certain applications that require heavy or specialized equipment, reducing the versatility of flying robots.

Privacy concerns: The increased use of flying robots has raised concerns about privacy invasion. Drones equipped with cameras or sensors have the potential to collect data or record images without consent, raising ethical and legal questions about individual privacy and surveillance. Proper regulations and ethical usage guidelines are necessary to ensure privacy protection. Risk of collisions: Flying robots share airspace with manned aircraft and other drones. The risk of mid- air collisions or accidents is a concern, especially if proper airspace management and regulations are not enforced. Collision avoidance systems and adherence to flight regulations are essential to mitigate this risk effectively.

The Software Components Remot Control (Transmitter Side)

The industrial robots have occupied a wide field at the present time and have begun to replace the work of human cadres in many different industries. So, I created a project for raw industrial carbon that is controlled wirelessly using an NRF with a frequency of 2.4 GH and a range of 1 km, and an antenna in a control panel, and considering it as a transmitter, where three moving resistors are connected to control its speed and its movement forward and backward, where these resistors with an analogue output are connected to the Arduino nano via the Arduino inputs. Voltage is fed to the Arduino via a 7.4-volt lithium battery. The voltage is reduced by using the LM2596 Dc- Dc, and the Arduino Nano is connected to the NRF with the antenna via the SPI protocol via the girls of the Arduino Nano. The NRF is also fed via DSN_360_mini, which works as a voltage reducer to 3.3 Volts by adjusting it to this voltage range before connecting it to the circuit. This is because the NRF operates with 303 volts. Therefore, the speed will be changed by means of the variable resistance to control the speed of the robot, as well as by means of the other two resistors. Its movement forward or backward will be controlled for a range of one kilometer. As shown. As shown below, the installation of the control panel.

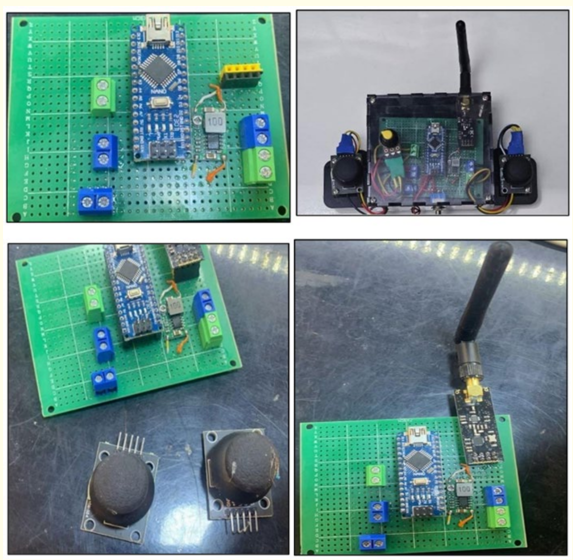


Figure 1: The Remote Control.

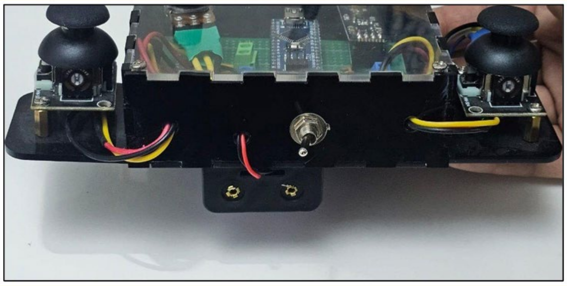


Figure 2: Installation of the Control Panel.

The Robot Body (Receiver Side)

Now the recipient's reference will be received by the NRF and an antenna from the control panel to the future to be received by the NRF and an anti-robot and also being tied to Arduino Uno via SPI Protocol as well as is used The LM2596 DC_DC effort to be reduced to be reduced for the Arduino piece of 12 volts and 9 amp to 9 volts nutritious for Arduino via fished binding. The special girls are controlled through the Parduano Ono via the-H-Bridge to deliver the nutrient battery to the H-Bridge to the directed 12 volt and 9 amp and thus being moved Recipient data to control your speed and try it. There is a cooling fan for not protecting and tissues. It is a backward screen. It is back from the body of the Android body to expose the battery charging rate as well as charging the battery in a drop The voltage is as well as a button running as shown in the Fig.3.

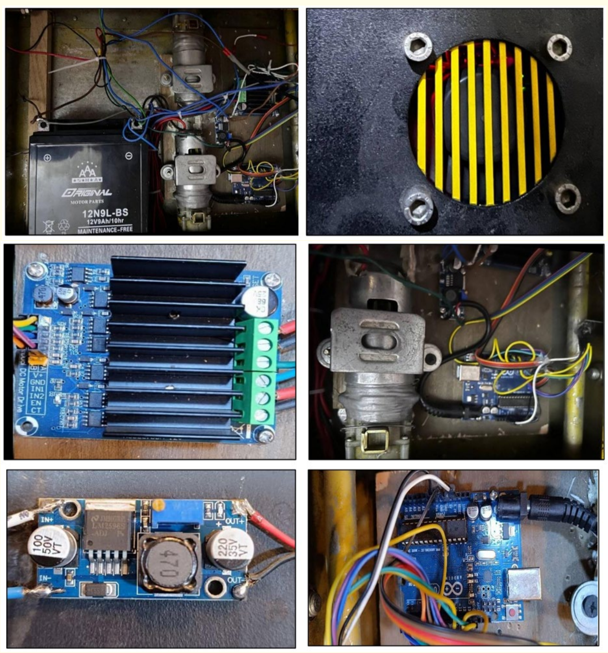


Figure 3: The Robot Body (Receiver Side).

The Metal Detection Circuit

Where a metal detection circuit was connected to sense the presence of metal on the ground, the idea was to sense mines, and due to the difficulty of obtaining this sensor, a ready-made metal detection circuit was connected, which consists of an antenna in the form of a coil and a group of transistors connected to a buzzer siren. Considering that the surface of the mine is made of metal, therefore it will be benefit from the idea of robot work to reduce human losses for detecting mines in forbidden areas, considering that the implementation of this project is in fact the actual sensor for detecting mines. This circuit was connected without programming directly to the feed. When it senses the presence of metal, it sends a sound to a siren.

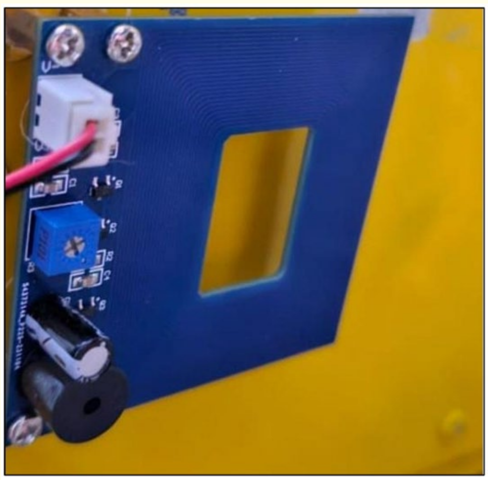


Figure 4: Metal detection circuit.

The Gas Detection Circuit

This robot can be used for several other uses, as it is considered crude and can be exploited appropriately for all industries. A gas detection circuit has also been added to sense the presence of a harmful gas and send the signal to the Buzzer siren, where it is fed from the 12 volt battery to the L7805CV voltage regulator to stabilize the voltage at 5 volts, and this connector will be connected to the MQ-02 gas sensor, as it operates on 5 volts and is grounded and its digital output is connected to a BC557 PNP transistor, because the signal coming out of the gas sensor is a weak signal, so we used the transistor to sense it, in the event of the presence of a harmful gas, i.e. The zero came to the N end, the BAIS will open, and the 5 volts will pass from the subscriber to the emitter, and the buzzer will work, as evidence of the presence of gas. In the absence of gas, i.e. one comes from the gas sensor signal, the BAIC will not open, and therefore the 5 volts will not pass to the buzzer, so it will not work. With work. This circuit is only for detecting gases and not for determining the type of gases, as shown in the Fig.5.

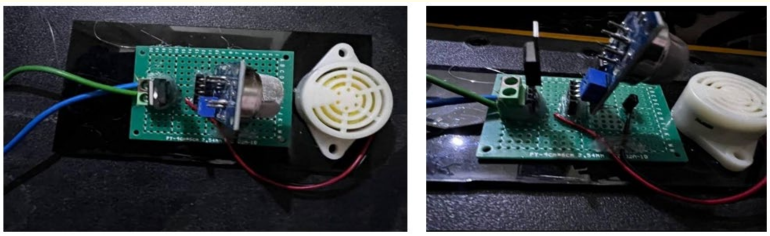


Figure 5: The Gas detection circuit.

The Result

This industrial robot is considered crude and can be used in several fields after development in future work: The mechanism of operation of the industrial robot is only to move up to one kilometer, and if it goes beyond this range, it stops in its place. Therefore, GPS is added to it in the future to determine its location, and thus its movement becomes free to depend on the image sent and received from the satellites. That is, freedom to move within a wide range without being restricted within a specific range. It is also possible to add an arm and install it on an industrial robot, as it needs high torque to allow the possibility of throwing the oil flame over a long range for use in burners instead of human cadres, thus the possibility of providing protection for human lives from the dangers of burners in oil applications in practical sites. During the movement of the robot and sending it in an area to detect the presence of a harmful gas, or whether to detect the presence of a metal or a mine in some land, it is supposed to send a signal to show or determine the place that contains this gas or the presence of the mine. Using one of the modern technologies to transmit and receive, where a camera is connected Thermal to a software controller is one of the software controllers developed to transmit the desired body sensing signal or harmful gas. It is widely used in the military field, where it is possible to attach a gun to it, send it, and control its movement like a human soldier, thus providing protection for human lives. For use in military applications, adding a cart or box to it and sending it to transport the wounded during wars who have suffered an injury that does not enable them to walk and return to their military positions, such as a leg amputation, is one of its most important applications for use in future work. This robot has a high torque of up to 500 Newtons, so it can pull weights of up to 100 kilograms. It can also be used in the agricultural field by planting site sensors under each tree and connecting sensors to different environmental conditions, as well as connecting a site sensor to it as well. To sense the humidity, water percentage, temperature, and wind, to carry out the irrigation process by connecting a tank above it, and other operations in the future according to its development, and thus we have provided agricultural personnel. This robot was manufactured to a high degree of quality, consisting of an iron shelf and a galvanized iron house or box to avoid corrosion. It was hiddenly welded with argon and iron welded on it for protection and safety, as well as fastening ties to the shelf to stabilize its movement. Therefore, it is possible to exploit it well to develop its work in the future.

Remote Control of the Robot

The picture below shows in figure 5.1, a wireless remote-control panel for an industrial robot using an Arduino Nano, an NRF antenna, and connecting both via the SPI protocol. The forward and backward movement is controlled by a joystick, which acts as a variable resistance, as well as to the right and left by another joystick. Its speed is controlled by a potential mater, and the remote control is fed by a 7.4V lithium battery.

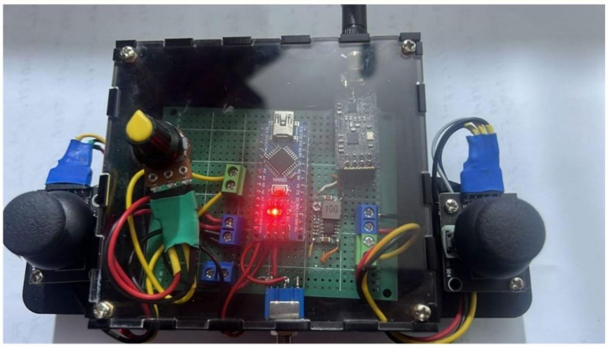
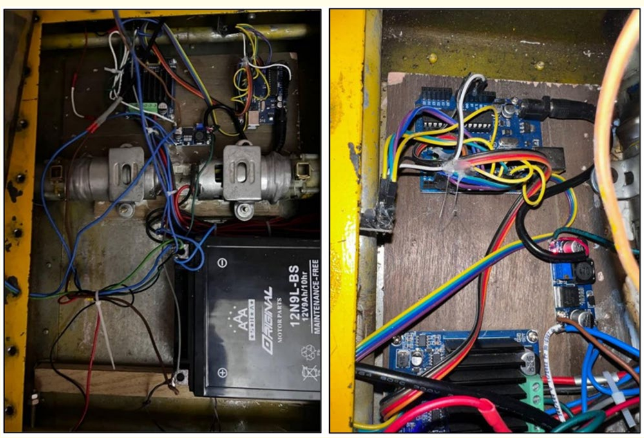


Figure 5.1: The wireless remote-control panel.

Internal structure of the robot body

As we can see in the Fig.6, shown below, the robot is running and photographed while it is working. It is composed, as we mentioned, of an Arduino Uno, Bridge, and NRF, which work as a receiver with an antenna, in addition to a battery and two DC 24-volt motors with approximately 500 Newtons. It is controlled using the remote control that was explained above, and the ESP came controller is connected to it. To avoid obstacles and send a signal to the web page in case he is sensitive to any mine or metal before reaching it.



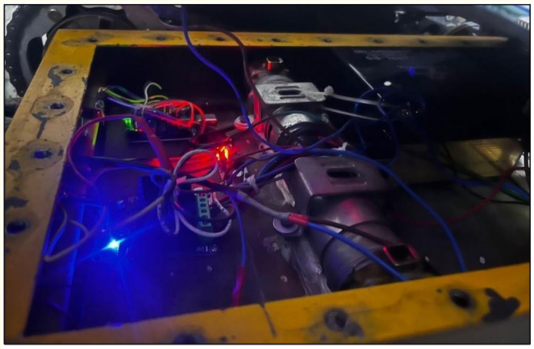


Figure 6: Wireless remote-control panel.

Gas Sensor Circuit

This circuit is attached to the upper surface of the robot to sense specific types of toxic gases. We cannot determine the type of gas, but only sense it and detect its presence. The extent of its sensitivity to saturation within the surroundings depends on the quality of the sensor used.

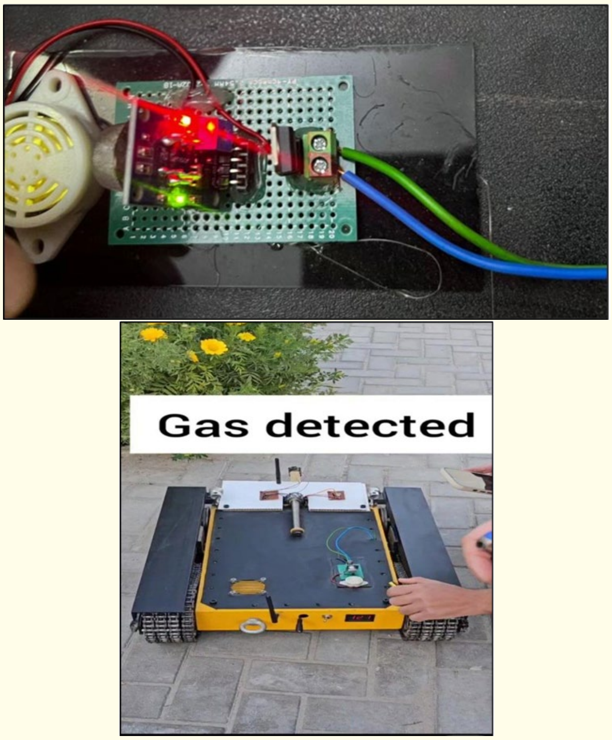


Figure 7: The Gas Sensor Circuit.

Metal and Mine Detection Sensor

The metal detection circuit was replaced as an alternative to the mine detection circuit, and thus it was used to sense types of metal and mines, considering that metal is one of the components of the mine, but there is no regret. It is possible to sense all types of metals, otherwise we sense any metal object in the path of the robot, so this depends on the quality of the sensor. It is used to sense the types of metals and the effect of the type of metal on the generated magnetic field, so that the robot sends a signal that the receiver senses before the robot's body reaches the mine or metal.

Figure 8: Metal detection.

ESP Camera

The camera was added as an additional part to avoid obstacles in the event that the robot departs from the eye of the observer controlled by the remote control, with the addition of a 32G RAM and an antenna in order to increase the resolution. In the event that the application is actually used on sites, it is preferable to replace this camera with a thermal camera because it can handle live video transmission without any Delayed and requires the use of another microcontroller, such as the Raspberry Pi.

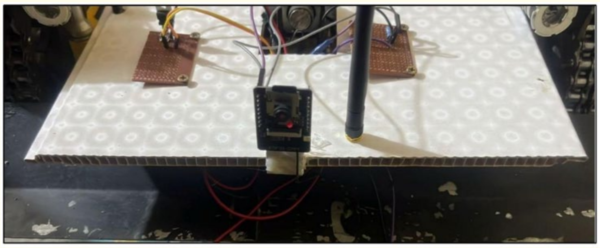


Figure 9: ESP Camera.

It is designed to work in different environments and open areas and to withstand harsh environmental conditions, as shown in Fig.10, 11, and 12.

Figure 10: Industrial Robot in Muqarnas Tile Pieces Environment.

Figure 11: Industrial Robot in Qir Paved Street Environment.

Figure 12: Industrial Robot in Mud Environment.

Conclusion

In this paper, Human-robot interaction has been an important topic of both science fiction and academic speculation even before there were any robots today. With the advancement and development of mine detection technology, mine detection remains a difficult and dangerous task that requires the appropriate skills and training to ensure Correct and safe detection of various mines, especially in forbidden and dangerous areas. This project was proposed by designing and implementing a robot made of high quality to withstand harsh environmental conditions to detect anti-personnel and anti-tank landmines in addition to toxic gases, as it is used in open environments of war, where the robot's range reaches 1000 meters, and it is designed to emit a light or sound when detected. Mine, while its weight is estimated at 27 kilograms. It is controlled remotely wirelessly. The importance of the robot lies in its ability to detect landmines in areas that are difficult to reach with other mine detection methods. It is also proposed to use it to treat the injured during wars, as there is no need to sacrifice people in such dangerous places, and it is possible to link it via satellite using GPS and follow up. Conducting things remotely. The proposed robot can be used in many military and civil applications (such as predicting volcanoes by detecting the toxic gases accompanying them, as it can help enhance efficiency and safety and save time in these operations, in addition to providing better access capabilities and improving the chances of survival and rescue in Emergency cases.

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