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ROBOTIC SOLUTIONS FOR EXPLOSIVE DETECTION

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ABSTRACT

Robots in bomb disposal as a vital tool for keeping bomb disposal crews safe. The use of a robotic arm, which can detect and dispose of explosive devices within a 100-meter radius, significantly reduces the risk of injury or death to human bomb disposal personnel. Manual operation of the robot via a computer and a mouse provides a high degree of control, which is critical when dealing with potentially deadly explosives. Additionally, the buzzer that alerts the user to the presence of metal detected by the sensor is an essential safety feature that helps to minimize the risk to human life. The use of a wireless camera to examine the metal and determine whether it is a bomb or not is another crucial aspect of the robot's design. This feature allows bomb disposal personnel to keep a safe distance from the explosive device while still maintaining control. The wireless camera provides real-time visuals of the situation, enabling the bomb disposal team to make informed decisions while minimizing the risk to their lives. In conclusion, the use of robots in bomb disposal is a crucial advancement in technology that saves lives and reduces the risks faced by bomb disposal crews. The robotic arm, computer control, and wireless camera are all essential features that provide a high degree of control and safety in a hazardous environment.

Keywords— ***Raspberry Pi, camera, GSM, GPS***

I. INTRODUCTION

Robots are being used in a wide range of industries and applications, including those that involve tasks that are too dangerous or difficult for humans to perform.. In addition to enhancing safety and efficiency, robots can also improve the quality and precision of work. In manufacturing, for instance, robots can assemble products with consistent accuracy, while in healthcare, robots can assist in surgeries with greater precision and minimal invasiveness. Furthermore, the advancement of technology has resulted in more sophisticated and intelligent robots that are capable of adapting to changing environments and interacting with humans in more natural ways. With the advent of artificial intelligence, robots can learn and improve their abilities over time, making them even more versatile and useful in various applications. Despite the many benefits of robots, there are also concerns regarding their impact on the job market and potential ethical issues. As technology continues to evolve, it will be important to carefully consider the implications of these advancements and work to mitigate any negative consequences.

While military robots have the potential to improve safety for personnel and civilians by performing tasks that are too dangerous or difficult for humans, they also raise ethical concerns about the use of autonomous machines in war. The use of military robots for reconnaissance, surveillance, and attacks has been criticized for reducing the human cost of

war and making it easier to engage in armed conflict. Moreover, the decision-making process of military robots is often opaque and difficult to hold accountable, which raises questions about the legality and morality of their use .It is important to consider the long-term consequences of the development and deployment of military robots. While they may offer immediate benefits in terms of increased safety for personnel and improved effectiveness in combat, the use of autonomous machines in war has the potential to fundamentally change the nature of armed conflict and create new ethical dilemmas. It is therefore crucial to carefully consider the implications of military robots and to engage in open and transparent dialogue about their use and regulation.

Bomb disposal robots are also becoming increasingly common, as they can help to neutralize explosive devices without putting human lives at risk. These robots are equipped with sensors and cameras that allow them to detect and locate explosives. The operator can then use a teleportation system to control the robot and safely dispose of the device. Overall, the use of military robots has the potential to save lives and reduce casualties in conflict zones. However, there are also concerns about the ethical and legal implications of using autonomous weapons systems. It is important to ensure that these systems are designed and used in a way that is consistent with international law and ethical principles .he aims to use a remotely controlled robot to disarm and destroy hazardous objects, such as bombs, without risking human lives. The robot is designed to be portable, cost-effective, and accurate, and can be controlled remotely via a Raspberry Pi. The robot is equipped with a webcam to provide a live feed of the area being monitored. The L298N motor driver allows the robot to handle two DC motors simultaneously, enabling it to move and operate in a range of environments. With the Raspberry Pi, the robot can cover large areas, and its operation can be easily monitored.

Robots are extensively used in various industrial applications such as material handling, pick and place, painting, and assembling of subsystems. They can also operate in hazardous environments, where human intervention may be unsafe or impossible. In recent years, the use of robots in surveillance has gained popularity due to their ability to enter small and hard-to-reach areas such as tunnels, mines, and small holes in buildings. Additionally, robots can survive in harsh environmental conditions for extended periods without causing harm or malfunction. Robotic system that is designed to operate in harsh or dangerous environments that may be difficult for humans to navigate. The system is equipped with sensors that allow it to detect hidden bombs or other hazardous materials, as well as operate in environments with low light or limited visibility. The system is controlled remotely through a wireless connection to a computer, allowing operators to safely direct the system from a distance. This type of technology can be incredibly useful in situations where human safety is at risk, such as in the aftermath of a natural disaster or in a terrorist attack.

II. LITERATURE SURVEY

Home security system that uses a Raspberry Pi and a camera to detect motion and alert the user through email and SMS messages. The system works by capturing images from the camera and analyzing them to detect any motion. If motion is detected, the system sends an email to the user with the captured image as an attachment. Additionally, the system sends an SMS alert to the user's mobile phone through a GSM modem. If the system is set up to record video, the recorded video will be automatically uploaded to a cloud server through the email server [1].

The system is designed to record video through a surveillance camera and upload it to a cloud server for storage and analysis. If the cloud server is not available, the data is stored locally on a Raspberry Pi device until the server becomes available again. This is a common approach for managing data in IoT systems where network connectivity can be unreliable .It also sounds like the system uses an IoT platform to control the movement of the surveillance camera. This can be an effective way to optimize the camera's coverage of a particular area, as the platform can use sensors and other data to determine the most effective positioning for the camera. [2].

The use of robots in rescue and search missions can be very helpful in situations where it may be difficult or dangerous for human rescuers to enter. Robots can be equipped with a variety of sensors and cameras to help search for and locate victims, and can be used to transport supplies or equipment to those in need .RF technology can be used

to control robots wirelessly, allowing rescuers to operate the robots from a safe distance. Ultrasonic sensors can be used to detect obstacles in the robot's path, helping it to navigate around obstacles and avoid collision [3].

Smartphone cameras attached to the robot can provide a wide, omnidirectional view, allowing rescuers to see what the robot is seeing and direct it accordingly. This can be especially useful in situations where visibility is poor or where rescuers cannot get close enough to the scene to see what is happening. Overall, the use of robots in rescue and search missions can help to improve the safety and efficiency of rescue operations, and can help to save lives in situations where time is of the essence [4].

Unmanned ground vehicles (UGVs) are robotic systems that operate on land without the need for human presence. UGVs can be remotely controlled by a human operator, or they can operate autonomously through the use of sensors and algorithms. UGVs find a wide range of applications in the military, such as border patrol, reconnaissance, surveillance, and combat. They are also used in civilian applications, such as search and rescue missions, hazardous material handling, and agricultural operations. In many cases, UGVs are guided by human navigation commands, where the human operator provides instructions to the robot to move from one point to another [5].

Human hand movements can be used to control a robotic motor in a variety of ways, including through hand wave mode or gesture-controlled mode. In a PC-based robotic arm (PC-ROBOARM), the hand movements can be captured by a sensor, such as a camera or a motion sensor, and then translated into specific commands that control the movement of the robotic arm .For example, if the user wants the robotic arm to move forward, they could make a hand gesture that is recognized by the sensor as a forward motion. [6].

Smart Arm can translate the hand gesture into specific movements of the robotic arm, taking into account its six degrees of freedom. These six degrees of freedom refer to the ability of the robotic arm to move in six different directions: up and down, left and right, forward and backward, as well as rotate around three different axes. Once the command is sent to the robotic arm, the motor is activated and the arm moves in the desired direction. This process can be repeated for multiple hand gestures, allowing the user to control the robotic arm in a precise and intuitive manner [7].

To perform image processing, you will need to capture images using the camera module and then analyze them to detect the object based on its color. There are many different image processing libraries available for Python, such as Open CV, that you can use to implement the color detection algorithm. Once you have detected the object, you will need to use the robotic arm to pick it up and move it to the desired location. You can use the GPIO robotic arm and move it to the desired position [8].

Finally, you can integrate all the software components into a single program that can be run on the Raspberry Pi. This program can be used to control the robotic arm and perform the color-based object sorting. Overall, building a robotic arm with real-time image processing capabilities using Raspberry Pi can be a fun and challenging project. With the right hardware components and software tools, you can build a fully functional robotic arm that can sort objects based on their colors [9].

The mobile controlled robot with DTMF decoder works as follows: A mobile phone makes a call to the robot's attached mobile phone. The user presses a key on the mobile phone during the call, which generates a DTMF tone. The DTMF tone is transmitted to the robot's phone stack, where it is interpreted by the DTMF MT8870 decoder. The DTMF decoder converts the DTMF tone into its binary digit counterpart, which is sent to the microcontroller. The microcontroller analyzes the binary digit and decides whether to activate the forward, backward, or return motor drivers .The motor drivers are then activated, causing the robot to move in the desired direction. The main advantage of this type of mobile controlled robot is that it can be controlled from a distance, making it ideal for use in hazardous or difficult-to-reach locations. [10].

III. THE PROPOSED METHODOLOGY

The proposed system for robotic bomb detection is to detect the bomb by using metal detector which will not only detect the bomb but also detects the position of the bomb. The improvement of the robotic bomb detection involves in the following way.

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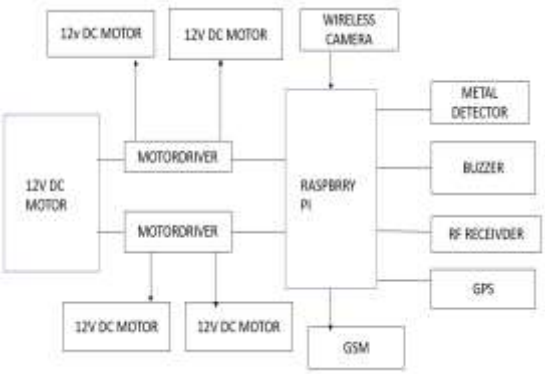
BLOCK DIAGRAM

Fig.1 : Block Diagram of Robotic Bomb Detection.



Robotic unit that is designed to replace soldiers and dogs at the borders during times of war. The system is cost-efficient and can operate in extreme environmental conditions. The system consists of two main units: a robotic unit and a remotely controlled unit. The robotic unit is powered by a microcontroller, specifically the Raspberry Pi, which serves as the central control of the system. It is also equipped with a motor and a 12V battery for power. The system has different sensors, each with a different use. For instance, it has a GPS sensor to sense the presence of obstacles and redirect the system automatically, and a pi vision camera to capture images of living objects in and around the system. The system also has a metal detecting sensor to detect the presence of metal objects underground. The software part of the system is a web application that displays the status of the GPS and GSM metal detecting sensors. The images captured by the pi camera are also displayed on the screen on the webpage. Overall, this system seems like an innovative solution that can be used to protect soldiers and dogs at the borders during times of war while also reducing costs and improving efficiency.

GPS: GPS module consists of a GPS receiver and an antenna. The GPS receiver processes signals received from GPS satellites and calculates the location and other information. The antenna is responsible for receiving the signals from the satellites.

GSM: The GSM module contains a cellular modem that communicates with the mobile network using the GSM protocol. It typically includes an integrated SIM card slot, which allows the module to authenticate with the network and access mobile data services.

MOTOR DRIVER: A motor driver is an electronic circuit that controls the speed, direction, and torque of an electric motor. It provides the necessary power and control signals to the motor to make it rotate at the desired speed and direction. Motor drivers are used in a wide range of applications, from robotics and automation to automotive and industrial machinery.

WIRELESS CAMERA: A wireless camera is a type of camera that can transmit video and audio signals wirelessly to a receiver or a network. This type of camera uses wireless technology, such as Wi-Fi, Bluetooth, or cellular networks, to transmit data.

BUZZER: A buzzer is a device that produces a loud, buzzing sound when activated. It usually consists of an electrically powered oscillator that generates a signal at a specific frequency, which is then amplified and fed to a speaker or a resonant element such as a piezoelectric transducer. Buzzers are often used in electronic circuits and devices as an audible signal to indicate the occurrence of an event, such as an error or a warning. They can also be found in everyday objects like alarm clocks, doorbells, and game show buzzers.

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RASPBERRY PI: The Raspberry Pi has a credit card-sized form factor and includes all the basic components of a computer, such as a CPU, RAM, and I/O ports. It runs on a variant of the Linux operating system, and can be used for a wide range of applications, including home automation, robotics, media centers, and web servers.

METAL DETECTOR: A metal detector is an electronic device used to detect metal objects buried underground or hidden within objects such as walls, floors, or ceilings. The basic principle of operation involves the use of an electromagnetic field to detect metallic objects. When the metal detector senses the presence of metal, it generates a signal that alerts the user

IV. OBSERVATION AND RESULTS

The primary goal of this project aimed at reducing risks to the lives of soldiers by detecting bombs. The use of a camera to monitor and detect the position of the bomb, connected to a Raspberry Pi with an algorithm for detecting metal it's important to ensure that the system is reliable and accurate in detecting bombs, as any false negatives or false positives could have serious consequences. It's also important to consider the potential limitations of the system, such as its range and the types of bombs it can detect. Additionally, it's worth considering the potential ethical implications of using such technology in a military context, as well as the potential for unintended consequences such as increased reliance on technology and decreased human judgment. Overall, while the use of technology to reduce risks in military contexts is certainly important, it's crucial to approach such projects with caution and a thorough understanding of their potential limitations and implications.

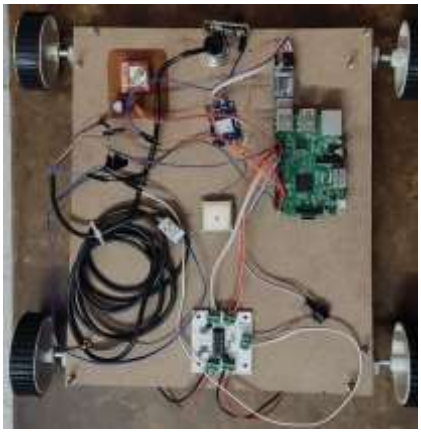

Fig: Prototype

Fig: Output result

V. CONCLUSION

While the development of a raspberry pi based bomb detection robot with live streaming and tracking is a challenging task, it is a critical one for ensuring safety in various scenarios. The use of robotics in different aspects

of life has increased over time, and the trend is likely to continue in the future. The locomotion of the robot is crucial for its ability to navigate different terrains and reach areas that may be difficult for humans to access. The use of wireless video transmission allows real-time monitoring of the robot's progress, while mines detection ensures the robot's safety. The tracking of the robot is also an essential feature that enables its control path motion, even in an unstructured environment. As such, different learning methods can be applied to ensure effective navigation and control of the robot. It is important to note that while robots offer several advantages in various applications, they cannot fully replace human beings in all aspects of life. Further research is necessary to ensure the safe and useful application of robots in different scenarios.

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