Mine & Smoke Detection Using Wheel Based Robot With Night Vision Camera

[1]Sanket Waje,[2] Vaibhav Pawar,[3]Saquib Ansari,[4]Rohan Vaidya,[5]Prof. Pramod Patil

[1]UG Student, [2] UG Student, [3] UG Student,[4] UG Student,[5]Professor
[1]Computer Engineering Dept. [2]Computer Engineering Dept. [3]Computer Engineering Dept. [4]Computer Engineering Dept.
[5]Computer   Engineering Dept.

[1]SIEM, Nashik, India.   [2]SIEM, Nashik, India. [3]SIEM, Nashik, India. [4]SIEM, Nashik, India. [5]SIEM, Nashik, India.

Abstract: Saving human life and providing security to the same both are two different aspects but both of them are essential and instead mandatory. This innovative system is made for operations which involve high risk for humans to enter, especially for some criminal case and may prove very beneficial for military area for spying purposes. The paper deals with the technical design and development of robot which is used in surveillance and metal mines and smoke detection. A wireless camera is added to the robot, which captures and broadcasts the present surrounding footage of the robot. Metal and smoke detector is used for mines and smoke detection. Microcontroller commands the robot. The movement of this robot is wirelessly controlled by a hand held RF transmitter to send commands to the RF receiver mounted on the moving robot. Since human life is valuable, these robots are the substitution of soldiers in war areas. This spy robot can be used in the areas where there can be threat from intruders or terrorists. At the time of war where it can be used to collect information from the enemy terrain and monitor at a far secure area and safely devise a plan for the counter attack , Tracking location of terrorist organization and the plan attack at suitable time .Making a surveillance of any affected area where human beings can't go.

Keywords: Surveillance robot, Metal mines Detector, Smoke Detector, RF controlled robot , LPC2148 , ESP 8266.
Index Terms - Component, formatting, style, styling, insert.

I.INTRODUCTION

This paper explains the benefits of using robotic method for the surveillance purpose and for metal and smoke detection . Robotic is bringing innovatory changes in the world by introducing new technologies . The basic aim to employ a robotic method is to ascertain human safety and lessen human efforts. Surveillance is major thing when we are going to secure anything as it is tedious job peoples are getting boarded because of that it will might risky to observing all this things we are going to make a robot which is continuously monitor thing. This robot continuously watch and sending a live streaming of it to a authorized person. Because of that monitoring the work will be somewhat easy and it will be make accurate because of technology. The implementation of this project to resolve the problem of replacing human to surveillance robot, because of this we reduce harm of human resource. Robot are usually miniature in size so they are enough capable to enter in tunnels, mines and small holes in building and also have capability to survive in harsh and difficult climatic conditions for life long time without causing any harm. Military robots were designed from last few decades. Nowadays, most of the system uses a mobile robot with a camera for surveillance. The camera mounted on the robot can move to different locations. These types of robots are more flexible than the fixed cameras. In it is given that mostly used surveillance robots are wheel robot. The wheel based robots are more suitable for flat platform. With the development in wireless communication and internet, the videos captured by wheel robot can be seen remotely on computer or laptop. The landmine disaster has been terrifying worldwide since in more than 50 countries, there are 550 million concealed mines . Governments are taking action to conquer this situation. One of the reason of designing this robot is to detect hidden mines, the robot has specified sensors that detect and locate the underground mines and avoid obstacles, without human contribution through wireless control. It is a reliable technology to carry out the assignment and to guarantee the safety The RF transmitter acts as a RF remote control that has the advantage of adequate range (up to 200 meters) with proper antenna, while the receiver decodes before feeding it to another microcontroller to drive DC motors via motor driver IC for necessary work. A wireless camera is mounted on the robot body for spying purpose even in complete darkness by using infrared lighting. At the transmitting end using Joysticks, commands are sent to the receiver to control the movement of the robot either to move forward, backward and left or right. At the receiving end four motors are interfaced to the microcontroller where they are used for the movement of the vehicle. After receiving the command robot will stop. After that the robot will move in the same direction in which previously the robot is moving. For this purpose we designed programs in embedded C .In order to fulfill this application there are few steps that has been performed i.e. 1) Selection of microcontroller that suits our application. 2) Selection of Robot. 3) Selection of DRIVER IC. 4) Selection of wireless camera. 5) Selection of sensors for metal and smoke detection

II. LITERATURE SURVEY

1. War Field Spying Robot with Wireless Night Vision Camera

Author: Priyanka Yadav1, Leena Chaudhari2, Swati Gawhale3

The project is designed to develop a robotic vehicle using RF technology for remote operation attached with wireless camera for monitoring purpose. The robot along with camera can wirelessly transmit real time video with night vision capabilities. This is kind of robot can be helpful for spying purpose in war fields. An ATmega16 microcontroller is used for the desired operation. At the transmitting end using Joysticks, commands are sent to the receiver to control the movement of the robot either to move forward, backward and left or right, ARM up and down etc. At the receiving end two motors are interfaced to the microcontroller where they are used for the movement of the vehicle. The RF transmitter acts as a RF remote control that has the advantage of adequate range (up to 200 meters) with proper antenna, while the receiver decodes before feeding it to another microcontroller to drive DC motors via motor driver IC for necessary work. A wireless camera is mounted on the robot body for spying purpose even in complete darkness by using infrared lighting

2. Arduino Controlled Landmine Detection Robot

Author: v. Abilash1, J. Paul Chandra Kumar

The paper describes an advanced multi-sensor demining robot. The robot transport system is based ona simple structure using pneumatic drive elements. The robot has robust design and can carry demining equipment up to 100 kg over rough terrains. Due to the adaptive possibilities of pedipulators to obstacles, the robot can adjust the working position of the demining sensors while searching for mines. The detection block consists of a metal detector, an infrared detector, and a chemical explosive sensor. The robot is controlled by means of an on-board processor and by an operator remote station in an interactive mode. Experimental results of the transport, control, and detection systems of the robot are presented. The main disadvantage of the robot is weight factor due to the overloading of sensor

3. Low Cost Radio Frequency Controlled Robot For Environmental Cleaning

Author:- M.Muthiah, K Nirmal , NK Sathiyendran

The paper presents the technical construction of a robot which is used in cleaning. The term "cleaning" sounds simple, yet we humans face a lot of problems with the disease ridden workplace, a few examples are factories, power plants, Bio- hazard chambers etc., where it is harmful for humans to work. RF signal is used to control this robot. It uses an Indium (micro-controller) for its operation.

The mechanical part is the base (rectangular wooden piece) with servo motor and the wheels (plastic wheels) in our case. The material used in mechanical part can be changed according to our prerequisite. The electronic part consisting of the RF signal receiver, Induino and the surveillance Camera are mounted on the base of the robot. The camera acts as the "eye" of the operator transferring live video data wireless either using W-Lan or using cloud computing (in case of monitoring over large distance). The cleaning mechanism includes a normal brush (material of the brush is selected as required) with a servo motor attached to it. This robot not only helps in cleaning rather can be used to monitor things

4. WIRELESSLY CONTROLLED MINES DETECTION ROBOT

Author: W. Farooq , Sameer d Dahir , Aslam Shaikh, This paper demonstrates the problem and effects of landmines in defense fields. We are proposing a robot that has the aptitude to detect the buried mines and lets user control it wirelessly to avoid human causalities. The robot is equipped with special wheels controlled by H-Bridge module, allowing it to move in all possible directions. In this paper, we focus on the safety of humans and the robot; the robot is equipped with special range sensors that help in avoiding the obstacles in the field by specifically detecting the position of obstacles. For the fabrication of the project, a special type of prototype made of lightweight temperature resistant metal is used to carry all objects. A wireless camera is added to the robot, which captures and broadcasts the present location of the robot. Microcontroller commands the robot. This technique has the practical benefit of reducing the number of casualties, after the implementation of the technique, the robot can be controlled efficiently and it robustly determines the position of the obstacle WIRELESS DIGITAL VIDEO CAMERA Design Document by Benjamin Tan Project Advisor: Bruce R. Land

5. WIRELESS DIGITAL VIDEO CAMERA DESIGN DOCUMENT BY BENJAMIN TAN PROJECT ADVISOR: BRUCE R. LAND

The objective of the project is to build a cheap wireless monitoring system for slowly varying environments. The system can be used to monitor bee hives, house solar panels and activities in the compound. The system consists of two IEEE802.15.4 Standard compliant wireless transceiver modules and microcontrollers, a CMOS digital camera, PC Graphical User Interface (GUI) and serial port modules.

The wireless transceiver modules communicate between the camera-side embedded system and the PC-side embedded system. The sequence of images sent from the camera-side transceiver is received wirelessly by the PC-side transceiver. The PC-side transceiver then transfers the images to the PC via the PC's serial port.

The sequence of images is displayed in the GUI. The GUI also features recording, playback of recording and deletion of recording functions, controllable by the user through the GUI.

III. PPROPOSED METHOD

A spy robot with detection robot is needed to be designed to employ in peace support, operations and in the clearance of contaminated areas. For the safety of the operator, the robot is controlled with help of controller using the RF module.

The robot has an metal detector and smoke sensor fixed to it in order to locate the mines as well as to detect the smoke. After the detection of mine robot produces warning alert to the personnel nearby with help of a buzzer that is mounted on the robot. The robot actuation is done with high powered DC motor supported by h bridge circuit that allows robot to move in any direction

BLOCK DIAGRAM

An Overall block diagram is shown in Fig 3.1 and 3.2 and the system consists of various electronic parts. The system includes the brain of the robot, LPC2148 microcontroller, metal detector sensor ,Smoke sensor, buzzer for warning alert, DC motors for actuation, RF module for controlling through PC, Metal detector for detection of mine.

These components are placed on the robot and the power is supplied to these with the help of a power supply unit.
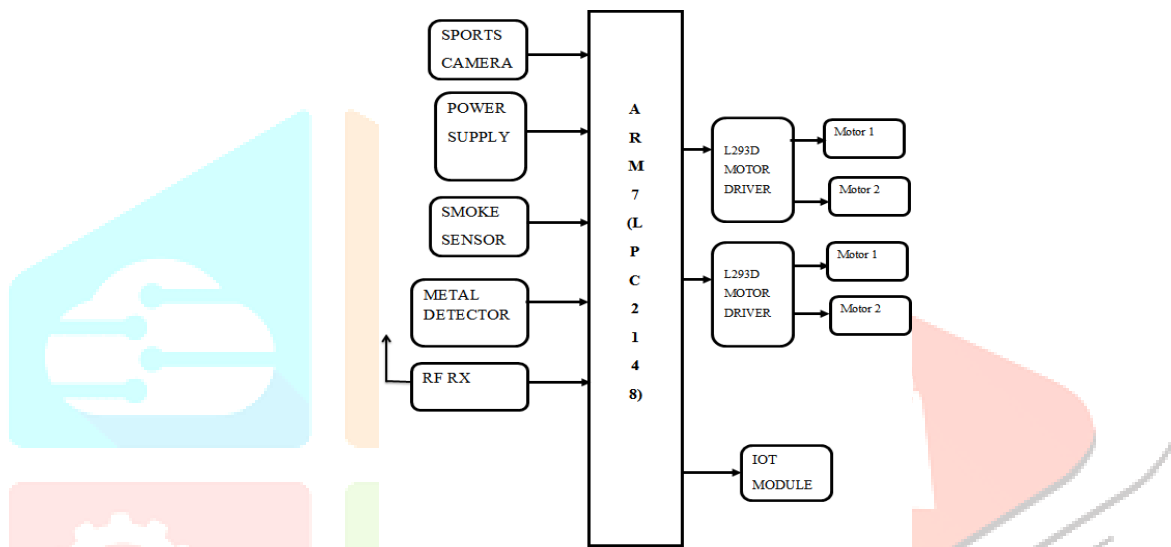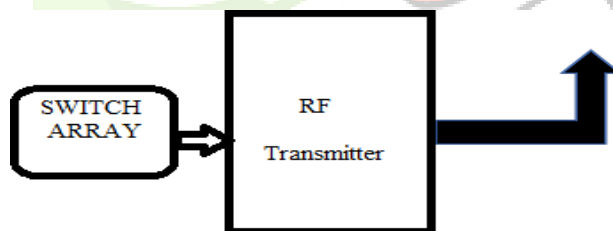.

Figure. 3.1 Transmitter Section.

Figure.3.2 Receiver Section

ARM LPC2148 Microcontroller

The full form of an ARM is an advanced reduced instruction set computer (RISC) machine, and it is a 32-bit processor architecture expanded by ARM holdings. The applications of an ARM processor include several microcontrollers as well as processors.ARM7 processor is commonly used in embedded system applications. Also, it is a balance among classic as well as new-Cortex sequence. This processor is tremendous in finding the resources existing on the internet with excellence documentation offered by NXP Semiconductors. It suits completely for an apprentice to obtain in detail hardware & software design implementation

RF MODULE

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of- sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. This RF module comprises of an RF Transmitter and RF Receiver. The

transmitter/receiver (TX/Rx) pair operates at a frequency of 434 MHz An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E-HT12D, HT640- HT648, etc. are some commonly used encoder/decoder pair ICs.

METAL DETECTOR

The metal detector is used to find the metal from a specific distance. It is employed to find the concealed and buried metal. The metal detector which we used uses an oscillator to generate an AC current. When this AC current passes from a coil, it generates an alternating magnetic field that helps in detecting the metal [8]. Fig.9 shows the operating principle of metal detector showing electromagnet field lines and eddy currents. If a portion of metal is in the range of the coil, the eddy current will be induced and make a magnetic field of its own. The difference of the magnetic field caused by metal is used to detect metal [8]. If there is any metal, the robot will stop and update the operator about the presence of mine and metal in the field. The detection of metal is shown on the LCD; the message which is displayed on the screen is "*Mine Detected*".

SMOKE SENSOR

A **smoke detector** is a device that senses smoke, typically as an indicator of fire. Commercial security devices issue a signal to a fire alarm control panel as part of a fire alarm system, while household smoke detectors, also known as **smoke alarms**, generally issue a local audible or visual alarm from the detector itself. An **ionization smoke detector** uses a radioisotope, typically americium-241, to ionize air; a difference due to smoke is detected and an alarm is generated. Ionization detectors are more sensitive to the flaming stage of fires than optical detectors, while optical detectors are more sensitive to fires in the early smoldering stage.

NIGHT VISION CAMERA

A night vision camera is a device that allows to see in the dark. The light that is able to see is electromagnetic radiation. Human eyes are only able to see a very small part of the electromagnetic spectrum. The part which is able to see is called "Visible Spectrum". But part of it is the infrared radiation. Infrared is a very low energetic radiation and it is widely used in night vision cameras. Basically the concept is simple – A night vision camera is a device that emits infrared "light" and is capable of detecting it in a camera. The only difference between a night vision camera and a camera that is taking a film of an environment that is being lighted by a normal lamp which can't see the infrared "light" with human eyes but it can be seen with the infrared camera

H BRIDGE MODULE

H-bridge plays a significant role in any robotic systems. It is used to handle the moves of a DC motor that is used to drive the motors. It allows motor to rotate clockwise or anti- clockwise. Inside the robot, it was hard to manage the level of amperes, so special H-bridge was designed for the purpose created by using MOSFETs, as shown in fig.10. BJTs are usually for low amperes and Mecanum wheels usually draw 10A, so MOSFETs are used. Eight MOSFETs are used in an explicit way to fabricate movement . The motive for choosing MOSFETs is that they can tolerate huge amounts of current. As it is used for high rating currents a protection circuit is installed. A simple H-bridge circuit with BJTs cannot tolerate the motor's load, so for using these motors efficiently, MOSFETs (Metal Oxide Semiconductor Field-Effect Transistor) are used. As demonstrated in fig. 10, Opto-coupler is also employed in circuit to detach the controller from leakage current by motor .

DC MOTOR

A **DC motor** is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor. DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications

Continuous Track Wheel

After a detailed market survey we came in to introduction of Continues Track type wheels The large surface area of the tracks distributes the weight of the vehicle better than individual tyres on an equivalent vehicle, enabling continuous tracked vehicles to traverse soft ground with less likelihood of becoming stuck due to sinking which was readily available and of which production cost was fairly lesser. Tracks equipped with rubber pads to improve travel on paved surfaces more quickly, smoothly and quietly. While these pads slightly reduce a vehicle's cross-country traction, they prevent damage to any pavement

IV. WORKING

When the operator turns on the remote, the RF transmitter side searches the RF present in the receiver side. Once it is connected, it would start working. At the transmitting end, there are four push buttons 1, 2, 3, 4; forward, back, right, left, respectively. The robot will operate according to the key pressed. Fig. shows the inner hardware of the robot. 360 degree rotating Wireless Camera is installed over the top of Robot which captures the 360 degree footage of surrounding and send it to the receiver portal. The sensors used in this system are Metal detector and smoke detector sensor respectively. When metal detector detects the presence of metal (mines) it sends the generated information to controller and controller sends high signal over the port connected to the buzzer and Buzzer gets on and gets off after specific delay When smoke detector detects the presence of smoke it send generated information to the microcontroller. The controller further send signal to the ESP8226 Wi-Fi module which further transmits the information over the cloud portal using internet . The cloud portal shows the information in term of Time and date (when the smoke gets detected by sensors)

V. RESULTS AND SIMULATION

There are mainly two parts in this project i.e., electronics part and mechanical part. In the electronics part the simulation of all the electronics part like LPC2148, metal and smoke sensor, dc motors etc. are done using the proteus software. The four planetary geared DC motor are connected to the output pins of L293D modules (3,16,11,14). The metal detector sensor is connected to the input pins (36, GND) to detect the metal mines. The smoke detector sensor are connected to the input pins (40, GND), for detecting of the smoke. The ESP8266 connections are connected to the output pins (48,44)of controller. For simulation, LPC2148 library have to import first to display and then sensors and motor has to imported . As pin configuration is stated above the connections are made in the software. Later International Journal of Engineering Science and Computing, May 2019 11905 http://ijesc.org/ the program is loaded in microcontroller for simulation.
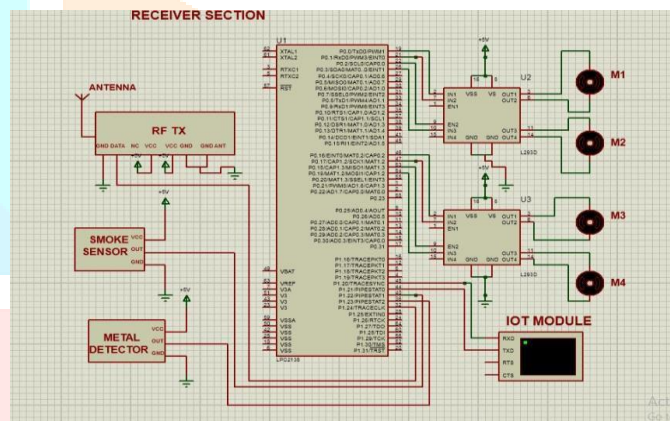

Figure 5.1 SIMULATION DIAGRAM

VI. CONCLUSION AND FUTURE SCOPE

This paper has described overall design for LPC2148 based spy robot for various applications i.e. surveillance purpose, metal mine and smoke detection purpose and implementation. The wheeled robot is less expensive, robust and it is a helpful tool for military use for surveying and monitoring purpose. The future scope is concentrated on the improvement of the body designs by placing suspension system to over shock from the uneven surfaces.. The power system is developed by replacing the battery with the solar panels to produce continuous power. The robot is equipped with a robotic arm for the bomb diffusion purpose. The retro-reflective panels can be deployed over the entire body of robot for making it invisible at certain level.

VII. REFERENCES

[1] Waqar Farooq, Nehal Butt, Sameed Shukat, Nouman Ali Baig,Sheikh "Wirelessly Controlled Mines Detection Robot"
https://www.academia.edu/31495545/Wirelessly_Controlled_ Mines_Detection_Robot

[2] Benjamin Tang "WIRELESS VIDEO CAMERA"
https://people.ece.cornell.edu/land/courses/eceprojectsland/STUDE NTPROJ/2008to2009/bt48/WiDiVCamReport.pdf

[3] Jigar J. Parmar, Chirag V. Savant "Selection of Wheels in Robotics
https://www.ijser.org/researchpaper/Selection-of-Wh eels- in-Robotics.pdf

4] V. Abilash1, J. Paul Chandra Kumar2 Ardunio Controlled Landmine Detection Robot
http://ijesc.org/upload/58c75b08e20d4f9694451a5f9e4dcd4b.Ardunio%20Controlled%20Landmine%20Detection%20Robot.pdf

[5]. PriyankaYadav1 Leena Chaudhari2 Swati Gawhale3 "War Field Spying Robot with Wireless Night Vision Camera
https:// www.ijraset.com/fileserve.php?FID=11366

[6]. M.Muthiah,Sri Venkateswara , K.Nirmal, Rk.Sathiendran Arobot Low Cost Radio frequency Controlled Robot for Environmental Cleaning
http://www.sooxma.com/docs/Abstracts/Low%20Cost%20Radio%20frequency%20Controlled%20Robot%20for%20Environmental%20Cleaning.pdf

[7].H. Kasban • O. Zahran • Sayed M. Elaraby • M. El-Kordy • F. E. Abd El-Samie "A Comparative Study of Landmine DetectionTechniques
https://www.researchgate.net/publication/225752842_A_Comparative_Study_of_Landmine_Detection_ Techniques

[8].Humanoid, Water Front Hotel, Cebu, Philippines Fire Locator, Detector and Extinguisher Robot with SMS Capability"
https://ieeexplore.ieee.org/iel7/738 6242/ 7393 160