International Journal of scientific research and management (IJSRM)
||Volume||4||Issue||10||Pages||4738-4743||2016||
Website: www.ijsrm.in ISSN (e): 2321-3418

A Review on Rough Terrain and Defence Robot

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Abstract: *Normally some of the risky and various tasks cannot be done by human. Thus there is need for change in present era. So, robot can be a good and effective option for risky purposes. Robot plays various roles in different fields of industries, medical, colleges, home appliances and military and defense. The proposed work is to design and develop a rough terrain beetle robot. Now a day's robot's comes in the market works on a simple terrain while we are on a project which works on plain surface as well as rough surface such as forest, hilly and rocky areas.*

In this paper we are focusing on the use of rough terrain robots instead of using other simple robots. This paper also presents an Defense robot which uses different technologies like Infrared sensor, PIR sensor Ultrasonic sensor, Bluetooth module and Wifi Technology etc. and this paper proposed a low voltage power supply, low cost and wireless robot which is controlled using microcontroller and Android Application.

Keywords: Microcontroller, IR Sensor, PIR Sensor, Bluetooth Technology, Wi-Fi Technology.

1. Introduction:

With the development of world the technology is enhanced day by day with the realistic projects and efficient work towards by developing of robots. This paper presents multipurpose functionalities of wireless robots. Nowadays for controlling and development of robots various technologies are used such as Zigbee protocols, RF modules, Touch screen, WiFi modules and other technologies. In this paper we discussed through various researches what development has been done in robotics in field of Rough terrain and Defense Robots and our proposed work regarding the following paper.

2. Literature Survey:

[1] M. Prem Kumar Er Prem Kumar had gave the paper on unmanned multi-functional robot using Zigbee adopter network for defense application. In proposed system, the communication can be done with the help of the Zigbee wireless communication network. In this system, the robot is monitored using the CMOS camera.

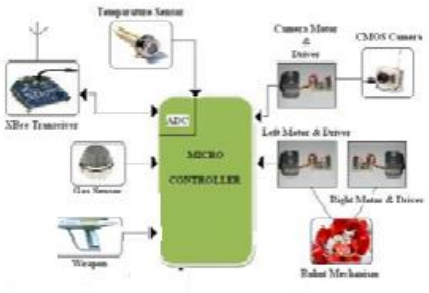

Figure1. Robot Section of Prem kumar paper

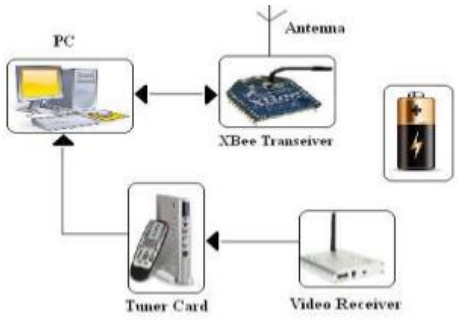

Figure2.Controller Section of Prem kumar paper

The entire control is resided with the microcontroller. In addition to this, bomb detection, bomb diffusion, gas leakage detection, live human body detection and pressure gun are included. In this, the robot can move through the rugged surfaces also. The control of the robot from remote location is done with a computer. The information to the computer is carried out by the advanced technology named Zigbee Technology.

This proposed system gives an exposure to design a simple robot that can be used to do multifunction in defense. Manual control is also employed to control the robot from the control room which is located far away from the border area. The system uses non-commercial Zigbee standard for wireless communication since this provides access to the as-yet unpublished specifications and permission to create products for market using the specifications. Our system is aimed towards the Zigbee technology up to 30 meters distance. In future we can increase the distance up to 100m distance. The proposed system is focusing on the welfare infantry to minimize the causalities to a great extent. This also helps on remote bomb detonation and diffusion.[1]

[2] Ramesh Nayak, Mithuna Shetty, Rakesh Ganapthi, Sushwitha Naik, Varsha Aithal. In this paper robot can be used in real war field. This paper is quite different from other because instead of using remote control it is using touch screen to control robot. The robot is fully controlled by the touch screen and the commands from the touch screen via ZigBee transmitter were received by the microcontroller. So this defense robot can be used in military applications.

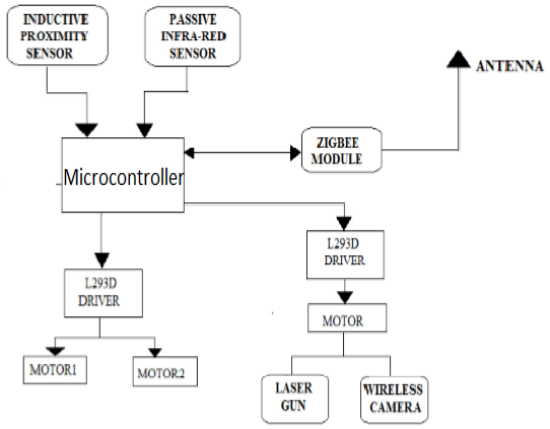

Figure3. Robotic Unit of Proposed Paper

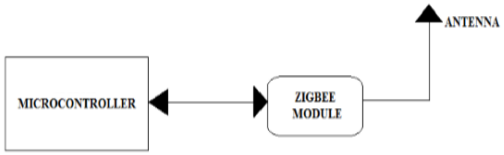

Figure4. Control Unit of Proposed Paper

An automated defense robot building is planned, that has a laser gun attached, which is utilized for pointing laser rays to destroy the target object. One of the most important things about these robots is that they have the capability to perform missions remotely in the field, without any actual danger to human lives. In the proposed system, a robot is developed that is controlled through Microcontroller. For the aiming purpose and to view the road and the surroundings in which the robot is travelling, wireless cameras are installed. Radio frequency can be used to control the robot.

These defense robots used in military are usually employed with the integrated system including gripper, cameras and sensors. This is specially designed for defense robotic system to save human life and protect the country from enemies. In the existing systems, personal computer using ZigBee protocol is used to monitor the robot.[2]

[3] Pooventhan K, Achuthaperumal R, Kowshik S, Manoj Balajee C R In this paper Surveillance is taken into account. Surveillance is the monitoring of the behavior, activities, or other changing information, usually of people for the purpose of influencing, managing, directing, or protecting them. Hence Robot which continuously Monitor the place and provides security is developed. In this project a robot is designed in such way that it provides high level surveillance as required using automation. The main objective of the project is to provide an efficient surveillance wherever high level security is needed. The proposed system is an embedded based robotic module. With the proposed system, humans can feel extreme comfort and can experience automation to the maximum.

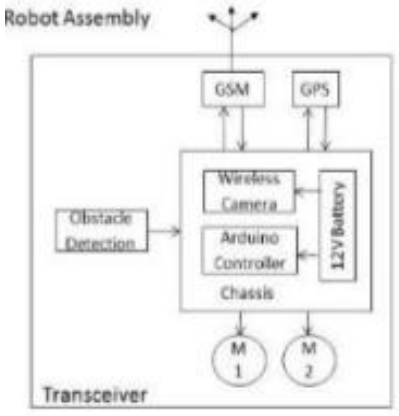

Figure5. Robot Section of Surveillance Robot

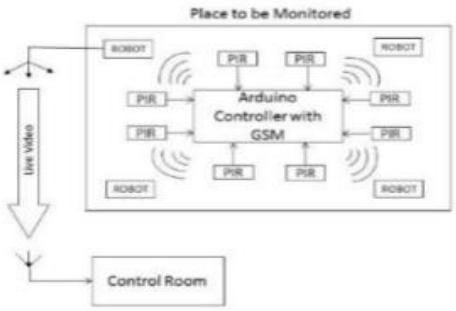

Figure6. Control Section of Surveillance Robot

Basically surveillance robot is nothing but the ordinary robot with the navigation mechanism along with some cameras, thermal sensors, and the communication devices like GSM, GPS modules. These robots can be navigated using servo motors to get the accurate navigation.

In the above diagram PIR refers to the Passive Infrared Sensor, GSM and GPS refers to Global System for Mobile communication and Global Positioning System respectively.

The surveillance robot was designed with AVR microcontroller using embedded platform. It monitors and secure a place from the adversaries which can be done by surveillance robot all the times with great accuracy and high precision. An IP camera is used which continuously monitors the place and sends the information to the control station. The Servo motor used provides the movement of robot with greater speed control compared to the conventional method. The future scope of the project has many openings that could be continued for various future

applications in monitoring and controlling etc., This robot can also be used in time of environmental disasters where the robot detects whether a human is present alive in that area. Domestic applications like Home security can also be implemented using this methodology. [3]

[4] Kunal Borker, Rohan Gaikwad, Ajaysingh Rajput, In this paper instead of using RF module for wireless communication they are using different modified techniques for wireless communication such as GSM. The new age of technology such as Android, GSM has redefined communication.

Most people nowadays have access to mobile phones and thus the world indeed has become a global village. At any given moment, any particular individual can be contacted with the mobile phone. New innovations and ideas can be generated from it that can further enhance its capabilities. Technologies such as Infra-red, Bluetooth, Wi-Fi which has developed in recent years goes to show the very fact that improvements are in fact possible and these improvements have eased our life and the way we live. Remote management of several home and office appliances is a subject of growing interest and in recent years we have seen many systems providing such controls. Mobile robots are robots which have the ability to move around and interact with their environment and not just hinged to a particular place. There are many labs and research groups from various universities and industries which are completely dedicated on researching mobile robots, because of their immense potential and varied application in industry, military, security, and entertainment.

The robot is specially designed for surveillance purpose. The control mechanism is provided along with video transmission facility. The video transmission is practically achieved through high speed image transmission. Initially, the robot will be equipped with an Android smart phone which will capture the scenario in front of it & will transfer the images to the server on which the user will be controlling and watching the live feed.

The Block Diagram given below explains the actual working of the robot. We can split it into three stages as follows-

1. Robot

2. Remote Computer

3. Communication link between the above two, which is a Web server.

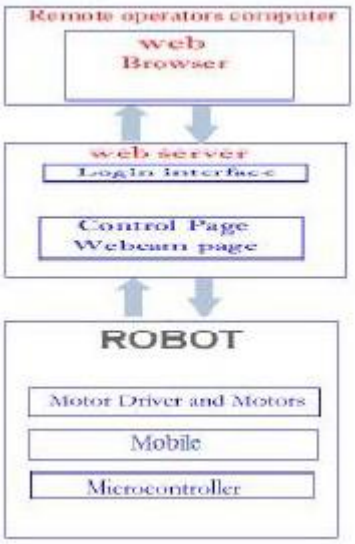

Figure7. Overall Block Diagram of Proposed Paper

1. Robot: - The main components of the robotic body as shown in the above Block diagram are an Android device, a microcontroller and motor drivers and motors. The Motion of the Robot is programmed using Atmega-8 microcontroller.

2. Remote Computer: - Now, the robot can be controlled by the user operating the Remote computer. The essential component here is the web browser on which we will be opening the control page to control the robotic action. Also we will be able to watch the live streaming on the video screen on the control page.

3. Web Server: - The web is consisting of a log-in interface and control page with video screen or a webcam page.

The Proposed model uses GSM or ANDROID application for wireless communication instead of using RF Module. As the main disadvantage of using a RF circuit and the main reason why RF circuits are not preferred today is the RF frequency band is available for almost all the users for data communication. So there might be a scenario where more than one user is trying to accommodate channel for its own communication. In such case the frequency band may get interference from another user. Or worst case would be, some user intentionally trying to jam our communication network. The RF jammer circuits are very easy to design; hence the question of security arises when RF circuit is used in the circuit. This security loop hole can be very dangerous when the robot is being used for very confidential purposes. In areas of military these security threats can produce disastrous outcomes. [4]

[5] Tarek Mohammad, In this paper they used IR sensor for measuring distance to an obstacle. They had divided IR sensors into three steps. First, the properties of the surface of the obstacle are determined. Secondly, the angle or orientation of the surface relative to the sensor is determined. Finally, the distance is calculated by using the information obtained in first two steps.

IR sensors are extensively used for measuring distances. Therefore, they can be used in robotics for obstacle avoidance. They are cheaper in cost and faster in response time than ultrasonic (US) sensors. However, they have non-linear characteristics and they depend on the reflectance properties of the object surfaces. So knowledge of the surface properties must be known prior. In other words, the nature in which a surface scatters, reflects, and absorbs infrared energy is needed to interpret the sensor output as distance measure.

IR sensors using reflected light intensity to estimate the distance from an object. Their inherently fast response is attractive for enhancing the real-time response of a mobile robot. Some IR sensors described in the bibliography are based on the measurement of the phase shift, and offer medium resolution from 5 cm to 10 m, but these are very expensive. Ultrasonic (US) sensors are also widely used to measure distances. Thus they have provided a reliable source of obstacle detections. Since they are not vision-based, they are useful under conditions of poor lighting and transparent objects. However, US sensors have limitations due to their wide beam-width, sensitivity to specular surfaces, and the inability to discern objects within 0.5 m. Because of the typical specular nature of the US waves reflection, only reflecting objects that are almost normal to the sensor acoustic axis may be accurately detected. The US sensors described in have precision of less than 1 cm in distance measurements of up to 6m. However, the time of flight (ToF) measurement is the most accurate method among the measurements used. This ToF is the time elapsed between the emission and subsequent collection of a US pulse train traveling at the speed of sound, which is approximately 340 m/s, after reflection from an object. For single measurement, this causes large response time, for example, 35 ms for objects placed 6m away. In addition, they offer poor angular resolution. In an unknown environment, it is important to know about the nature of surface properties in order to interpret IR sensor output as a distance measurement. Here, US sensor can play an important role in determining the surface properties. The co-operation between the US and IR sensors are utilized to create a complementary system that is able to give reliable distance measurement. They can be used together where the advantages of one compensate for the disadvantages of the other. The integration of the information supplied by the multiple US and IR sensors can be a means to cope with the spatial uncertainty of unknown, unstructured environments in several applications of advanced robotics, such as flexible industrial automation, service robotics, and autonomous mobility. This paper details a method that determines the infrared reflectance properties of a surface and then calculates the distance by using these properties. The basis of our approach is the Phong Illumination Model, which is usually used in computer graphics routines. This model is able to figure out the reflectance properties of any surface illuminated by a point light source such as IR LED. However, this method requires other sensing modalities to get the information on the distance to obstacle initially. US sensors can fulfill the requirements in unknown environment. Then we tested and characterized the effects of distance on two sensors. National Instruments Data Acquisition System with LabView software was used to collect data due to its ability to measure the smallest possible increments of voltage drop/rise.

In this project, they focused on the ability of the sensors to detect the range of objects of flat surfaces and of different materials. The experiments indicate that the low cost US and IR sensors are able to give reliable distance measurement. The results obtained show satisfactory agreement between the Phong Illumination model and the real data obtained in the validation tests. It has been shown that US sensor has slightly higher resolution than that of the IR sensor, especially for small distance measurement within their usable ranges. Differences between the measured distances and actual distances indicate necessary re-calibration. More care should be taken when placing the objects from the sensors during acquiring data since the small change in angle could show very different distance than the actual one. The amplitude from the US sensor is dependent on the distance and orientation of the obstacle relative to the sensor, where small orientation of the reflecting surface does not have much effect on the IR sensor amplitude. However, the amplitude from the IR sensor is dependent on the reflectivity of the obstacle, where surface color and smoothness does not have much effect on the output signal from the US sensor. [5]

3. Proposed Work:

We have concluded from these existing and above discussed technology we can use a bug leg shaped wheels for running on a rough terrain. We can also use different sensor like PIR sensor, IR sensor and Ultrasonic sensor for purposes like for distance measurement, obstacle detection, for depth sensing and for distance measurement respectively. Instead of using wireless camera we are using smart phone for live streaming of surroundings for spying this can be done with help of IMO application which is installed in mobile phone and due to internet services we can easily spy at any time. For wireless communication with Robot unit we are using Bluetooth module and easily control our robot with the help of android Application using USART Technology. Hence Android application is used as a remote control for robot which control movements of motors due to which wheel and is controlled laser shooter.

In this proposed model we want to achieve five aspects:

1. To design radar concept: In this mode we use the ultra sonic sensor that sense the obstacle and measure the distance and display in LCD.

2. Accident avoiding feature: In this mode we use the infrared sensor that sense automatically and check the problem and automatically stop and weep the buzzer.

3. Depth detection: In case of depth the robot sense the depth automatically stop and weep the buzzer.

4. Wireless robot: In this mode we operate the robot wireless technology through Bluetooth technology.

5. Human Checker: In this mode we use the PIR active module for human detection.

3.1 DESIGN OF PROPOSED MODEL:

In this proposed model contains two units one is Robot unit and Control unit.

Robot unit: The heart of the system is Microcontroller, which controls all the activities of the robot section. Sensors such as PIR, Ultra-Sonic, and two Infrared sensors are used. Six motors have been used in this project. Four for wheel control and two for laser Shooter control. Also Opto-coupler IC are used to drive the motors. Mobile phone is used for live streaming and Bluetooth module is used for wireless communication between Robot and Control unit.

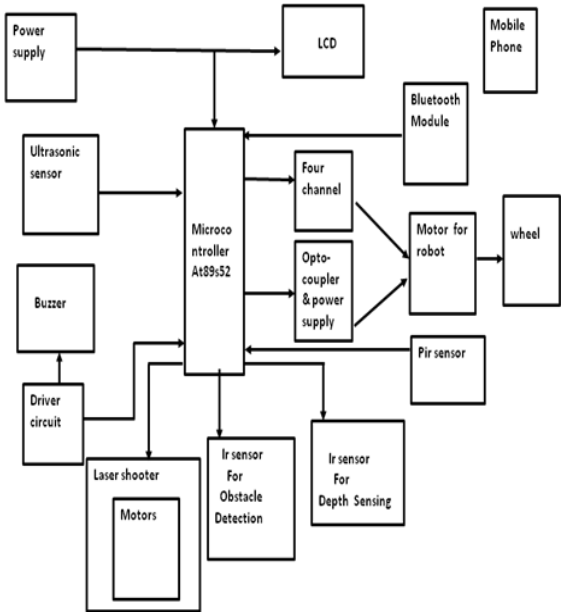

Figure8. Block Diagram of Robot Unit

Control unit: The robot is controlled by Android Application. An Android application uses USART technology and Bluetooth Module to Communicate with Microcontroller so that Microcontroller accepts commands. This allows the user to control the directional movement as well as Laser Shooter Movement of the robot. The Android Application is installed on Smart phone and due to which user can easily control the robot at any time and with the help of IMO application we can easily monitor the current situation.

4. CONCLUSION:

The proposed robot has scope of widespread industrial, defense and home applications. It can be used to analyze the environment of a coal mine without any human intervention. It can also be employed in a hostage situation to pin point the exact location of terrorists with the help of ultrasonic and PIR sensor, saving many lives during rescue mission. Another application is home security system to sense movement of intruder through PIR sensor. Various advantages of this system are its range of operation up to 100m, secure data transfer can be done with the help of Bluetooth Module and Android Application. Entire project will help in Military and Defense operations such as human detection, distance measurement, obstacle detection and also due to their bug like wheels it can travel in all terrains.

5. ACKNOWLEDGEMENT:

The author expresses his sincere gratitude to Professor Pragati Gupta of the department of Electronic and Communication Engineering at Moradabad institute of Technology for his valuable advice and guidance throughout the project. Thanks are due to Professor Amit Saxena for his constructive suggestions for his continuous support to complete the project successfully. At last author would like to thanks their parents for their cooperation.

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