

# Smart Bomb Disposal Robot

Yash Sanjay Salunke<sup>1</sup>, Mahima Gokul Chaudhari<sup>2</sup>, Aarti Gajiram Charoskar<sup>3</sup>, Tushar P. Pandhi<sup>4</sup>

<sup>1</sup>Student, <sup>2</sup>Student, <sup>3</sup>Student, <sup>4</sup>Professor,  
<sup>1,2,3,4</sup>Department of Electrical Engineering,  
<sup>1,2,3,4</sup>MET's Institute of Engineering, Nashik, Maharashtra, India

**Abstract:** Security & safety of the nation is one of the most important consideration from generations. To detect the threats and neutralizing it are the major challenge from security point of view. Police & armed forces are working every day & putting their life in risk to achieve this. So to achieve this operation & to minimize the life casualties, we proposed a robotic system for bomb neutralization along with metal detector and toxic gas detector. Proposed robot will be used with the help of wireless camera & robotic arm, robot will be driven to desired location & will cut the wires. This process can be done by observing visuals from the camera & driving robot using remote. Metal detector and toxic gas sensors will turn on the buzzer inside robot on detection of respective threats.

**Indexterms:** Wireless Robot, Arduino, Automation, Security, Metal Detector.

## I. INTRODUCTION

The project has been designed keeping in view the current law and order situation in throughout the world. Everyday hundreds of trained personnel are either injured or lose their lives while defusing bombs. Our robot provides an extra layer of protection to the bomb diffusing squad by allowing them to check and analyze a suspicious objects before actually approaching it for disposal. Mobile robots reduce or eliminate a bomb technician's time-on-target.

Although a number of projects with similar functionalities can be found. For Example the British Police have a bomb disposal robot, the Israeli Army has it and it is also being used by bomb disposal squads and a number of states of USA. The main idea of this robot is to provide the bomb disposal squad with safety and security from the risks that they face every day. The bomb disposal squads in India have metal detectors and other equipment for bomb detection and disposal, but they have to risk their lives by approaching the bomb or the suspicious packet without any safety and precautions.

This project presents the wireless bomb diffusing robot with wireless remote control and video camera for live feed. An robotic arm fitted for bomb diffusing.

## II. LITERATURE SURVEY

Table 1: Literature Survey:

Sr. No.	Authors	Methodology	Conclusion
[1]	Anjir Ahmed Chowdhury, Md. Akter Hamid, Md. Nahian Al Subri Ivan	Disposal Robot: Pickup and carry bomb to another location with robotic gripper fitted on wireless robot.	Able to pickup up to 5kg weight and achieve 4 degree of freedom in minimum cost.
[2]	Nandgopal Rathod, Puneeth .G, P. Brahmaiah	This system makes use of robotic arm as well as robotic vehicle controlled via RF remote. The system also includes night vision camera.	It detects the signal which is transmitted and according to that control robot in forward, backward, left turn, right turn movements.
[3]	Shinde Pushpa.D., Davane Rahul D., Patil Poonam B.	Wireless robot controlled through Zigbee based remote and wireless camera with live feed.	Robot is controlled through wireless remote and able to cover 360 degrees for bomb pickup.
[4]	Siddharth Narayanan, C. Ramesh Reddy,	Here focus is made only on robot arm. Arm is controlled using hand gesture.	This is the innovative approach to replace the traditional computer interface and joystick method of arm control.

Disposal robot[1] is design to carry bombs instead of neutralize it. Which increases the risk with moving bomb. Though it's a low cost model, its material expense is around Rs.39000 which makes it costly. Robot's electronics capability is less due to use of DC motors in arm. Also there is lack of mechanical design in project [2]. Robot[3] is made for bomb disposal instead of neutralize it. Which increases the risk with moving bomb. Though the method is innovative, it needs multiple sensors on drivers hands which introduce one more step in the interface. It makes system more sensible to errors. This will also required more training and stability in hands.[4]

Before this many researchers did work on bomb disposal and defusing robots. Though the most appropriate design consist of an wireless robotic vehicle controlled through wireless remote. This vehicles can be controlled from distance. Camera fitted inside vehicle helps to see the visuals around the robot. Using which driver drives the robot. An robotic gripper used in most of the cases to diffuse the bomb or pick and place the bomb for disposal.

**III. PROBLEM STATEMENT**

The development of synthetic chemicals has increased production of powerful explosives. Most of the time, material with a doubtful origin is manipulated by specially trained bomb squads. However, since the explosive is prepared for the highest damage, complicated and even remotely controlled triggering mechanisms challenge a specialist's talents. Today's squads wear safety suits in case of an explosion, which minimize the pressure of an explosion and prevent injury to a certain level. On the other hand, they limit movement capabilities and increase stress. Despite advanced safety precautions, handling of explosive ordnances brings high risks for the operator's life.

**IV. OBJECTIVES**

After research on existing systems, bellow objectives are finalized for the project

- Main objective of this project is to provide wireless surveillance.
- Wireless control robot with robotic arm for bomb diffusion from long distances.
- To provide audio alert & visuals from the field of operation.
- Detection of hazardous gases.
- Metal detection to identify the danger.

**V. BLOCK DIAGRAM**

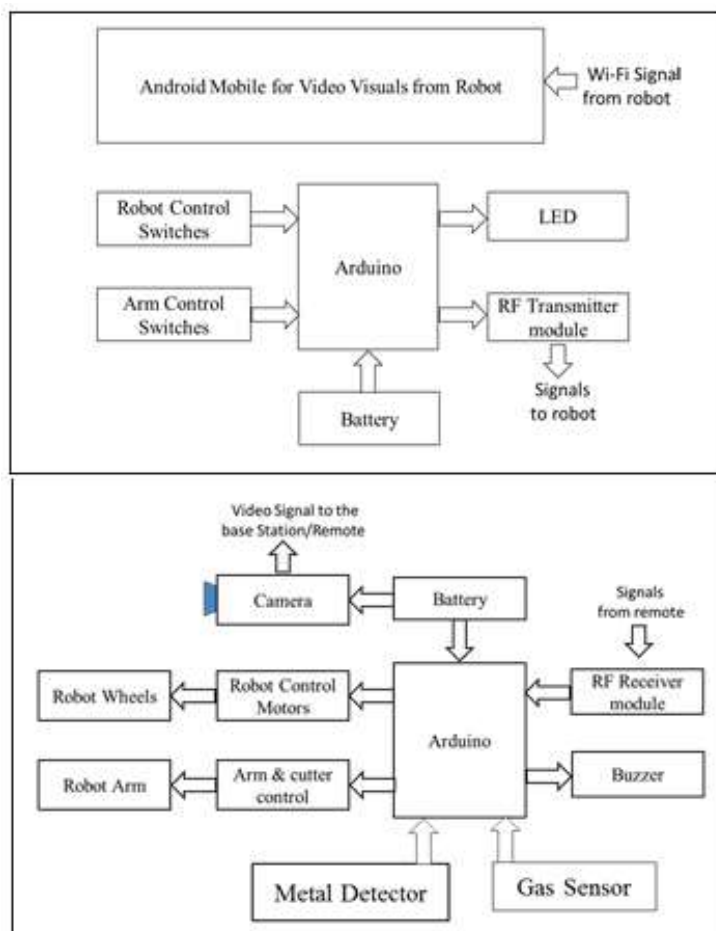
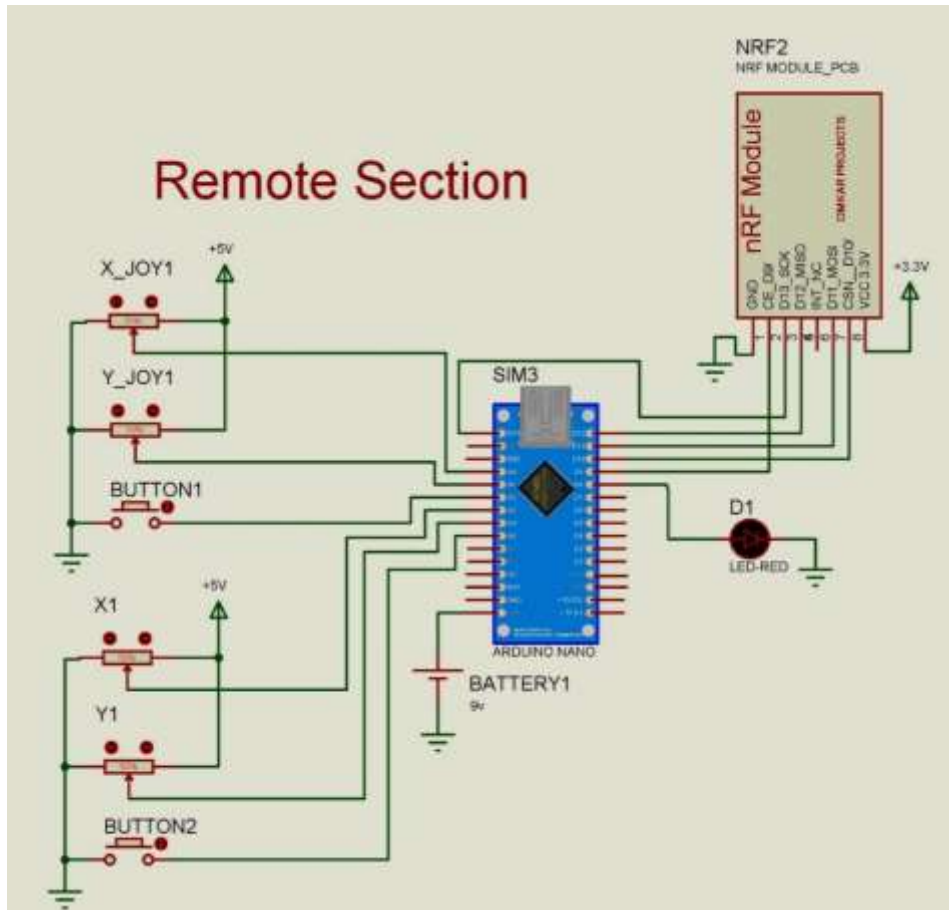


Figure 1: Block Diagram of System

Top part of block diagram represents remote section. In remote Arduino will be the main processing unit of remote control. It will send the RF signal to robot using RF transmitter module. Switches are connected to Arduino. led is used to provide blinking indication when switch is pressed. Switches gives signal to Arduino. Then Arduino sends corresponding control signal to wireless RF transmitter. Transmitter transmits the signal in the form of RF waves to the robot. Complete remote is powered by battery.

Bottom part of block diagram represents the Robot section. Here RF signal received by RF receiver are given to Arduino. Then Arduino decodes that signal and identify the switch pressed on remote. According to pressed switch, Arduino gives signal to robot control motors, arm control motors and cutter. A metal detector and Gas sensor provides corresponding signal to arduino when any threat is detected. In this case, arduino turn on the buzzer. LED is used to provide indication when signal is received. Complete remote is powered by battery.

**VI. CIRCUIT DIAGRAM**



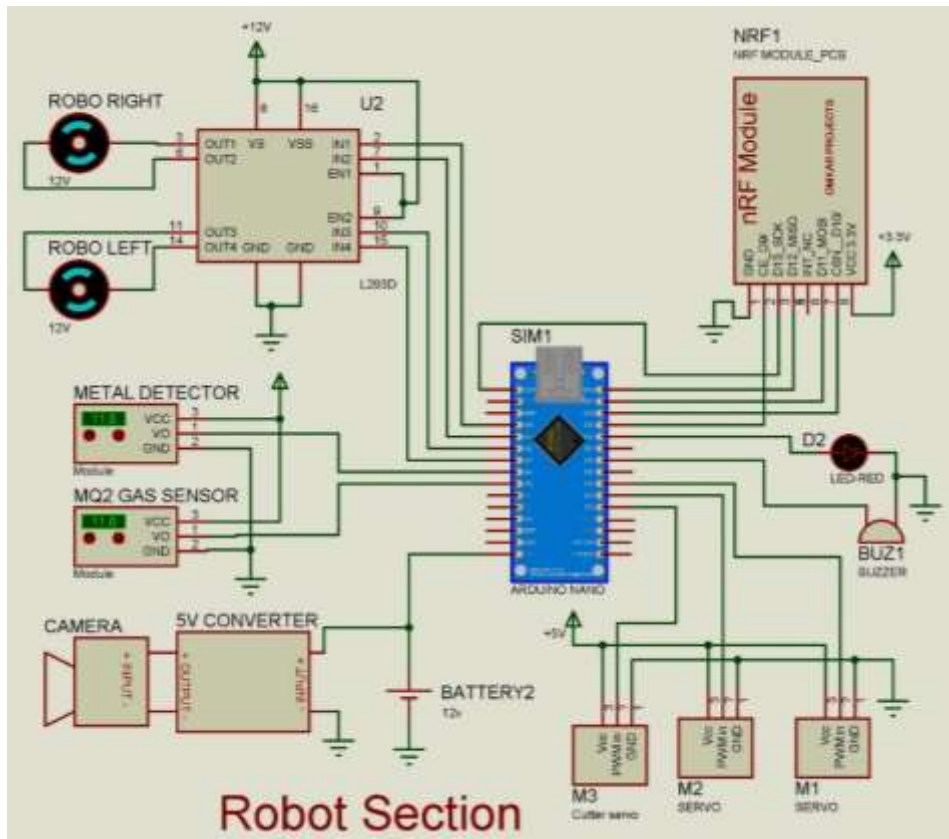


Figure 2: Circuit Diagram of System

**VII. ROBOT MOTOR SELECTION**

For speed of 50m/min with wheel of 10cm diameter, needed motor rpm will be,

$$\begin{aligned} \text{Wheel Circumference} &= 2 \cdot \pi \cdot r \\ &= 2 \times 3.14 \times 0.05 \\ &= 0.31\text{m} \end{aligned}$$

$$\begin{aligned} \text{So, rpm} &= \text{Distance} / \text{Circumference} \\ &= 50 / 0.31 \\ &= 161 \text{ rpm} \\ &= \sim 150\text{RPM} \end{aligned} \tag{1}$$

Overall robot weight contains below considerations:

Table 2: Robot Weight Consideration:

Sr.No.	Part Name	Approx. Weight (in Kg)
1.	Robot body	1.2
2.	Cutter assembly with motor	0.3
3.	Electronics & Battery	0.6
4.	Robot arm with Motor	0.6
5.	Robot motor & wheels	0.5
Total		3.2Kg

So from above table, approximate weight of robot is 3.2Kg. To run this robot, minimum 2 motors of 2kg torque will be sufficient.

So, from above calculations, standard consideration parameter for motor selection are:

- Robot torque required= ~3.2kg
- Power source= 12v DC
- Precision required= No
- Speed required= 150RPM.

So, 2 DC motor of 12V, 150RPM are used.

### VIII. POWER REQUIREMENT OF ROBOT

Table 3: Voltage and current requirement for robot components:

Sr. No.	Component	Number used	Voltage required (in Volts)	Current required (in mAmp)	Total Current (in mAmp)	Power Required (in mWatt)
1	Arduino	1	12	50	50	600
2	DC motor	2	12	200(max)	400	4800
3	Servo Motor	3	5	210(max)	250	3150
4	Gas & Metal sensor	1	5	150(max)	150	750
5	RF transmitter	1	3.3	20(max)	20	66
Total					830	9366

So from above observation for complete system,

- Voltage required is 12V, 5V, 3.3V
- Maximum current required is 830mAmp. = 0.8Amp
- Maximum power required is 9366mWatt.=9.4Watt

By using 12V external input supply, 5V & 3.3V can be taken from Arduino supply port pins. So no need to use any extra supply.

With 12V and 9.4 Watt power, current required is

$$\text{Maximum Current needed} = \frac{9.4}{12} \\ = 0.78 \text{Amp}$$

So 12V, 1.3 sealed lead acid battery is suitable for the robot.

### IX. IMPLEMENTATION & RESULTS

By testing the robot on field, there are some parameter which actually work for robot are given bellow in table

TABLE 1: PERFORMANCE EVALUATION OF SYSTEM

Sr.No.	Parameter	Values
1	RF remote range	10ft
2	ESP Camera Range	10ft
3	Degree Of freedom of Robot	2
4	Maximum Height cover by robot from ground	1.5ft
5	Battery Backup	30 minutes

### X. ADVANTAGES

- Wireless bomb defusing operation to minimize the risk.
- 24\*7 monitoring of surveillance area through remote location.
- Will be helpful to avoid loss of lives in rescue operations.
- Hazardous gas detection feature can detect many toxic gases
- Metal detection will help to avoid and identify the danger.

### XI. LIMITATION

• Though project prototype working successfully, it need to be more powerful and heightened to cover large objects. Also, the wireless transmitter range needs to be increased to make it work on the field.

### XII. APPLICATION

We have proposed it as an assistant robot to the bomb disposal squad but there are a number of other applications of this robot. It can be used by:

- Police: In hostage situations
- Military: For reconnaissance missions
- Fire: To provide video feedback of the site for analysis
- Nuclear: For handling hazardous or radioactive materials.

### XIII. CONCLUSION

The robot provides an extra layer of protection to the bomb-diffusing squad by allowing them to check and analyze a suspicious object before actually approaching it for disposal. In this project we studied the ground situation and

understood the problem during security checks and noticed 3 important checks which are metal detection, gas detection and bomb defusing. To answer all these difficulties, a robot is designed. A robot is able to drive from long distance and live feed can be observe from camera. Since robot is occupied with metal detector and gas detector, it can detect these threats without putting human life in danger. The robotic arm is capable of cutting wires as per the signals from the remote. We believe that the robot will play an important role in saving lives and helping in detecting security threats.

#### **XIV. FUTURE SCOPE**

Research and development is never-ending work. An attempt can be made to apply artificial intelligence-based techniques to monitor and control robots.

#### **REFERENCES**

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