

GESTURE CONTROLLED SURVEILLANCE ROBOT FOR MILITARY USE

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ABSTRACT

Generally robots are programmed to perform specific task which human can't perform, or where conditions are not certain to work for humans. Thus we can use these robots to perform those tasks that may be harmful for humans. This motivation helped us to build a robot to undertake missions like border patrol and surveillance. This robot specially designed for surveillance purpose. This robot works on human hand gesture command and capable of travelling from one point to another. It uses GPS and Webcam to detect the route and obstacles. The setup and working gesture controlled surveillance robot is described in this paper.

I. INTRODUCTION

Now a days the demand for military robots has increased tremendously. This has created lot of opportunities for researchers to develop efficient robots. Huge investments are made by nations for the research of new defense systems capable of safeguarding citizens as well as soldiers from terrorist threats and certain environmental conditions on the border[1]. One of them is gesture controlled surveillance robot which undertakes missions actively like border patrolling and surveillance. A Gesture Controlled robot is a kind of robot which can be controlled by our hand gesture not by old buttons . Human hand gestures are natural and with help of wireless communication. It is easier to interact with robot in a friendly way than usual remote controlled robot. The robot moves according to your hand gestures from a distance. The structure of robot uses Arduino Uno, RF transmitter, receiver module, accelerometer, GPS, Webcam. The Arduino Uno reads analog output values i.e. x-axis and y-axis values of accelerometer which changes depending on hand motion and converts that analog value to respective digital value. The digital values are processed by microcontroller and sends the command to robot via RF transmitter .This commands are received by RF receiver and processed by microcontroller to drive the motor to a particular direction. The robot moves forward, backward, right and left when we tilt our palm forward, backward, right and left respectively. The robot stops when the hand is kept parallel to ground. There is a camera mounted on robot which is capable of zooming in and out as well as capable of rotating in 360 degrees. We will get output video stream constantly on our android based smartphone or laptop by which we will decide the movement of our robot. The robot also consist of GPS system which is used to inform the exact location of robot .

II. PROPOSED SYSTEM

We divided the our task into two parts to make the task easy and simple to avoid complexity and make it error free. First it the transmitting section and second is receiver section. The transmitter section comprises Arduino Uno, 3-axis accelerometer, RF transmitter and battery for power supply to transmitter section. The hand gestures are shown in fig 2. The receiver section consists of one RF receiver, one motor driver IC, two DC motors, GPS module , webcam, 12V power supply. Before making the movement of robot we will get continuous stream of video from camera by internet on our android based smartphone or laptop. And by deciding through the video we will move the robot accordingly. We will also get the location coordinates through GPS module. And then we will use hand gestures to move the robot from one point to another point.

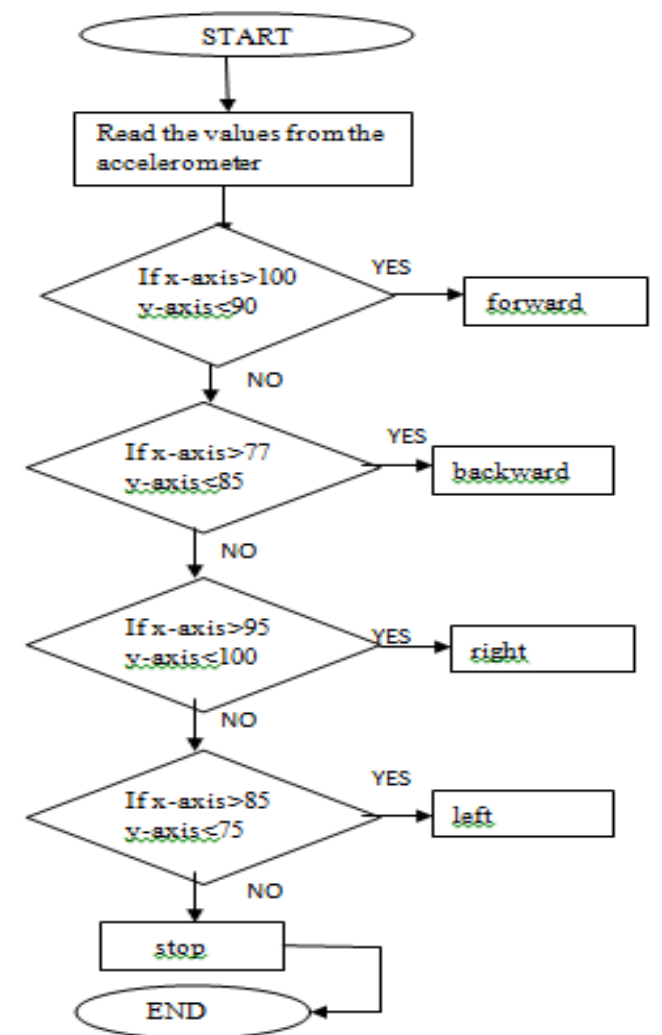


Fig1: flowchart of program

III. HARDWARE COMPONENTS USED

The paper consists of following hardwares:

3.1. Arduino Uno:

It is a microcontroller board based on ATmega328[5], [6] which has 14 digital I/O and 6 analog pins. It has everything that is needed to support the microcontroller. Simply connect it to the computer with a USB cable to get started with the Arduino Uno board. It is flexible, easy to use hardware and software. Arduino Uno can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators.

3.2. Accelerometer :

The ADXL335 [4] is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. It has 6 pins. 3 pins is for X,Y,Z axis. First pin for power supply (VCC), second pin for ground (GND) and the last one for self-test (ST). It operates on 3.3V from the Arduino Uno board. X and Y axis pins are connected to A0 and A1 pin of Arduino Uno board respectively. It can measure the static acceleration of gravity from tilt sensing applications as well as dynamic acceleration resulting from motion, shock or vibration and gives corresponding analog values through X,Y,Z axis pins .The ADXL335 is available in a small, low profile, 4mm x 4mm x 1.45 mm, 16-lead, plastic lead frame chip scale package. The low cost and small size of 3-axis accelerometer, are the two factor that makes it effective to detect the hand gesture.

3.3 RF Transmitter , Receiver Module:

RF stands for radio frequency[7]. It is available in different operating frequencies and with different operating range. We have used 433 MHz RF Tx/Rx module. RF module is often used along with a pair of encoder and decoder. It can transmit the signal up to 500 ft of range at rate of 1 Kbps to 10 Kbps. Transmitter module consists of 4 pins (GROUND, VCC, DATA, ANTENNA). DATA pin is connected to encoder (pin 17). A 17 cm single strand wire antenna is used which is connected to antenna pin of Tx module. Transmitter receives serial data and transmits RF signal wirelessly to the receiver through this antenna.

To test the RF transmitter module just connect the DSO with the data pin of the transmitter module and check that a train of pulses are coming or not , if no pulses will occur then it means that modules are not working. Receiver module consists of 8 pins. 3 ground pins, 2 VCC pins, 2 DATA pins and 1 antenna pin. DATA pins are connected to decoder (pin 14). In this module also, a 17 cm single strand wire antenna is used for receiving RF signal from transmitter.

To test the RF receiver module just connect the DSO with the data pin of the transmitter module and check that a train of pulses are coming or not , if no pulses will occur then it means that modules are not working and not receiving the data from the transmitter module.

The length of the antenna is determined according to the frequency range of RF module.

We know,

Wavelength, $\lambda = \text{speed of light (c) / frequency (f)}$

$$= 3 \times 10^8 / 433 \times 10^6 \text{ m}$$

$$= 0.69284 \text{ m}$$

So, Antenna length = $\lambda/4$

$$= 0.69284/4 \text{ m}$$

$$= 0.1732 \text{ m} \approx 17 \text{ cm}$$

3.4 GPS module:

A navigation system used in the autonomous mode for obtaining location coordinates.

3.5 Camera:

The system uses a smartphone with camera for continuous real time video streaming of the system and its surroundings[2]. An IP-based Android application, running on the smartphone enables the system to transmit the real time video wirelessly. A camera is an optical instrument that records images that can be stored directly, transmitted to another location, or both.

3.6 9V and 12 V batteries:

We give power supply to the robot by using 9V and 12V batteries. 9V power supply is for the transmitter and 12V power supply is for receiver.

3.7 DC motors:

We use two DC motors for the movement of robot .

IV. DESIGN AND WORKING

The transmitter is kept on the palm and receiver moves according to the movement of palm. First, person gets the images and location coordinates from camera and GPS. There are five different gestures for the movement of robot i.e. forward condition when palm is tilted forward, backward when palm is tilted backward, left when palm is tilted left , right when palm is tilted right and stop condition is executed when palm is kept straight parallel to the ground. As shown in figure 2.

4.1 Algorithm of the gestures:

Flowchart of the program is shown in figure 1



Fig 2: hand gestures

V. CONCLUSION AND FUTURE SCOPE

In this paper a robot has been developed which works accordingly to your hand gestures. We have used RF module which works on the frequency 433 MHz and has a range of 50-80 meters. This robot is used mainly for patrolling on borders and for surveillance in military. Gestures, camera,GPS system used to embellish the robot.

The robot can be made waterproof to avoid it as limitation. The robot can also be made advanced by installing machine gun or another military devices which will require more gestures also.

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