Design and Modeling of multi-purpose vehicle for Defence

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Abstract- Automation or automatic control is the use of various control system for operating any equipment or device such as a remote controlled (toy) car, switching on telephone networks, and other useful applications with minimal or reduced human interventions. This paper proposes a design and implementation of a remote controlled car by Wi-Fi technology via computer or mobile devices. In completing this research work, wireless software and hardware technologies have been used, such as wireless module of ESP8266 for transceiver (transmitter and receiver), Arduino Uno as microcontroller, an H-bridge L293D IC for motor controller, and two electric DC motors are used to move the automobile. Two objectives of this project are to expand the limitation range of a normal radio frequency car using Wi-Fi technology and also to create a ubiquitous technology for automobile that operates in daily life with a control system. The test result shows that the controlled car can move in any direction. However, the performance depends on the device signal strength where the maximum testing range is only about 1KM distance from the user's location.

Keywords – Arduino Nano, Wireless modules, shooting ability, long range, Motor driver module, Camera and video transmission.

I. Introduction

Vehicle has been a staple of advanced manufacturing for over half a century. Vehicle and their peripheral equipment become more sophisticated, reliable and

Miniaturized, these systems are increasingly being utilized for military and law enforcement purposes. A remote control vehicle is defined as any robot that is remotely controlled by a means that does not restrict its motion with an origin external to the device. Mobile robot with controlled remotely have important rules in area of rescue and military. Surveillance is the monitoring of behavior. Robot

Surveillance has a function to monitor the behavior of people, objects or processes within systems for conformity to expected or desired norms in trusted systems for security or social control. The technological evolution of video based surveillance systems started

with analogue closed circuit television (CCTV) systems. And for self-defense vehicle carry gun.

II. Working

Microcontroller: The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. The **Arduino Nano** is very much similar to the Arduino UNO. They use the same Processor (Atmega328p) and hence they both can share the same program. One big difference between both is the size UNO is twice as big as Nano and hence occupies more space on your project. Also Nano is breadboard friendly while Uno is not. To program a Uno you need Regular USB cable where as for Nano you will need a mini USB cable. The technical difference between Uno and Nano is shown below. The Arduino board is designed in such a way that it is very easy for beginners to get started with microcontrollers. This board especially is breadboard friendly is very easy to handle the connections. Let's start with powering the Board. **Powering you Arduino Nano:** There are totally three ways by which you can power your Nano. USB Jack: Connect the mini USB jack to a phone charger or computer through a cable and it will draw power required for the board to function.Vin Pin: The Vin pin can be supplied with a unregulated 6-12V to power the board. The on-board voltage regulator regulates it to +5V Pin: If you have a regulated +5V supply then you can directly provide this o the +5V pin of the Arduino.
Input/output: There are totally 14 digital Pins and 8 Analog pins on your Nano board. The digital pins can be used to interface sensors by using them as input pins or drive loads by using them as output pins. A simple function like pinMode() and digitalWrite() can be used to control their operation. The operating voltage is 0V and 5V for digital pins. The analog pins can measure analog voltage from 0V to 5V using any of the 8 Analog pins using a simple function liken analogRead()

These pins apart from serving their purpose can also be used for special purposes which are discussed below:
Serial Pins 0 (Rx) and 1 (Tx): Rx and Tx pins are used to receive and transmit TTL serial data. They are connected with the corresponding ATmega328P USB to TTL serial chip.
External Interrupt Pins 2 and 3: These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
PWM Pins 3, 5, 6, 9 and 11: These pins provide an 8-bit PWM output by using analogWrite() function.
SPI Pins 10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK): These pins are used for SPI communication.
In-built LED Pin 13: This pin is connected with an built-in LED, when pin 13 is HIGH – LED is on and when pin 13 is LOW, its off.
I2C A4 (SDA) and A5 (SCA): Used for IIC communication using Wire library.
AREF: Used to provide reference voltage for analog inputs with analogReference() function.
Reset Pin: Making this pin LOW, resets the microcontroller.

Wireless module: The n**RF24L01 is a wireless transceiver module**, meaning each module can both send as well as receive data. They operate in the frequency of 2.4GHz, which falls under the ISM band and hence it is legal to use in almost all countries for engineering applications. The modules when operated efficiently can cover a distance of 1km (ideal conditions) which makes it a great choice for all wireless remote controlled projects.The module operates at 3.3V hence can be easily used with 3.2V systems or 5V systems. Each module has an address range of 125 and each module can communicate with 6 other modules hence it is possible to have multiple wireless units communicating with each other in a particular area. Hence mesh networks or other types of networks are possible using this module. So if you are looking for a wireless module with the above properties then this module would be an ideal choice for you. The NRF24L01 module works with the help of SPI communications. These modules can either be used with a 3.3V microcontroller or a 5V microcontroller but it should have an SPI port. The complete details on how to use the module through SPI is given the data sheet below. The circuit diagram shows how the module should be interfaced with a microcontroller.

Here I have shown how for a 3.3V microcontroller, but it applies the same for a 5V MCU as well. The SPI Pins (MISO<MOSI and SCK) are connected to the SPI pins of the Microcontroller and the signal pins (CE and CSN) are connected to the GPIO pins of the MCU.

If you are interfacing the module with Arduino, then there are ready made libraries available like the R24 Library. With the help of these libraries you can easily interface the **n**RF24L01 with Arduino with few lines of code. If you are using for some other microcontroller then you have to read through the datasheet to understand how to establish the SPI communication.

Motor Driver The L293D is a popular 16-Pin **Motor Driver IC**. As the name suggests it is mainly used to drive motors. A single **L293D IC** is capable of running two DC_motors at the same time; also the direction of these two motors can be controlled independently. So if you have motors which has operating voltage less than 36V and operating current less than 600mA, which are to be controlled by digital circuits like Op-Amp, 555 timers, digital gates or even Micron rollers like Arduino, PIC, ARM etc.. this IC will be the right choice for you.

Using this L293D motor driver IC is very simple. The IC works on the principle of Half H-Bridge, let us not go too deep into what H-Bridge means, but for now just know that H bridge is a set up which is used to run motors both in clock wise and anti clockwise direction. As said earlier this IC is capable of running two motors at the any direction at the same time, the circuit to achieve the same is shown below.

All the Ground pins should be grounded. There are two power pins for this IC, one is the Vss(Vcc1) which provides the voltage for the IC to work, this must be connected to +5V. The other is Vs(Vcc2) which provides voltage for the motors to run, based on the specification

of your motor you can connect this pin to anywhere between 4.5V to 36V, here I have connected to +12V.

The Enable pins (Enable 1,2 and Enable 3,4) are used to Enable Input pins for Motor 1 and Motor 2 respectively. Since in most cases we will be using both the motors both the pins are held high by default by connecting to +5V supply. The input pins Input 1,2 are used to control the motor 1 and Input pins 3,4 are used to control the Motor 2. The input pins are connected to the any Digital circuit or microcontroller to control the speed and direction of the motor. You can toggle the input pins based on the following table to control your motor.

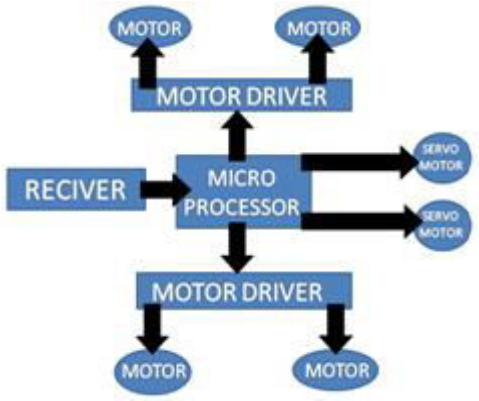

Figure 1. Block Diagram required for implementation of proposed Robot

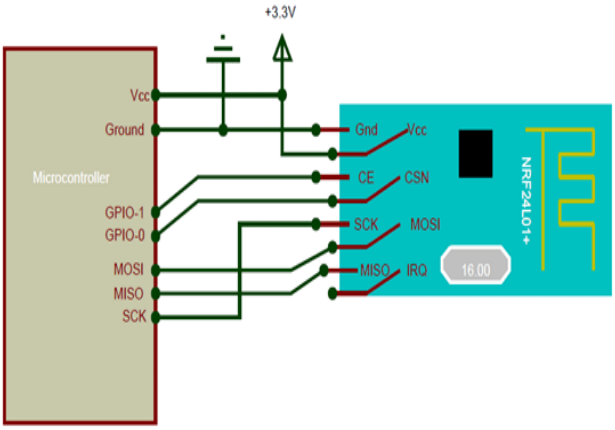

Figure 2. shows how the module should be interfaced with a microcontroller

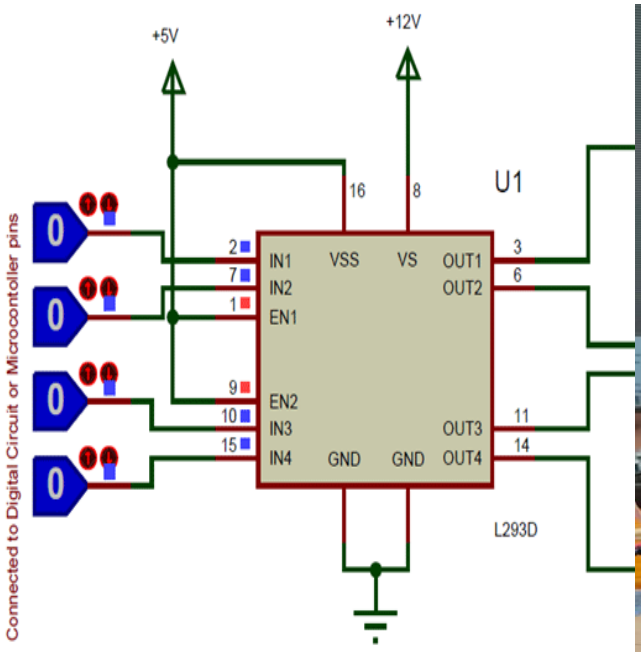

Figure 3. Connected to digital or microcontroller pins

III. RESULT

The Gun and Camera is kept on a platform which is connected to a chassis the platform is kept straight with help of Servo Motors. The camera is kept on the gun and rack & pinion arrangement is placed to trigger the gun. The upper half our vehicle is design such that it help in surveillance and defense. The lower body of vehicle is design such that it can move on any surface(sandy, rocky and smooth surface) The implemented vehicle is shown in fig.4. and hence cost is low.

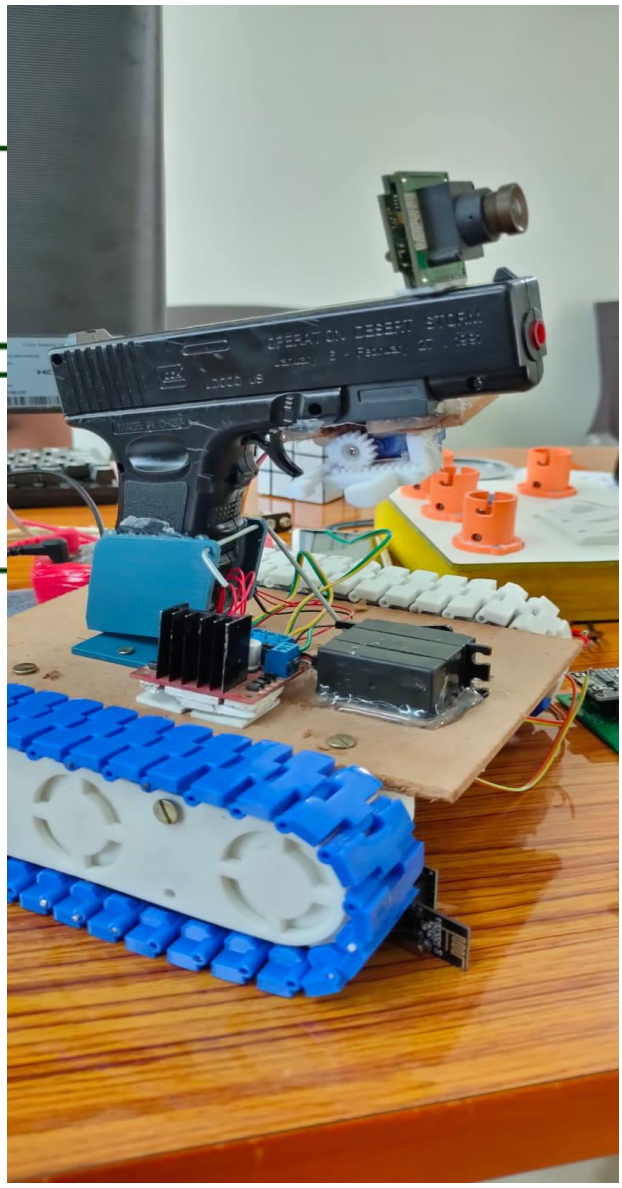

Figure. 4: Hardware implementation of Vehicle

IV. Conclusion

The simple and easy to handle proto type model is design and modeled. To perform the work on actual model which is using now days is so complex and only trained cadets can handle only. This problem is overcome by our model. Advancement like thermal camera, bomb finding and defusing can also attach future in this model. This vehicle was built by keeping Military application in mind. So, it come with basic video surveillance and gun.

V. Reference

1.K.Kaneko,F.Kanehiro,S.Kajita,H.Hirukawa,T.Kawa sakiM.Hirata,K.A kachi,T.Isozumi,"Homanoid robot HRP_2".IEEE International Conference on robotics and automation",New Orieans,LA,26 April-May 2004

2. W.Lao,J.Han and Peter H.N.De With,"Automatic video-based human motion analyzer for consumer surveillance system ",IEEE transaction on consumer electronics,Vol. 55, 2009.

3. P.Saucy ,F.Mondana,"Keep On The Web:Open access to a mobile robot on the internet",IEEE robotics and automation magazine, March 2000.

4. **M**.Karthikeyan, G**.**Sreeram**,"** Intelligent Exploration and Surveillance Robot In Defense Environment", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol.3, Special Issue 1, February 2014

5. Karthikeyan,R.S.Karthik,Prasanna Vishal TR,S.Vignesh."Snitch:Design and development of a mobile robot for surveillance and reconnaissance",2015 International Conference on Innovations in Information Embedded nd Communication Systems,ICIIECS. 2015.

6. Widodo Budiharto, Design of Tracked Robot with Remote Control for Surveillance.

7. K. Brannen, "Army kills off MULE unmanned vehicle", Military Times, 15 August 2011.