Border Security and Multi Access Robot using Embedded System

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Abstract

Background/Objectives: This paper presents the various fields surveillance has become important to ensure security and safety, research into motion detection and other sensory information has been conducted in order to equip a mobile robot with surveillance capability. **Methods/Statistical Analysis**: Apart from that this study proposed to learn the continuous surveillance it is also sensitive to Metal, Bomb, Fire and Electromagnetic field. It has the ability to carry loads up to 50 kgs. **Findings:** The Robot has a Wireless Camera which constantly monitors the location and transfers the live audio/video to the remote control center. In control section, a RF transmitter and receiver module operating at 433.92 MHz (Zigbee band) to send and receive data. **Applications/Improvements**: This paper was designed for special applications like military and industrial purpose with special attention to surveillance report.

Keywords: PIC Micro Controller, RF Transmitter, Robot, Sensors, Wireless Camera, Zigbee

1. Introduction

Border security and multi access robot using embedded system is based on three terms viz., 'Mechatronics', 'embedded system' and 'Robotics'. Mechatronics is a term created to represent the total technology of mechanisms and electronics. Its recent organic combination with electronics has certainly brought about a striking advance in the functions and performance of machines. This striking advance lay in the background of the creation of the new term "mechatronics".

An embedded system is a special-purpose system in which computer is completely encapsulated by the device it controls. Unlike a general-purpose computer, such as a personal computer, an embedded system performs predefined tasks, usually with very specific requirements¹. Since the system is dedicated to a specific task, design engineers can optimize it, reducing the size and cost of the product. Embedded systems are often mass-produced, so the cost savings may be multiplied by millions of items².

A robot is a re-programmable multifunctional manipulator designed to move material, parts, tools or specialized

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devices through variable programmed motions for the performance of a variety of tasks and used for Relief operations³.

Robots were used in many industrial applications⁴⁻⁷. This paper presents the various fields surveillance has become important to ensure security and safety, research into motion detection and other sensory information has been conducted in order to equip a mobile robot with surveillance capability.

2. Methods

This study proposed to learn the continuous surveillance. It is also sensitive to Metal, Bomb, Fire and Electromagnetic field⁸. It has the ability to carry loads up to 50 kgs.

2.1 Control Room Mechanism

On the Parent PC side, RF receiver which receives the transmitted RF signal from the robotic model. It



Figure 1. Block diagram of control room module.

is then decoded and the binary data is fed into the microcontroller. The microcontroller communicates serially with the PC through RS-232. The live audio and video signal transmitted, is received through a wireless receiver tuned to 900MHZ. The user can also control the robot movement after visually witnessing what is happening at the remote location⁹. When a command is given to move in a particular direction, it does so through another pair of transmitter/receiver tuned at a frequency of 433.92 MHz as shown in the Figure 1.

2.2 Robot Module Mechanism

Microcontroller is the heart of the Robotic model. The sensor network consists of Intruder sensor, fire sensor and metal sensor. Intruder sensor is "Proximity Sensor" which has an IR transmitter and IR internally¹⁰. When an intruder comes before the robot, the reception of

IR rays at the detector is interrupted and is informed to the microcontroller through a logical change in the state. In the case of fire, a LDR can be used for sensing yellow and blue flame and reject sunlight and other luminaries.

This study provided necessary circuit to reject ambient and luminaries lightings and senses only desired flame coloring. This study is using simple and effective potential divider to find out flame. The eddy currents in the metal object then creates a magnetic field in themselves which in turn send a signal back to the receiving unit on the metal detector¹¹. The metal detector then reacts in some way usually by sound. These changes in state of each sensor are AM modulated, encoded and send through RF transmitter at a frequency of 433.17MHz. This study has a separate wireless enabled camera for monitoring live audio and video signal at a frequency of 900MHz as shown in the Figure 2.



Figure 2. Block Diagram Robot Module

3. Algorithm used for the Functioning of the Robot

Step: 1 Start the process.

Step: 2 Choose any one of the inputs from the following modes:

Step 2.1 Keypad control

Step 2.2 Biological interface

Step 2.3 Direct access

Step: 3 Get the input from these one of the modes. **Step: 4** If the pressed input is forward then move the robot in forward direction.

Step: 4.1 Else if the pressed input is reverse then move the robot in reverse direction.

Step: 4.2 Else if the pressed input is left then move the robot in left direction.

Step: 4.3 Else if the pressed input is rotate then rotate the camera.

Step: 5 Get the data or audio video data from the off-site module.

Step: 6 Go to Step 2

Step: 7 Stop the process.

4. Special Features and Result Analysis

This study was successful in modeling a robot with three sensors which are used to sense any metal, bomb, electromagnetic field and fire. The mobile robot can effectively be controlled from a distance of 100 meters. This type of robot can find its application in areas where humans cannot go and monitor, thereby helping in surveillance operations and also aides in disaster management. In addition to the camera the robot has special sensors to sense its surroundings. This study considered three sensors embedded in this robotic vehicle.

The Electromagnetic sensor (Reed Relay) senses the electromagnetic radiations and Causes the vehicle to stop in its track, only the reverse operation remains active then. The metal sensor (Inductive Proximity Sensor) also acts as bomb sensor. It helps in sensing metal and explosives like RDX. The Fire Sensor (Light Dependent Resistor) helps in detecting fire as it can sense YOR colors and stops the vehicles forward motion. The robot has two stepper motors attached to its wheels, thereby helping the robot to move forward, reverse, left and right¹². The commands given from the control center are transmitted through wireless to the field (robotic vehicle) and the corresponding robotic action can be viewed from the control center¹³. In addition, the robot has the ability to carry weight up to 50 kgs. Thus the robot has been designed to act as a compact surveillance vehicle as mentioned in the Figure 3.

Thus, this paper was designed for special applications like military and industrial purpose with special attention to surveillance report.

5. Conclusion

This study presented a mobile robot with on-board sensory system. It is designed with a special ammunition delivery mechanism. The robot was designed for military



Figure 3. Flowchart of on-site & off site module.

and industrial purpose with special attention to surveillance applications. This study suggests to extend the proposed system to sense the harmful gaseous vapors. The grid based navigation system which provides accuracy in movement to implement the perfect navigational capabilities in the mobile robot for more accurate navigation. GSM technology is used for sending SMS and autodial to a fire station to inform about the fire. Thus, many advanced features can be included to enhance this robotic vehicle.

6. References

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