Final Year Project Report

Unmanned Ground Vehicle for Surveillance

With Self-Defense System

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Unmanned Ground Vehicle for Surveillance With Self-Defense System

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Abstract

Our aim is to create a robot vehicle that could be used for surveillance and spying of an area which is not suitable for human approach. This robot would be capable of self-defense. It would reach the areas not suitable for humans to collect required information.

We designed a wirelessly controlled robotic vehicle which can be operated through a range of 200 meters using 433 MHz RF transmitter and receiver. This can also sense the obstacles on its way for manoeuvring its path by using Ultrasonic sensors. This vehicle is equipped with a metal detector that can detect any land mine on its way, and wireless camera which will transmit the live video remotely.

Dedication

Dedicated to Allah Almighty for His infinite mercy that He has granted to us throughout our studies and we also dedicate this work to our Project Advisor **Basit Shahab** &**Our Parents** who enlightened our minds with knowledge, tried to include the spirit of hard work and dedication in us so that we could have a bright future in terms of being good human and turn out to be competent Engineers with powers to take challenging engineering problems and provide logical solutions to these problems.

Acknowledgements

Engineering is not only hard work and perseverance; it also involves imagination, motivation and dedication. It is eagerness to learn and desire to excel; it is planning and managing.

Planning is vital for any project. Throughout our project several problems of technical nature emerged but by the grace of **ALLAH ALMIGHTY**, they were overcome and our final year project was completed in time. In this regard, guidance and suggestions of our Project Advisor **Muhammad Basit Shahab** proved to be a beacon of light throughout the derivation in which we remained engaged in this project.

Finally, we are also grateful to our dear Parents for their love, support and prayers without which we could not have achieved anything.

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1 Introduction

Surveillance, Espionage or spying involves individual obtaining information that is considered secret or confidential without the permission of the holder of the information. Spying area in military ground where enemy stay can be took before taking any action.

A robot is a virtual or mechanical artificial agent. In practice, it is usually an electro mechanical system which, by its appearance or movements, conveys a sense that it has intent or agency of its own.

Our aim in building this project is to create a wirelessly controlled robotic vehicle which can be operated through a range of 200 meters using 433 MHz RF transmitter and receiver. This can also sense the obstacles on its way for manoeuvring its path by using Ultrasonic sensors. This vehicle is equipped with a metal detector can detect any land mine on its way, and wireless camera which will transmit the live video remotely.

This unit is helpful and useful for surveillance of an area in defense grounds for enemy, spying purpose where the human reach is not recommended or avoided. The unit is small handy portable and can reach places easily.

1.1 MAIN FEATURES OF THE PROJECT

1. Effective in implementation
2. Low power consumption and compact size.
3. Long control range due the usage of Radio Frequency devices.
4. Robot monitored from a remote area (no need of 'line-of-sight' arrangement).
5. Manoeuvring its path by sensing and avoiding obstacles.
6. Land mine detection.
7. Wireless video surveillance.

1.2 THE SIMPLIFIED BLOCK DIAGRAM

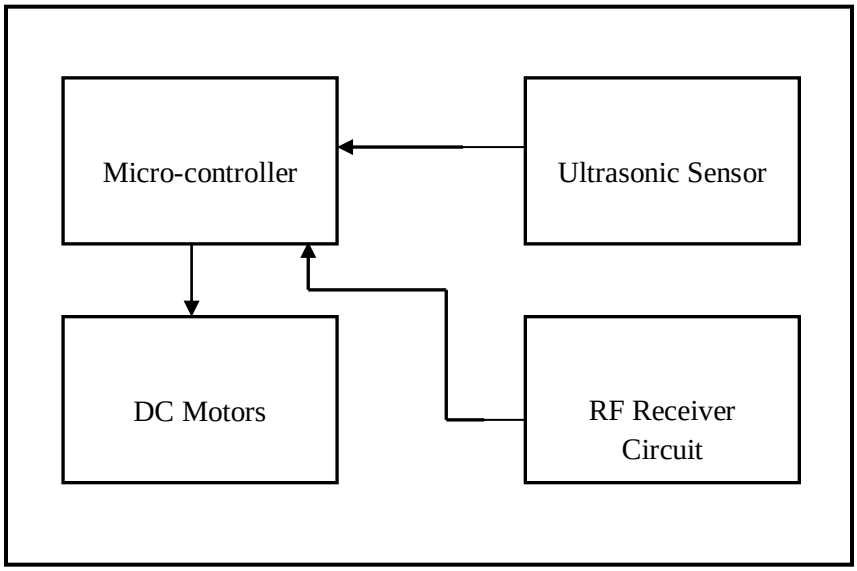

Figure 1.1 UGV

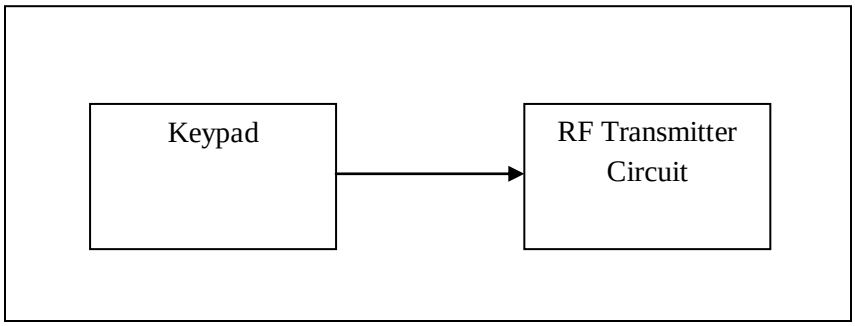

Figure 1.2 Remote

1.3 Radio Frequency Module

An **RF Module** (Radio Frequency Module) is a (usually) small electronic circuit used to transmit and/or receive radio signals on one of a number of carrier frequencies. RF Modules are widely used in electronic design owing to the difficulty of designing radio

circuitry. Good electronic radio design is notoriously complex because of the sensitivity of radio circuits and the accuracy of components and layouts required achieving operation on a specific frequency. Design engineers will design a circuit for an application which requires radio communication and then "drop in" a radio module rather than attempt a discrete design, saving time and money on development.

Several carrier frequencies are commonly used in commercially-available RF modules, including 433.92MHz, 315MHz, 868MHz and 915MHz. These frequencies are used because of national and international regulations governing the use of radio for communication.

Transmitter

Figure 1.3 RF TRANSMITTER

1. GND
2. DATA IN
3. VCC
4. ANTENNA

A transmitter is a circuit with an output sent through the air by light, sound or electromagnetic waves at a specific frequency. Radio frequency (RF) transmitters are widely used in radio frequency communication systems. The function of a radio frequency (RF) transmitter is to modulate, up convert and amplify signals for transmission into free

space. The radio frequency transceiver modules can use a wide range of input voltages; as a result, transmitter voltage varies by module specification. Higher radio frequency module voltages usually result in greater transmission distances. In this case, a wireless transmitter module shown above is used, where the launch frequency for it is at 433MHz. This transmitter module is stable and reliable, high quality and low cost features.

Particularly suitable for variety of small volume application of wireless remote control alarm and MCU for short-range wireless data transmission with a wide range of voltage (3V-12V) and low power characteristic (10mW). Above is the transmitter module. The transmitter module sends an electromagnetic signal that encodes the information, whereas the receiver accepts the signal and decodes it.

Features

- Working voltage: 3v-12v
- Working current: 10-15ma
- Frequency:433mhz
- Range: 100 mts
- Transport speed:4800kbps

Receiver

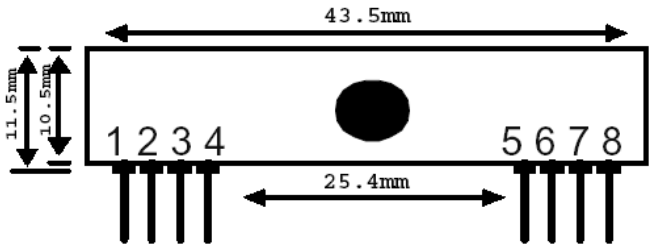

Figure 1.4 RF RECEIVER

PIN Connections

1- ANT	5-VCC
2- GND	6-DATA
3- GND	7-DATA
4- VCC	8-GND

A receiver is a circuit capable of accepting and processing light, sound or electromagnetic waves of a specific range. RF receivers are electronic devices that separate radio signals from one another and convert specific signals into audio, video, or data formats. RF receivers use an antenna to receive transmitted radio signals and a tuner to separate a specific signal from all of the other signals that the antenna receives. In this type of receiver, which is the wireless radio super regeneration receiver module, the 433MHz radio frequency signal sent by the transmitter module is received and the incoming data extracted from the signal. The extracted data is then sent out in serial format to the decoder board. Above is the receiver module that is used in this project. This low cost RF receiver module can be used to receive RF signal from any 433MHz transmitter. Super regeneration design ensures the sensitivity to week signal. The key benefits of this device are the low power consumption easy to integrate (V+, GND and DATA) and also it is so small in dimension.

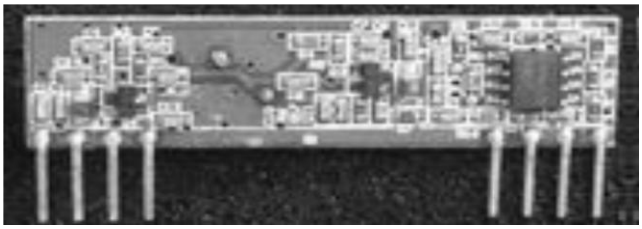

Figure 1.5 RF RECEIVER MODULE

Features

- Working voltage: 5v
- Working current: 0.5-0.8ma
- Frequency:433mhz
- Range: 100 mts
- Transport speed:4800kbps
- Decoder IC:HT 648

Applications

- Burglar alarm system
- Smoke and fire alarm system
- Garage door controllers
- Car door controllers
- Car alarm system
- Security system
- Cordless telephones
- Other remote control systems

1.4 Ultrasonic Sensor

The sensors that we have used in our project for measuring distance are ultrasonic distance sensors. Ultrasonic sensors operate in high frequency range i.e. above 20 KHz. Ultrasonic distance sensors generate high frequency sound waves that are transmitted by an ultrasonic transmitter and are received by an ultrasonic receiver. The distance to an object like another vehicle or wall is determined by measuring the time taken by the sound wave generated by the transmitter to reflect back and to be received by the ultrasonic receiver. The distance to the object/wall is half the distance travelled by the sound wave as it is reflected back.

Three ultrasonic distance sensors were used in our Project for the front, rear and on the right side of the Robotic Car. All the three sensors were designed and experimentally checked at different situations. The detail of experiments that were performed on the ultrasonic distance sensors and its results are given in Chapter 2.

Another thing that is to be kept in mind in the ultrasonic transmitted and received signal is the duty cycle of the signal. Duty cycle is the period that a device spends in an active state as the fraction of the total time that is to be considered. In other words it is the time during which the device is operated.

The speed of sound varies with the change in environment. The speed of sound in air depends upon the temperature of the surrounding. All tests that we conducted regarding ultrasonic sensors for our project were at room temperature i.e. $27^{o}C$. The speed of sound in air at room temperature ($27^{o}C$) is approximately equal to 347.2 m/sec.

1.5 Metal Detector

A **metal detector** is a device which responds to metal that may not be readily apparent.

The simplest form of a metal detector consists of an oscillator producing an alternating current that passes through a coil producing an alternating magnetic field. If a piece of electrically conductive metal is close to the coil, eddy currents will be induced in the metal, and this produces an alternating electric field of its own. If another coil is used to measure the electric field (acting as a magnetometer), the change in the magnetic field due to the metallic object can be detected.

1.6 Wireless Camera

A **wireless camera** is a standalone device that connects directly to a wireless local area network (LAN) to provide real-time video that can be viewed from anywhere in the world. Once the camera is connected, users can view live video feeds from any web browser or mobile device. While most wireless cameras are used for security purposes, they can also be used to keep an eye on children and pets at home or employees in an office. Basic wireless IP cameras constitute an affordable, easy-to-use and real-time surveillance solution for both residences and small businesses.