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Camouflage based Multipurpose Army Robot Using Raspberry Pi

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***Abstract*: The main technique is to camouflage the robot. According to the surrounding colour the colour of the robot changes. Colour sensing camera is used to capture the image which is based on the RGB format. Face detection is done by the camera which can turn in 360 degrees. When authorized person is detected the gun does not target the person. When unauthorized person is detected, the message is sent to PC, it processes and the gun triggers and targets the person. To detect any obstacles like metal when the robot is moving, Proximity sensor is used. In moving only robot can do all these activities. The robot starts to move when power supply is fed.**

***Keywords*: Camouflage, Face detection, Proximity sensor, Colour sensing camera.**

1. Introduction

Basically, army robot can do many tasks such as camouflage, face detection, metal detection, unauthorized person detection and automatic destroy. The security of the nation is in the hands of the soldiers. This robot can be used in the risk prone areas and protect the soldiers from foe. IR sensor is used to detect temperature variations. If any variations are found by the IR radiations, these signals are coded by microcontroller and transmitted to the receiver. Face detection of any person enables efficiently to authenticate a person. The system has set of database of facial patterns of each person. These faces can be captured by camera or can be loaded from the previously captured storage images. The system reads the image in the RGB format which will be three dimensional image in the MXNX3 form. Each dimension represents the red, green, blue colour components of the image. Robot changes the colour of the LED as the output. The movement of the robot starts when power supply is fed and the rotation of the motors start. The metal can be sensed by the Proximity sensor. The movement of the robot is controlled by program which is dumped in microprocessor. H-bridge is used to control the direction of the spin of the DC motor, without changing the way that the leads are connected. The robot is cost effective.

2. Methodology

1. The major part of missile detection and destroy system is detection of object. For this purpose, we are going to implement the ultrasonic sensor based detection system.
2. This will give us exact distance of object from destroying unit. According to the calculated distance robotic wheel will be operated.
3. The sensor circuitry will be fitted on the antenna. Antenna will be made up of combination of ultrasonic sensor and stepper motor. Bluetooth app will be used to send control signal i.e. to move forward, backward, left or right. Main part this system will be Raspberry pi microcontroller.
4. For coding of this controller we are using Python. The whole simulation of this system will be carried out using python language, layout will be designed using software.

3. Proposed System

This section includes detail block diagram and its description with respect to all main modules of the project. In given diagram ultrasonic transducer will sense the object with the help of antenna and stepper motor rotate antenna 360 degree, if any object detected then it will display on the LCD display. DC motor has used for moving hardware with antenna with motion right, left, upward downward .it require 5-volt power supply.

A. Transmitter

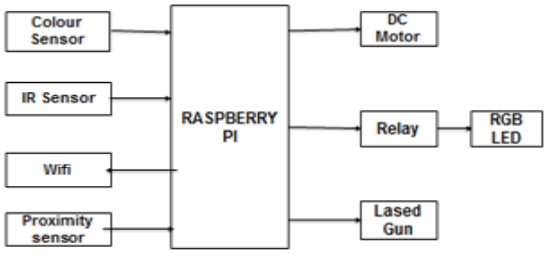

Fig. 1. Transmitter of missile detection and automatic destroyed system

B. Receiver

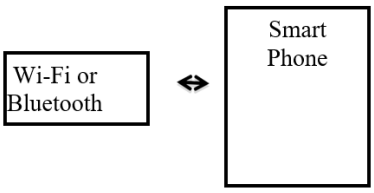

Fig. 2. Receiver of missile detection and automatic destroyed system

C. Raspberry pi

The Raspberry pi is a low-power 64-bit microcontroller. It has 1.2 GB RAM memory. It has Wi-Fi and Bluetooth features. It has 1.2 GB memory/32bit flash memory. It has 64bit memory/12 GB RAM. It has 32 GB flash memory. It has 5 ports. It has 40 pins, out of these 40 pins 28 pins are general purpose input output pins.

Raspberry pi is a broadcam B+ type. It has 64-bit memory. There are five ports in the Raspberry pi. There are forty pins in the Raspberry pi.

Features:

High-performance, 5V-power supply Microcontroller.

Operating Voltages: 5Volt.

Raspberry pi is available in four different types, namely A, A+, B, B+ types. The type of the Raspberry pi used in the project is of type B+.

It has Wi-Fi and Bluetooth features. Raspberry pi comes under ARM Cortex 11th type. It has two camera ports. It has power supply port. It has one USB port. It has one Ethernet port.

In total Raspberry pi B+ has 40 pins. Out of these forty pins 28 pins are GPIO. It supports for both Wi-Fi and Bluetooth model.

In the present implementation Broadcom B+ is used.

Out of microcontroller, Arduino and ARM cortex, ARM Cortex is the best one. Under ARM Cortex 11 Raspberry pi is found.

D. Ultrasonic Sensor

This sensor is a high performance ultrasonic range finder. It is compact and measures an Amazingly wide range from 2cm to 4m. This ranger is a perfect for any robotic application, or any other projects requiring accurate ranging information. This sensor can be connected Directly to the digital I/O lines of your microcontroller and distance can be measured in time Required for travelling of sound signal using simple formula as below.

Distance = (Echo pulse width high time * Sound Velocity (340M/S)/2)

Distance in cm = (Echo pulse width high time (in micro s)*0.017)

Features:

1. Working Voltage: 5V(DC)
2. Working Current: 15mA
3. Working frequency: 40HZ
4. Output: 0-5V (Output high when obstacle detected in range)
5. Beam Angle: Max 15 degree
6. Distance: 2cm - 400cm
7. Accuracy: 0.3cm
8. Input trigger signal: 10us impulse TTL
9. Echo signal: PWM signal (time required for sound signal to travel twice between source and obstacle)
10. Size: 45mm*20mm*15 mm

E. LCD

Liquid Crystal Display also called as LCD is very helpful in providing user interface as well as for debugging purpose. A liquid crystal display (LCD) is a flat panel display that uses the light modulating properties of liquid crystals (LCs). LCD Modules can present textual information to user. The 2x16 character LCD interface card with supports both modes 4-bit and 8-bit interface, and also facility to adjust contrast through trim pot. In 4- bit interface 7 lines needed to create 4-bit interface; 4 data bits (D0 – D3), three control lines, address bit (RS), read/write bit (R/W) and control signal (E).

F. Stepper motor

Stepper motors are, in effect, DC motors with a twist. Instead of being powered by a continuous flow of current, as with regular DC motors, they are driven by pulses of electricity. Each pulse drives the shaft of the motor a little bit. The more pulses that are fed to the motor, the more the shaft turns.

As such, stepper motors are inherently “digital” devices, a fact that will come in handy when you want to control your robot by computer. By the way, there are AC stepper motors as well, but they aren’t really suitable for robotics work and so won’t be discussed here. Stepper motors aren’t as easy to use as standard DC motors, however, and they’re both harder to get and more expensive.

But for the applications that require them, stepper motors can solve a lot of problems with a minimum of fuss. Let’s take a closer look at steppers and learn how to apply them to your robot designs.

Inside a unipolar stepper motor. Note the two sets of coils and stators. The unipolar stepper is really two motors sandwiched together.

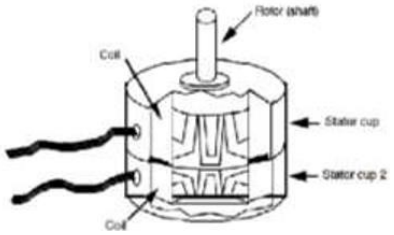

Fig. 3. Stepper motor

G. DC motor

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. 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. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line.

DC motors were the first type widely used, since 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 motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

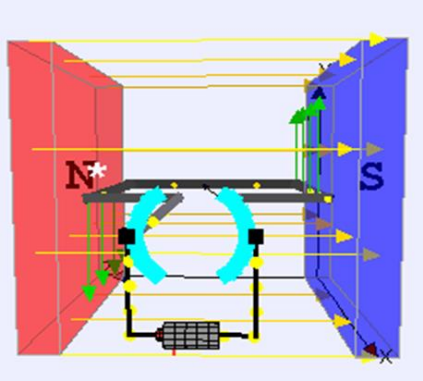

Fig. 4. DC motor

H. Bluetooth module

These are small and cheap CSR BC417143 based wireless Bluetooth transceiver modules (link is external) are widely used in all kind of embedded projects. They are intended for serial communication and preloaded with serial port profile (SPP) firmware. The module has user configurable parameters like Device name, Pairing PIN and Serial speed. In most cases the default values of these parameters should be changed (at least Pairing PIN code) to suit your application. It is done by entering special AT commands when the module it is not remotely connected to any other Bluetooth device. Bluetooth module configuration tool (hc04conf) is a command line utility for quick an easy configuration of Bluetooth transceiver modules connected to the serial port (or USB to serial converter) of your machine. It works on Windows, Linux and Mac OS X systems. Supported Bluetooth modules are HC04/HC06, permanently programmed as a slave device (aka "linvor"), possibly HC-07 and HC-09. Using hc04conf, you can configure pairing PIN, Bluetooth device name, and serial baud rate of the connected Bluetooth module. Another useful feature of the hc04conf program is the ability to automatically detect serial baud rate of the connected module. It helps when dealing with unknown or misconfigured modules.

I. Power supply

Power supply circuit is used to supply power throughout the series; the power needed for the whole series is equal to 5 Volts DC. There are several components in the power supply circuit, such as transformers that serve for lowering the voltage. Capacitors are used as filters. And the last is the type LM7805 regulator IC that functions as a regulator of the power output by 5 Volt.

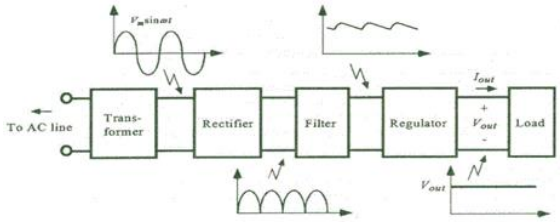

Fig. 5. Components of a typical linear power supply

Calculations:

We require 5v at the o/p of the regulator.
The drop out voltage of the regulator is 2v. As per the data Sheet

V_{dc}=5+2=7v
So at the regulator input, the voltage applied should be of 7v

According to the formula,

$V_{dc}=2v_m/pi$

Assuming there is no ripple Capacitor from

$V_m=V_{dc}(pi/2)$ =(7 x 3.14)/2
=10.99V

V_m=10.99V

During one cycle, two diodes are conducting
Drop out voltage of one diode =0.7v
Drop out voltage of two diodes =1.7v

$V_{im}=V_m$+1.4v

=10.99+1.4=12.39v

V_{im}=12.39v

$V_{rms}=V_{im}$/sqrt(2)

=12.39/sqrt(2)

=8.76V

V_{rms}=8.76V

So we select transformer of 9V.
Similarly,

$I_m=I_{dc}$ x pi/2
I_m=400 x 3.14/2
=628mA.

$I_{rms}=I_m/sqrt(2)$

=628mA/sqrt(2)

444.06mA

I_{rms}=444.06mA

So we select the transformer of current rating500mA.
Considering the above transformer rating,
We take the transformer of 0-9V/500mA.
Transformer – 0-9V/500mA step-down transformer.

4. Result

This proposed system uses an ultrasonic module interfaced to a microcontroller of AVR family. An ultrasonic transducer comprising of a transmitter and receiver are used. The transmitted waves are reflected back from the object and received by the transducer again. The total time taken from sending the waves to receiving it is calculated by taking into consideration the velocity of sound.

Then the distance is calculated by a program running on the microcontroller and displayed on a liquid crystal display screen interfaced to the microcontroller through Bluetooth wireless communication. The circuit is used to receive the reflected signals of 40 KHz from the missile object, to feed that to a program of the microcontroller and to switch on appropriate load while the program is executed at the microcontroller. When the microcontroller receives the signal from ultrasonic receiver it activates the door gun by triggering the gate of MOSFET through a transistor or relay. The sensor is fitted on antenna and is rotated and controlled by stepper motor through 180 degrees. If there is any target within the detection range, the application will turn the launcher to the nearest detected target and fires.

5. Conclusion

The Ultrasonic transceiver (Transmitter and Receiver) detects missile object and displays the missile direction on LCD through Microcontroller. If there is any target within the detection range, the application will turn ON the Laser gun to the nearest detected target and fires. A buzzer alarms when any of the ultrasonic sensor identifies the missile to alert the nearest people.

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