International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 6 Volume No.6 October - November – 2022
DOI:10.46647/ijetms.2022.v06i06.046 ISSN: 2581-4621

Bomb detector robot design & implementation for defense apps

[1]Ananya Saumya (USN : 1DS21EC027), [1]Anitosh Dash (USN : 1DS21EC032), [1]Krushi Raj (USN : 1DS21EC099), [1]Preethi S. Aralikatti (USN : 1DS21EC149), [2]Dr. M. Sindhu Shree M., [3]Adithya T.G., [4]Dr. Pavithra G., [5]Dr. T.C.Manjunath* Ph.D. (IIT Bombay), Sr. Member IEEE, Fellow IE, Chartered Engineer

[1]First year BE UG (ECE) Second Sem Students, Dept. of Electronics & Communication Engg., Dayananda Sagar College of Engineering, Bangalore, Karnataka
[2]Assistant Professor & Mini-Project Guide, ECE Dept., DSCE, Bangalore, Karnataka
[3]UG B.Tech. (CSE) Student of Third Semester, Dept. of Computer Science & Engg., PES University, Bangalore
[4]Associate Professor & Mini-Project Guide, ECE Dept., DSCE, Bangalore, Karnataka
[5]Professor, HOD & Mini-Project Guide, ECE Dept., DSCE, Bangalore, Karnataka
**Corresponding author email id : tcmanju@iitbombay.org*

Abstract
In this paper, we present the design & implementation of a bomb detector robot for the defense applications. The hardware has been designed and practically implemented. The work presented here is the mini-project work of the 2nd sem students of electronics & communication engineering department of dayananda sagar college of engg., bangalore.
Keywords—Bomb, Design, Implementation, Defense, PWM, Bluetooth, Arduino, and RF Transmitter.

1. Introduction

A brief introduction about the related work that is being done is presented in this introductory note. In the modern era, a significant portion of the national budget has been allocated to the military in order to implement low-tech, high-security measures and protect the border security forces from intruders. Robotics is used by some defence groups since it is so much more effective than human personnel in the realm of defence.

Multifunctional Robots are essential in preventing human casualties and property damage during disasters, armed conflict, and mining. As a result, it will become more significant in the next era. The robot is made up of a vehicle-mounted camera that takes pictures, It uses gesture recognition and body heat signatures to distinguish people while sending the collected images to the base operating station through the cloud. The robot may enter enemy territory covertly, mine deep below, and enter disaster zones while transmitting data to the controller via a camera.

The primary goal of this essay is to strengthen defences through the use of robots, which will assist warriors in saving lives during times of war and tragedy. The system described in this paper uses an Arduino Raspberry Pi board, metal detectors, gas sensors, IR avoidance sensors, PIR sensors, ultrasonic sensors, light detector sensors, and a GPS module to enable the robot to perform many rescue operations.

2. Review of Literature / Survey

In this section, the review of literature is presented in brief, which serves as the base for many of the works. In this mini project, a mobile robot that can be used for bomb investigation and disposal of a bomb setup using a remote control is designed and built. To remotely manage and track the mobile robot, a visual operator interface application has been created in the Qt-Creator environment, which is compatible with many operating systems. This robot can rotate around its own axis and has a great degree of mobility. It is equipped with an Acorn RISC Machine (ARM) based control board, a high definition moving camera, and a moving arm with an AK-ER bomb setup disposal weapon.

International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 6 Volume No.6 October - November – 2022
DOI:10.46647/ijetms.2022.v06i06.046 ISSN: 2581-4621

After being compiled, the C++-based control software was transferred to the ARM-based control board using File Transfer Protocol. For communication between mobile robots and operator centres as well as for robot control operations, this architecture makes use of the User Datagram Protocol. The robot's whole operation can be handled remotely from a computer. The actuator for the arm is a DC servo motor, and the servo is managed by a PWM signal produced by the microcontroller.

3. Robotic Operations

Robotic operation is managed by a wireless module to extend its operational range. Additionally, build a rudimentary autonomous robot to assist in the transportation of the bomb as well as a basic bomb dispersal robot that is capable of handling straightforward tasks like cutting wires, turning on switches, lifting light things, etc. gives us video feedback as well so that we can control the robot in an efficient manner. Here, a robotic arm is used. We're going to employ a servo motor as an actuator. The robot base will rotate 180 degrees, and the elbow, shoulder, and gripper will all move in response to user input.

At the control application, this input is first processed before being serially delivered over a radio link. The robot then receives this information and processes it once more. The system's output is the signal that has been processed and sent to the proper module. The robotic armour robot adds an extra layer of protection to the bomb disposal team by enabling them to inspect and examine a suspicious package before actually approaching it for disposal. This module could be the robot's motor or base. The time-on-target for a bomb technician is decreased or eliminated using mobile robots. Robots eliminate risk in potentially fatal situations, allowing bomb technicians to concentrate on handling explosive devices rather than the immediate threat to life and limb. Even if a robot is unable to disrupt something, it can still be utilised to communicate information to help choose the right instrument and advancing downrange operation. Additionally, actions captured by a robot's camera can serve as proof for additional investigation.

4. Proposed Research Methodologies In Implementation Of The Mini-Project

A foundational knowledge of the system can help identify factors that affect human-robot interactions and strategies to expand robot design, enhance human-robot training, and enable mission exchanges between humans and robots in an efficient manner. Thus, this study delves 3 into the human user experience of EOD human-robot interactions in order to establish a foundation of understanding on which any logical debate of robot design and use within close teams such as EOD must be founded. The study employs qualitative methodologies to explore the environment, expectations, attitudes, and emotions that are a part of this human-robot connection in order to accomplish this goal.

We’re outlining a method of using an android device’s Wi-Fi for robot control. The Android application’s controllers are made for controlling the robot's movements. The operation of these controllers is specified by embedded C and Python programmes that are loaded onto the Raspberry Pi and shown using a monitor connected to the Raspberry Pi. Switches, relays, transistors, or MOSFET circuits can be used to turn DC motors "On" or "Off," with "Multi-direction" control being the most basic type of motor control. The robot's location is determined using the GPS, which also transmits the coordinates of areas with metal, barriers, and gases.

To move the robot, DC motors and sensors are also used as additional hardware components. Toxic gas detection is done using gas sensors, and bomb detection is done using metal detectors. To determine how close an object or person is, an ultrasonic sensor is employed. The monitor or a mobile phone can be used to control the robot's movement. The robot may move in any direction depending on the situation in order to locate any bombs or dangerous residues in the immediate area.

5. Proposed Methodology

In this section, we present the proposed methodology that is being used in the mini project work. We have used both the hardware as well as the software part. The hardware & software tools used in the

International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 6 Volume No.6 October - November – 2022
DOI:10.46647/ijetms.2022.v06i06.046 ISSN: 2581-4621

mini-project are as follows … Arduino uno's, Relays, DC motors, LCD displays, wires, wheel, sensors.

6. Analysis

The paper presents the results of Zhou Hongfu et.al. research's on the DC servomotor control system for a robot that can dispose of bombs. This research is based on PID control and PWM output for the DC motor drive. Eight DC servomotors in the bomb-disposal robot were constructed with PID control, and the best PID settings were found through experimentation. The embedded PC104 system processes the encoder signals input and PWM output for the DC servomotor control system in the design. Matlab Simulink is used in the research to simulate the PID control model and the PWM generating model. The study employed Matlab's xpcTarget to perform real-time control.

The dual arm bomb disposal robot proposed in this study by AkibJayed Islam et.al. [2] is intended to support bomb disposal units. To dispose of bombs securely and easily from a distance, two segmented robotic arms (3 DOF and 3 DOF) are put on a mobile base with an IP camera. The proposed model is wirelessly controlled, and its primary purpose is to take the place of humans in bomb disposal operations. An effective, mobile, and secure bomb disposal robot is created using mathematical modelling of the dual arm and simulation-based direct kinematics to examine performance.

The design and construction of a semi-autonomous, unmanned robotic system utilised for various military and rescue missions is the subject of this work by Rakshana Mohamed Ismail et.al. [4]. The soldiers can better prepare for their operations with the aid of a live feed from the wireless camera and data analysis of the environmental composition by different sensors in the region being monitored. Using Arduino and Zigbee technology, the above-mentioned tasks can be done. The Arduino mega is connected to the Zigbee, which is connected to the various sensors and the robotic arm. Data is sent and received via Zigbee technology.

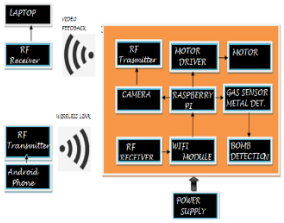

Fig. 1 : Proposed block diagram of the bomb detection robot system

7. Conclusive Remarks

Thus, the suggested method offers exposure to the creation of straightforward robots that support military applications. The robot is remotely controlled manually from a control room. After checking the DC motors' rotation through simulation, the hardware for the robot is constructed. A wireless camera fixed to the robot is used whenever the buzzer alarms by detecting a metal in order to determine whether the object is dangerous. If so, the robotic arm is manually operated to securely deactivate or dispose of the explosive. Robots created in this way could take the role of bomb disposal teams in the military and police.

8. Final Remarks

The wireless Bomb Disposal Robot was created with the ability to meet the demands of the bomb squad, the military, the police, and those who work with hazardous materials. It can be used in a variety of settings and scenarios and has countless applications. For instance, it can be utilised for managing mines in one situation and by the bomb disposal team in another. A different application, however, can offer current information in a hostage situation.

References

[1]. J. David and N. Cheeke, "Fundamentals of ultrasonic waves," CRC Press, Florida, USA, 2002, ISBN 0-8493-0130-0.

DOI:10.46647/ijetms.2022.v06i06.046 ISSN: 2581-4621

[2]. S. P. Singh, A. Verma, and A. K. Shrivastava. "Design and development of robotic sewer." Proceedings of the First IEEE International Conference on Emergence Trends in Engineering and Technology, Jul. 2008, Nagpur, India, pp. 1317-1320.
[3]. A.K. Shrivastava, A. Verma, and S. P. Singh, "Partial automation of the current sewer cleaning system," Invertis Journal of Science and Technology, vol. 1, No. 4, 2008, pp. 261-265.
[4]. O. Duran, K. Althoefer, and L. Seneviratence, "State of the art in sensor technologies for sewer inspection," IEEE Sensors Journal, Apr. 2002, Vol. 2, No. 2, pp. 73-81.
[5]. H. He, and J. Liu, "The design of ultrasonic distance measurement system based on S3C2410," Proceedings of the IEEE International Conference on Intelligent Computation Tech. & Automation, Oct. 2008, pp, 44-47.
[6]. Y, Jang, S. Shin, J. W. Lee, and S. Kim, "A preliminary study for portable walking distance walking distance measurement system using ultrasonic sensors," Proceedings of the 29th Annual IEEE International Conference of the EMBS, France , Aug. 2007, pp. 333-338.
[7]. C. C. Chang, C. Y. Chang and Y. T. Cheng, "Distance measurement technology development at remotely teleoperated robotic manipulator system for underwater Technology, Apr. 2004, pp. 333-338.
[8]. D. Webster, "A pulsed ultrasonic distance measurement system based upon phase digitizing," IEEE Transaction on Instrumentation and Measurement, Vol. 43, No. 4, Aug. 1994, pp. 578-582.