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Empirical Development of Army Spying Robot using Bomb Sensing and Removal Mechanism

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Abstract- The need for combat robots in the military has grown substantially in recent years. As a result, intelligent robots start to emerge. Dangerous tasks in civilian and military settings are routinely carried out by a subset of robotic platforms, such as remotely controlled vehicles. Creating and using such robots might eliminate the need for people to carry out risky tasks. The data collected is communicated to a human observer. With a tele-operated system, a human operator remotely operates the machine. Explosive devices pose the greatest threat to military and police personnel alike. The purpose of this article is to design a new type of spy robot that will allow us to keep an eye on our advantaged locations. The robot's size also facilitates its potential use as a clandestine agent robot. The robot has a transmitter built in so that its movements can be tracked. The robot must be operated manually so that it is not lost due to a lack of human participation. It might be used as a government operative robot in the near future, and not just for long-range purposes.

Index Terms— IoT; bomb detection; robot armies; robotic spies (IOT).

I.INTRODUCTION

Without a doubt, the military is the key end-user of strategic innovations and often serves as the principal sponsor of strategic innovations. There have been several sudden deployments of fundamental military technology that have matured to the point where they can be used in industrial robotics. Nonetheless, the significance of military autonomy as well as modern mechanical autonomy remain substantially different [1]. The military makes use of specialized robotics equipment, whereas the current definition of a robot is more akin to that of a highly intelligent and versatile factory-scale production unit. Use of advanced robots in the military is not out of the question in the future. The unique robot's price and progress towards its specialized capabilities will increase its popularity among the military market. The goal of this study is to show that the inspiration for the use of robots in the military and in industry is the desire to reduce or eliminate the need for human workers [2]. According to the sources, quality, cost, and acculturation are driving forces behind the switch, however it's important to note that each of these areas is employing a different set of tools to achieve their goals.

A combination of technological advancement as well as the requirement for high-performance robots led to the development of new robotics control devices, new drives, and enhanced control techniques, resulting in robots that are quicker, more accurate, and more intelligent than ever before. Many high-end robot applications are suitable for the control system shown here. The Arduino in this espionage and bomb detector robot received orders via the remote's RF transmitter. So, this robot can serve military purposes as a spy and bomb detector. Several dangerous tasks that human soldiers simply cannot perform are now delegated to robots, which are used by the vast majority of military organizations. A gripper, camera, video screen, and sensor array are all common components of military espionage robots. Furthermore, the military robots come in a wide variety of designs, each tailored to a certain task [3].

Nowadays, keeping tabs on international buffer zones is a herculean task. Under hostile situations, the security troops keep an eye on the perimeter.

You have the aid of officially manufactured reconnaissance cameras, but they only watch over very restricted zones [4]. Since we can't alter the camera's perspective on the go, having the cameras fixed in one place isn't all that helpful. In addition, it is impossible to install the cameras in forest areas since the trees obstruct the vision. Figure 1 shows the military spy robert.

Figure 1. Military spy robot.

A radio frequency (RF) module is a tiny electrical component used to send and receive radio waves between electronic gadgets. Below are the project's top three priorities:

1. Detecting
2. Spying
3. Diffusing

Here, we spied on them with the use of a webcam. This wireless camera is mostly utilized for real-time video feedback and broadcasting. To acquire a clear picture even at night, the night vision camera is employed. The metal detector and chemical sensor are being used for detection. The bomb's precise location is given to the spies. The Arm is also employed for the purpose of dissemination. This bomb-defusing robot is capable of doing basic activities such as cutting cables, lifting light objects, etc. in response to control signals sent by the human operator.

There have been several sudden deployments of fundamental military technology that have matured to the point where they can be used in industrial robotics. Nonetheless, the value of military autonomy and the value of contemporary mechanical autonomy are different in very significant ways. Robotic equipment is used in the military. The contemporary robot is essentially a large-scale intelligent and flexible production machine. Future military uses for advanced robots are always possible [5].

One of the goals of robot design is to inspire people by making them feel safe and protected. Its security and safety robot's technology has several useful features, such as mechanical vehicle control through RF and Wi-Fi and the ability to avoid obstacles in its path. With the use of a high-powered remote camcorder, the police and military keep tabs on the area's hostile environs. Assisting you are officially manufactured reconnaissance cameras, but their field of view is quite limited [11] [12].

The robot's primary function is to protect the bomb disposal team from the hazards they face on a regular basis. While bomb disposal teams in India use metal detectors and maybe other technology to identify and neutralize explosive devices, they nonetheless put themselves in danger by approaching potential bombs or suspicious packages without taking the necessary safety measures. Our robot will provide an additional safety net for bomb squad personnel by allowing them to quickly and easily inspect any suspicious package; if a threat is identified, the robot may be programmed to defuse the device.

Without the ability to dynamically adjust the camera's location, fixed-mount cameras aren't all that helpful. Mounting the cameras in forested areas is also impossible because trees would obstruct the omnidirectional vision of the cameras' stepper motors. The received signals indicate that the sound and visual stream from the receiver device may be used to make actual progress. Moreover, this robot may be used to access restricted areas, such as tight crevices and high shelves that are out of reach for humans. The individual's safety is prioritized throughout this building's design.

II. Related Study

Every day, media all around the world report on yet another trained individual who was injured or military service member who was killed while defusing an explosive device. A robotic arm is utilized to safely identify and dispose of a device within a 100-meter radius of the robot, all while protecting the bomb disposal team [6]. The created robot may be operated manually by the operator via computer and mouse. When the metal detector

detects an object, it triggers an audible alarm. The metal is inspected for bomb making components with the use of a wireless camera. If the bomb is located, the robot may be remotely controlled to explode it. The robot's general design relies on a lot of different parts working together. Using Proteus software, a personal computer is used to replicate the initial set up, and later to manage the entire hardware setup.

Each passing day sees advancements in robotic automation in response to rising global need for tools to manage crises, save lives, and reduce harm to humans. A user-friendly robot that can be accurately operated from a distance is necessary for these kinds of jobs. In order to keep costs down, the researcher of [7] concentrates on the development of a remote-controlled bomb disposal robot that makes use of locally accessible technology. The robotic arm of the developed robot has four degrees of freedom, allowing it to pick up and transport complex objects with ease and precision. The robot's arm and body were both hand-crafted from Aluminum alloy to meet the designer's specifications. The robot's capabilities were maximized by installing sensors that could detect gas, fire, and obstacles. Evidence of defused bombs weighing up to 10 kg can be stored in the chassis. Validation of the robot's mechanical design was accomplished with the help of solid works. PCB and schematic design were both completed in Proteus. Raspberry pi was used as a CPU in the control system, while Arduino mega was utilized for communication and sensing purposes. Internet access is required for robot operation. A separate Python script allows the robot to be managed through the internet.

The purpose of this research is to use the Microsoft Kinect controller to steer the bomb disposal robot and give it some degree of intelligence. This graph also illustrates the time difference among the joystick and Microsoft Kinect controllers. The advocates examined the bomb disposal robot's mechanism and design, and then developed a twin arm robot with 10 DOF; this allowed them to create a counter torque and lessen the burden on the servo motor. The proponents of artificial intelligence use Microsoft Kinect joints to get the necessary data for building vectors and acquiring angles from those vectors using dot product [8].

The proponents of the Microsoft Kinect controller have built a robot that can execute all 23 of the activities that the joystick-controlled robot could, and have conducted 30 trials of each activity to see how quickly the robot could finish them. They add up how long it took each controller to complete the assignment, get an average, and then compare the results to one another. The proponents also claimed that the bomb disposal robot's design had been executed, along with the algorithm for developing intelligence; however, they noted that the robot's arms could only lift light things, and its wheels could only move about on level terrain. In a similar vein, proponents evaluated the tasks that could be accomplished by both controller types and found that the Microsoft Kinect controller was faster at them than the joystick controller.

In article [9], we developed a robot that can assist in military operations. Its primary function is covert monitoring in hostile territory. This robot may also be used to signal the location of a wounded soldier in a war zone and summon medical assistance, increasing the likelihood that the soldier will survive. In addition to these benefits, robots are also used in the security sector. The robot can instantly change directions, turn left and right, move ahead and backward, and turn at any angle on its axis, all thanks to its tank-circuit design. A wireless camera mounted on the robot's head relays combat video and audio to a control room in real time. The robot has a laser gun that it may employ to shoot its opponent when it becomes necessary to launch an attack. All of its duties on the battlefield will be carried out in accordance with instructions from the control room. By watching the robot on a screen in the control room, an operator in the control room may give the robot real-time instructions. The robot vehicle has a passive infrared (PIR) sensor that can tell if a soldier is still alive, and if not, will send an emergency signal to the control center. Use the robot's RFID reader to determine whether or not the person is a military or an intruder. The robot can safely navigate the restricted area since it is outfitted with a bomb scanner. If the robot is taken captive by the enemy, we can employ the self-attacking technique to kill it.

With the repeated demonstrations of the evolutionary changes brought about by robotics, it is no surprise that this field is now being applied to every conceivable industry. The days of the military unwittingly walking into traps or naively invading a country only to be struck down are over. While there

are still many unknowns in high-risk military operations like bomb defusing, fighter pilot aviation, and entering enemy territory, technological advancements are allowing the military to do these things with greater confidence.

Due to their human nature, soldiers are prone to anxiety and frailty, and they will never be able to match the consistent overall performance of a robot. For an issue as large as landmine detection in any particular region, the employment of robots will transform things for the better in the same way that unmanned aerial vehicles have transformed the narrative of military fighter aircraft. Human capital is now widely recognized as a country's most valuable resource; therefore, every measure that can be taken to protect this asset, particularly if it yields additional advantages, must be taken.

Swarms of these robots are now feasible thanks to advancements in artificial intelligence (AI), mobile robotics, and the Internet of Things (IoT), which together allow them to collect data from their environment via detectors and relay it back to an operator station, just like a human soldier would. In addition, they can also recognize landmines, which are explosives placed to kill troops who are invading an area. In article [10], the author elaborates on how the military may use swarms of robots to perform jobs with a high risk of fatalities and find that they are genuinely more effective and risk-free when carried out by the robots.

III. Methodology

Our project's primary objective is to ensure the security of the bomb squad's personnel by providing an additional layer of defence during defusing operations. Some of these surveillance robots may be operated remotely; they are equipped with a camera and can send back data or video to a central monitoring station. Most robots of this sort are appropriately little in order to facilitate rapid movement. For this mission, we have built a remote-controlled military mediator/spying robot out of a PIC 16F628A and PIC 16F877. These covert robots are equipped with a remote-controlled camera, batteries, and an antenna. The robot and the rest of the system are remotely controlled by two distinct PICs. CCD cameras are used to record and store data and information on our robot.

Microcontroller

The PIC16F628A is an 18-Pin microcontroller with a CMOS FLASH architecture and 8 bits of programmable logic, 16 of which may be utilized as input/output. This microcontroller features a single Capture/Compare/PWM, 128 bytes of EEPROM data memory, a USART module with 2 comparators, and an internal oscillator running at 4 Mhz. This microcontroller module allows for programming at low voltage. It supports voltages between 2V and 5.5V, making it usable for systems with logic levels between 3.3V and 5.0V. The PIC microcontroller supports a wide variety of power-saving sleep modes, including Brow-out Reset, Power-on Reset, Watchdog timer with a separate oscillator, and many others.

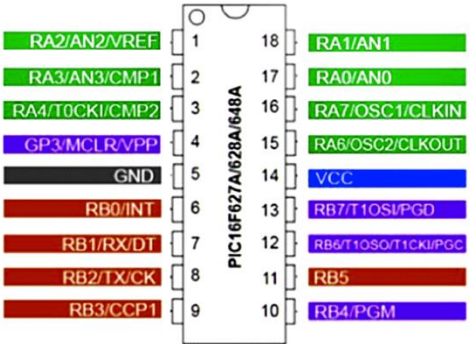

Figure 2. PIC16F628A

The PIC16F877A may be seen in Figure2. The PIC16F877A has a 256-byte EEPROM data memory, is self-programmable, has an ICD, two comparators, eight 10-bit A/D converter channels, two capture/compare/PWM functions, a synchronous serial port that can be set up as either a 3-wire Serial Peripheral Interface or a 2-wire Inter-Integrated Circuit bus, and a Universal Asynchronous Receiver Transmitter (USART). Figure 3 shows the PIC16F877.

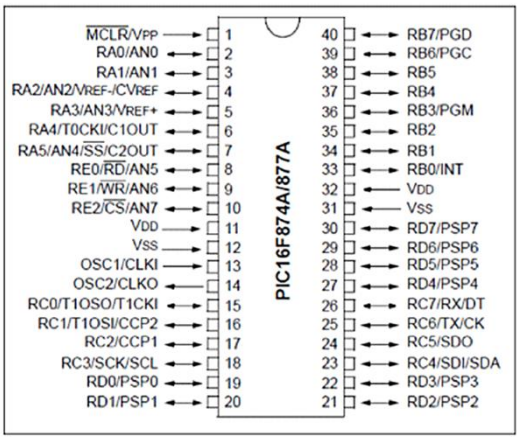

Figure 3. PIC16F877

L293D Motor Driver

In order to operate the motors of an autonomous robot, an integrated circuit chip called a "motor driver" is typically employed. A motor driver connects an Arduino to a motor. The L293 series consists of the most widely used motor driver ICs, including the L293D, L293NE, etc. These integrated circuits are made to manage dual DC motors. Dual H-bridges are what the L293D is made of. The H-bridge circuit is the easiest way to manage a low-current motor. Henceforth, the motor driver IC shall be referred to only by its part number, L293D. The L293D features a 16-pin layout. This L293D MOTOR DRIVER is seen in Figure4.

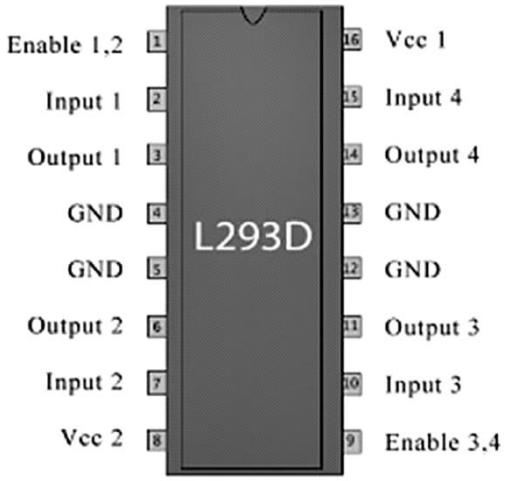

Figure 4. L293D MOTOR DRIVER

Robot Vehicle

In order to control the robot, we have access to forty pins on the 16F877 micro-controller (PLC). This PIC 16F877 uses a single LM7805 to provide a stable +5v to the microcontroller. In addition to relaying information between the system and the RF module, the PIC 16F877 also issues commands to the motor driver, allowing the robot to move with pinpoint accuracy along the predetermined course or route. This level of accuracy is crucial for the success of these robots. Our robot is powered by a set of three DC brushed motors. We've utilized an L2989 motor driver to power the motors. There are two L2989 in use here; one powers the brushed DC motors, and the other controls the CCD camera. As we've indicated, our robot is powered by brushed DC motors, and each motor is directly linked to a wheel. As a result of the reversible nature of brush DC motors, each wheel may be driven in either way. The project's motion is managed by a single DC motor unit. The second pair is attached to the camera and allows for panning and tilting. Two limit switches, one for each direction of movement, are linked at the camera's pivot. As soon as the camera comes into touch with the limit switch, it will immediately cease moving, and the camera's ability to do a U-turn will be disabled.

The receiver, as illustrated in Figure 5, receives orders from the remote, processes them, and then sends them on to the driving circuits, which in turn move the motors. Then, the motors in the camera and the unusual wheel are given the instructions for moving. The CCD camera records in real time, and the captured images are instantly uploaded to the camera's capture card and shown on the monitor.

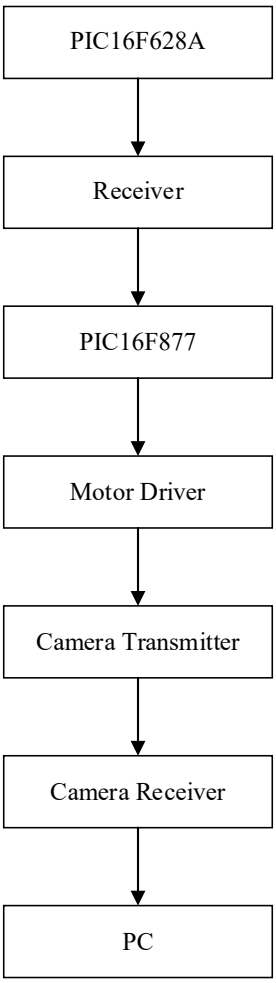

Figure 5. Spy Robot overview

IV. Results and Discussions

The bomb scanner is essentially a metal detector, able to locate any metallic objects inside the specified zones. given that metals are used in the construction of the explosives. The robot's bomb

detector, which is equipped with an antenna, is located at its base. The Bluetooth connection between the smartphone and the robot allows the user to command the robot's motions. Robot model programmed into a microcontroller; robot equipped with a bomb detection and removal mechanism. Our strategy has been proven to function throughout testing. While evaluating the success of our article, accuracy will be paramount. Our best efforts have been put into this. We can see the current events in great detail. We have not detected any negative effects from our design. When we direct it using the remote, the robot follows the engine's path. This camera allows us to monitor the area around the robot's covert location. Most users will be able to operate the circuit efficiently if it is kept simple.

The system's input is determined by the user's choices. An input-processing programme under user control. Then, it's sent across a Radio Frequency (RF) link and picked up by a robot to be processed. The finalized signal is then transmitted to the correct subsystem. In this way, the motor or module of the robotic arm may be operated.

Table 1. Control for the robot

S.No.	Robot Movement	Key
1.	Forward Movement	2
2.	Backward Movement	8
3.	Movement towards Left	4
4.	Movement towards Right	6

With the help of the computer and the serial monitor, you may command the robot in the ways shown in Table1.

This paper's objective is to reduce casualties sustained during psychological militant attacks. The war machine is designed to withstand terrifyingly violent attacks. This robot may be operated with a remote control and is radio frequency (RF) based. You were shown a remote camera with the intention of using it to remotely monitor your opponents. It can sneak into the enemy territory, gather intelligence with its tiny camera eyes, and relay that information back to us. When there's a chance of gatecrashers or scaremongers, this robot undercover spy may make an appearance in high-security areas including celebrity homes, malls, jewellery rooms, and more. As every human life has value, these machines have replaced humans as the adversaries of the oppressors who use terror to maintain power in combat zones.

Table 2. Distance vs delay.

Distance (m)	**Delay (s)**
5	20
10	32
15	38
20	45
25	49
30	59

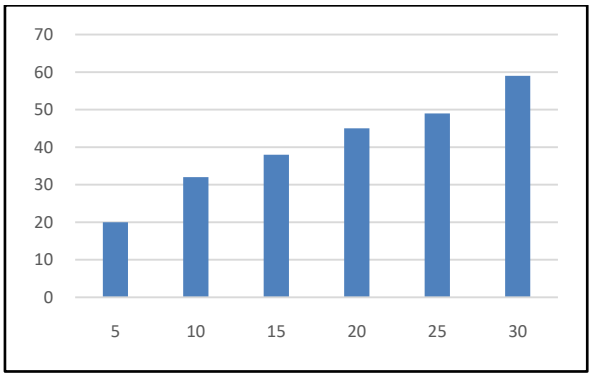

Figure 6. Distance vs delay performance

You may add more functionality to this spy robot by feeding it new operating processes and components like a Wi-Fi module and a raspberry pi. This robot has a lot of potential for the future, and it may one day be equipped with gas sensors to identify toxic or dangerous substances in the air. In addition to its numerous other applications, this sort of robot may be employed as a bomb diffuser, lowering the likelihood of injury or death to personnel. More so, the robot may be programmed with a termination framework that will cause it to shoot at every enemy it detects. It is possible to further develop the technology by providing guidance to the acceptance circuit and controlling it via satellite communication. It will be put to use at malls for things like picking up dropped shopping carts and painting cars. Similar to how the framework may be turned android based, where everything can be managed with a high-end mobile phone. The robot is equipped with a camera, and its eyesight may be improved with the help of a special kind of lighting called halogen light. This robot can be controlled not just with the touch of a button, but also with the sound of your voice.

V. Conclusion and Future Scope

Hence, the suggested approach controls the expense of openness to design for simple robots that aid in

military applications. The robot is manually controlled from afar via a control room interface. Once the robot is alerted to a potential threat by a warning signal, such as the presence of metal, a remote camera mounted on the robot is utilized to confirm the threat's nature. In this case, the bomb is physically incapacitated by a human operator using a robotic arm, and the weapon's characteristics and other data are stored in the cloud for future reference. In this way, the robot may be detached for short periods of time while still guaranteeing the area's safety. As a result, the authorities may monitor the surrounding area more closely and establish order if necessary. This suggested development would help strengthen our security measures against intruders. As many of our peripheries are located in mountainous regions, this mechanical construction may also be used in places where human access is difficult. As an added benefit, the suggested digital framework may be put to use in the search for catastrophe victims. Anywhere there is a chance of gatecrashers or scaremongers, this robot undercover spy can make an appearance. This includes celebrity homes, shopping malls, jewellery rooms, and more. In conflict zones, where human life is always precious, these robots have replaced the human opponents who were previously motivated by terror.

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