

“ROBONOID DEVICES FOR SAFETY PURPOSES”

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ABSTRACT: Robonoid is a lightweight, back-packable, multi-terrain robot capable of detecting a variety of devices without making any harm to the operator. It helps bomb disposal experts to find and deactivate improvised explosive devices (IEDs). It is a remote controlled robot. It is equipped with wireless camera to send video signals to monitor the robot and the surroundings. It has a light source, so that it can work at night and a robot car which gives the platform for mounting gun, arm, light sources and camera. The robot also has a full functional arm and is capable of movement of 5 degree with the scope of 360 degree around. This makes it very flexible. It also has the ability to place small charges to disrupt suspect devices, and further enhancements, including the incorporation of wire-cutters, have been implemented. Robonoid has the ability to send video footage back to the operator at a safe distance thereby enabling troops to assess a situation prior to moving forward or entering a structure, potentially safeguarding lives. The RCV can be used to assist with the disposal of roadside bombs whilst allowing troops to remain at a safe distance.

Keywords: Robotics; Sensor, etc

1. INTRODUCTION

Robots are now-a-days playing a major role in automation for large volume production, quality compliance. Robot An electromechanical device automates the work in many applications like military application, industrial power plant etc. Robots are reliable means to go at places where human intervention is either impossible or can cause hazardous effect on human health e.g. nuclear power plant, chemical factories etc.

Robonoid is a remote controlled robot. It is equipped with wireless camera to send video signals to monitor the robot and the surroundings. It has a light source, so that it can work at night and a robot car which gives the platform for mounting gun, arm, light sources and camera. The robot also has a full functional arm and is capable of movement of 5 degree with the scope of 360 degree around. This makes it very flexible.

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Robotics develop man-made mechanical devices that can move by themselves, whose motion must be modeled, planned, sensed, actuated and controlled, and whose motion behavior can be influenced by “programming”. Robots are called “intelligent” if they succeed in moving in safe interaction with an unstructured environment, while autonomously achieving their specified tasks.

1.1 Components of robotic systems

This figure depicts the components that are part of all robotic systems. The purpose of this Section is to describe the semantics of the terminology used to classify the chapters in the: “sensing”, “planning”, “modeling”, “control”, etc.

The real robot is some mechanical device (“mechanism”) that moves around in the environment, and, in doing so, physically interacts with this environment. This interaction involves the exchange of physical energy, in some form or another. Both the robot mechanism and the environment can be the “cause” of the physical interaction through “Actuation”, or experience the “effect” of the interaction, which can be measured through “Sensing”.

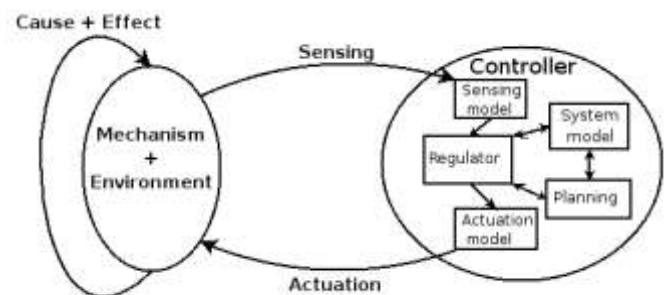


Figure 1. Robotics as an integrated system of control interacting with the physical world.

Sensing and actuation are the physical ports through which the “Controller” of the robot determines the interaction of its mechanical body with the physical world. As mentioned already before, the controller can, in one extreme, consist of

software only, but in the other extreme everything can also be implemented in hardware.

Within the Controller component, several sub-activities are often identified:

1.1.1 Modeling. The input-output relationships of all control components can (but need not) be derived from information that is stored in a model. This model can have many forms: analytical formulas, empirical look-up tables, fuzzy rules, neural networks, etc.

The name “model” often gives rise to heated discussions among different research “schools”, and the EBook is not interested in taking a stance in this debate: within the EBook, “model” is to be understood with its minimal semantics: “any information that is used to determine or influence the input-output relationships of components in the Controller.”

The other components discussed below can all have models inside. A “System model” can be used to tie multiple components together, but it is clear that not all robots use a System model. The “Sensing model” and “Actuation model” contain the information with which to transform raw physical data into task-dependent information for the controller, and vice versa.

1.1.2 Planning. This is the activity that predicts the outcome of potential actions, and selects the “best” one. Almost by definition, planning can only be done on the basis of some sort of model.

1.1.3 Regulation. This component processes the outputs of the sensing and planning components, to generate an actuation set point. Again, this regulation activity could or could not rely on some sort of (system) model.

The term “control” is often used instead of “regulation”, but it is impossible to clearly identify the domains that use one term or the other. The meaning used in the WE Book will be clear from the context.

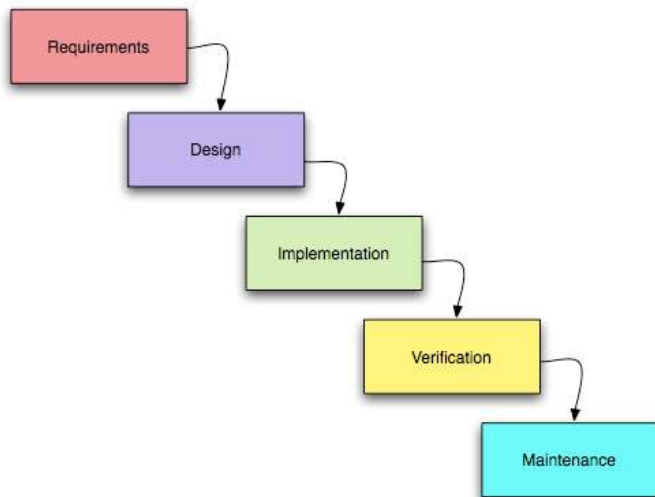


Figure 2. Robotics Water Fall model of project development

2. OBJECTIVES OF ROBONOID

- The robot is wirelessly controlled using Radio Frequency module.
- Robot will be activated using passkey.
- Encoding and Decoding of signal will be controlled by HT12E IC as Encoder and HT12D IC as Decoder.
- Robot will have ATmega32 microcontroller, which will execute the signal quickly and establish a good communication between sender and receiver.
- It will have night vision and thermal wireless camera.
- The robot will have Smoke detector, LPG GAS Detector, Temperature, Humidity sensor and Metal Detector.
- Robot will be operated at 12V, 4A Current.
- Robot will be climb in the stairs.
- It will have the attached robotics arm for picking the object.
- Metallic body of Robonoid will provide the strength to the robot.
- It can climb and move in any rough path.
- Should be controlled from remote places

3. FEATURES & APPLICATIONS

3.1 Flipper

Both sides flipper are use i.e. front and back, Front flipper are used for staircase condition Back flipper are used for back packable i.e. to cross the obstacles.



Figure 3. Both sides flipper

3.2 ARM

Arm having platform for mounting water gun, camera, light source etc. This arm is fully functional having 5 degree movement around 360 degree of rotation. Arm is useful for picking & placing the objects if required. The arm cutter will be used for bomb disposable purpose.

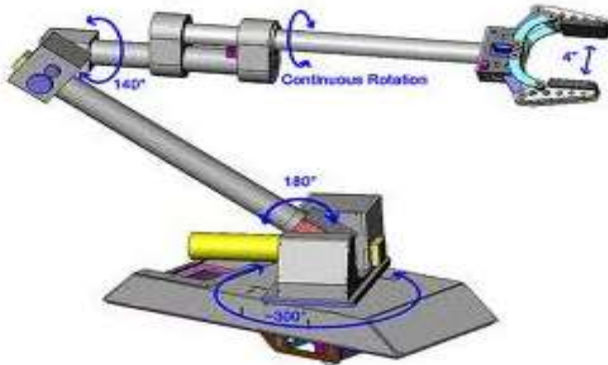


Figure 4. 360 degree of rotation arm

3.3 Front & rare end camera

The front camera is used by the bot to move in forward direction while the rare end camera is helpful to detect the gorilla attack.

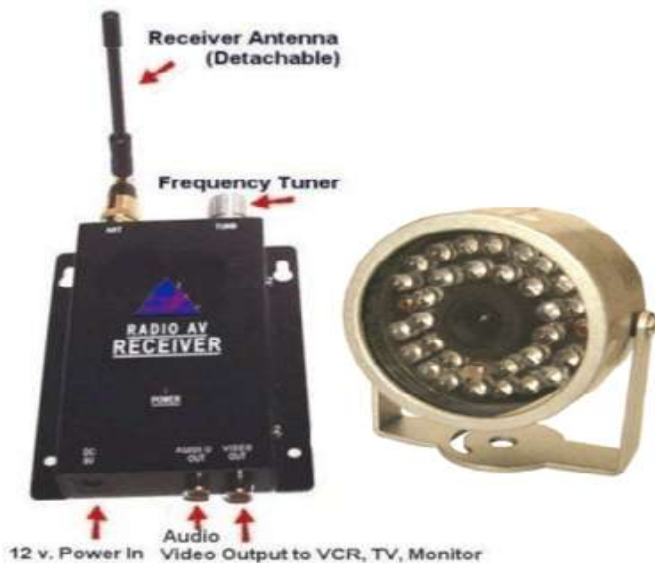


Figure 5. Wireless camera

3.4 THERMAL Cameras

It is useful in smoke, light, fog condition and darkness for detecting purpose

- Assess problems in electrical wiring by detecting changes in temperature along electrical circuits
- Rapidly identify areas of missed insulation
- Detect energy losses either due to air leaks or breaks in the walls
- Detect areas of moisture accumulation in the walls, roofs and ceiling
- Detect excessive heating in engines, mechanical devices

Thermal camera will also detect the conditions such as if someone is crossing the borders.

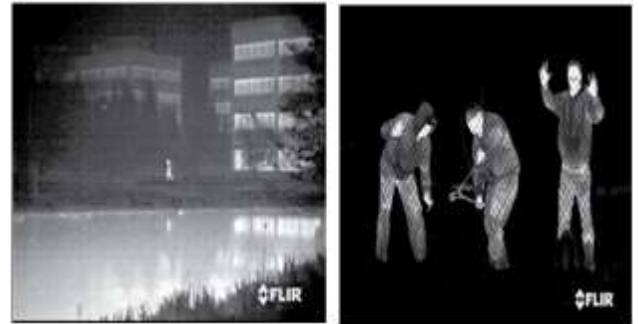


Figure 6. Thermal Cameras view

The camera is also useful to see in the fog conditions this helps in spying purpose. The main important feature of thermal camera is that it can be rotated 360 degree.

3.5 Night vision cameras:



Figure 7. Night vision Cameras view

The night vision cameras are useful to capture images when the light intensity is low especially at night.

3.6 Air Quality Control Sensor

Air quality sensor for detecting a wide range of gases, including NH₃, NO_x, alcohol, benzene, smoke and CO₂. Ideal for use in office or factory, simply drive and monitoring circuit.



Figure 8. Air Quality Control Sensor

3.7 Natural Gas Sensor

Detect dangerous gas leaks in the kitchen or near the gas heater. This unit detects 300 to 5000ppm of Natural Gas. Ideal to detect dangerous gas leaks in the kitchen. Sensor can be easily configured as an alarm unit. **The sensor can also sense LPG and Coal Gas**



Figure 9. Natural Gas Sensor

3.8 Temperature & Humidity-Sensor

These sensors are used to measure the temperature & humidity of the surrounding.



Figure 10. Temperature & Humidity-Sensor

3.9 METAL DETECTOR

Metal detector is used to detect the metal parts present in the bomb such as nails etc.



Figure 11. Metal detector

3.10 Mini fire extinguisher

This robot is also equipped with the co2 gas cylinder also known as fire extinguisher in its arm to extinguish the fire on

a small scale. The bot is also having a facility of a nozzle that is used at the time of connection with the water tank which can provide water to extinguish the fire.



Figure 12. Fire extinguisher

3.11 Smoke detector

The smoke detector is used to detect the smoke to prevent fire from spreading & human safety



Figure 13. Smoke detector

3.12 Sharp Distance Measurement Sensor (20-150 cm)

The distance sensor is used to calculate the actual distance in units of an object from the bot.



Figure 14. Distance sensor

3.13 Power Source

- Onboard Battery (with option to connect to any vehicle for aux power when required). There would be a facility for adding battery pack
- Can have a micro IC engine; which can be used only if sensor are not operational and in open

3.14 Body Frame

- Acrylic body (4mm) with aluminum metal encasing for higher strength
- Enclosure for weather and water proofing
- Modular Design; will ensure that each equipment is a part of sealed box; the boxes can be replaced with the ones most relevant for a mission. E.g. bomb disposal would require gas sensor etc.; whereas rescue operation would require a camera and medical sensor such as pulse rate and blood oxygen level.

3.15 Control unit

The control unit is the main unit of all, as all the images taken by the bot, all the readings of each & every sensor will also be displayed & whole controlling of the bot is done through this unit. All the four cameras images can be viewed at a same time by/at the control unit.



Figure 15. Control Unit

4. BLOCK DIAGRAM

1st Phase:

Transmitter End –

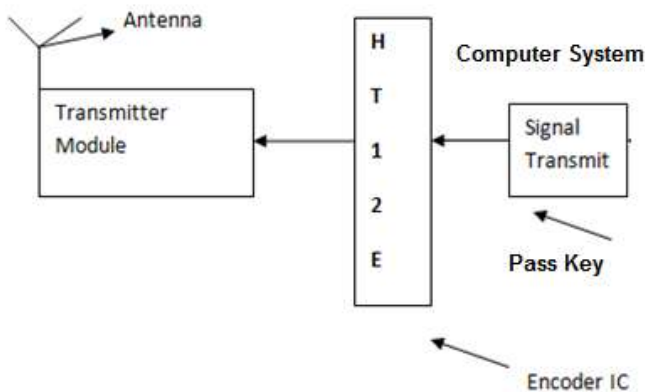


Figure 16. Transmitter block diagram

Here User will send the signal using Joystick to the encoder which will encode the inputted signal and send it to the receiver end using 434MHz of Frequency.

Receiver End (Attached at the Robot) –

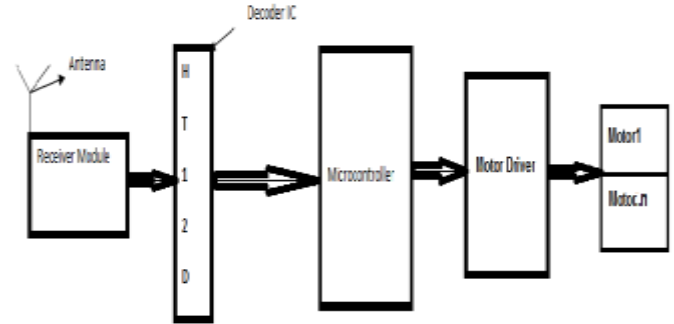


Figure 17. Receiver

The receiver will be connected to the Robot in which the receiver will detect the signal transmitted from the transmitter and send that signal to the HT12D decoder for its decoding, which will logically executed by the microcontroller and send the signal to the Motor Driver for its operation and control.

FLOW CHART:

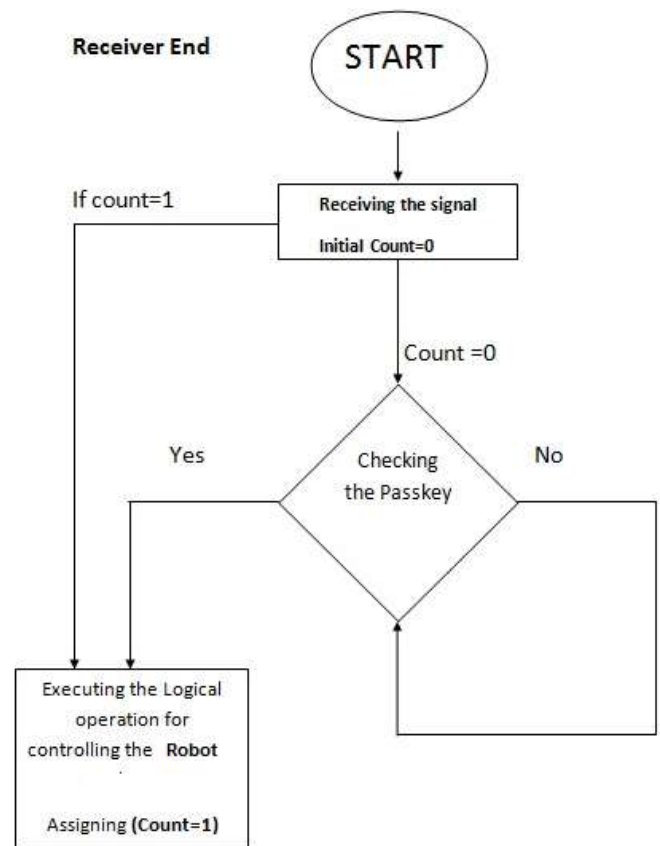


Figure 18. Flow chart

2nd Phase (Temperature Detection, Smoke and LPG Detection):

Transmitter (Attached within Robot) –

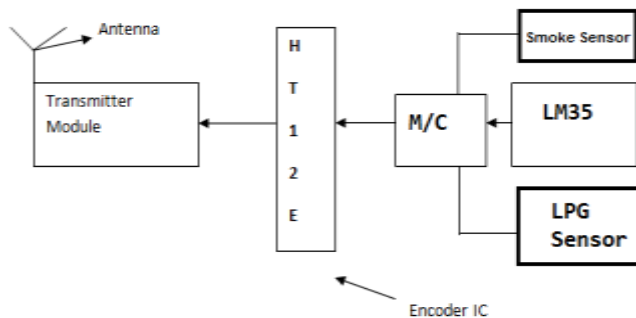


Figure 19. Transmitter (Attached within Robot)

In this case a metal detector will be attached with the robot system, which will detect the presence of any metallic components in its path.

Receiver (User)

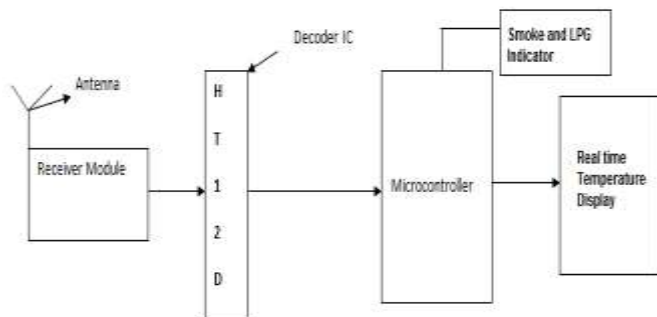


Figure 20. Receiver (User)

Here Receiver will detect the signal transmitted from the transmitter and decoded into its original form by Decoder IC which will be further process by the microcontroller and the output will be displayed in the LCD Screen.

Presence of indication will be in the form of LED Output.

Green LED= No Presence

Red LED=Presence

5. ADVANTAGES

As in coal mine: There has to be so much of safety, because there is much more hazards to human life working there due to blast of gaseous. So to prevent this we can use our SPY BOT to keep eye on such situations because human life is invaluable.

In military: to see plans and conditions in enemy region, it is very dangerous to send the soldiers directly. So by the use of spy robot audio/video information at our control room. It is also useful to sniff 'hidden' mines.

In Nuclear Plant: It is so important to provide safety to human being in nuclear plant due to highly inflammable materials.

In Steel Plant: Molten steel is source of hazards and this can be taken care by SPY BOT

➤ **In petroleum Industries:** High risk of fire exists so SPY BOT can observe the severe conditions and send it to control room.

6. FUTURE SCOPE

a. This robot should have its own upgradable which would be capable of self-test and running its own diagnostics sub-routine

b. The robot should be capable of upgrading its own firmware and operating system with a very simple PC interface; without any need to remove its circuits.

c. Feature; example hand movement or drive system. This is the most effective way to ensure a modular firmware design.

d. Robot should have its own HID (Human Interface Device) component which will allow a trained operator to perform basic repair / software configurations with sending it to lab or attaching it to a standalone computer.

Hardware subsystem will be highly modular and divided into sub-modules. It should be ensured that there is minimum dependency on custom-made components (example any special type of temperature sensor should be avoided at the same time easily available IC should be use)

e. Additionally robot may be capable of deploying child bots; which are capable of performing following kind of analysis

i. Access are not accessible by mother-robot

ii. Perform area assessment using lower power as compared to mother-robot

iii. Use mother-robot as re-transmission station

7. CONCLUSION

It is a multi-functional intelligent machine. It performs various functions such as bomb detecting, bomb defusing, rescue mission, defense mission, and security purpose.

Robonoid word has deep meaning. Robotics in turn takes the scale of development by employing various branches, tools, mechanism & performs wide variety of functions for the benefit of mankind. From this whole ocean of robotics.

This Robot does all basic functionalities such as video transmission, capture images in network range of operation. This Robot is cost effective solution for the people who wish to make a robot operating in a network range with appropriate security measures. This robot does not point to a specific application but a whole tries to convey the message of cost effective building of Robonoid with all the capabilities as wired robot can have.

8. REFERENCES

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