A

Project Report

On

FIRE FIGHTING VEHICLE WITH SMS AND CALL ALERT

Submitted to

RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNLOGIES,KADAPA

in partial fulfilment of the requirements for the award of the Degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

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Vempalli,Kadapa-516330,

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CERTIFICATE

This is to certify that the project report entitled "**FIRE FIGHTING VEHICLE WITH SMS AND CALL ALERT**" a bonafide record of the project work done and submitted by

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EXTERNAL EXAMINER

DECLARATION

We hereby declare that the project report entitled “FIRE FIGHTING VEHICLE WITH SMS AND CALL ALERT” submitted to the Department of ELECTRONICS AND COMMUNICATION ENGINEERING in partial fulfillment of requirements for the award of the degree of **BACHELOR OF TECHNOLOGY**. This project is the result of our own effort and tha it has not been submitted to any other University or Institution for the award of any degree or diploma other than specified above.

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ABSTRACT

Fire incidents are disasters that can potentially lead to the loss of life and property. It can also cause damage and permanent disability to the affected victim.Firefighters are primarily tasked to handle fire incidents, but they are often exposed to high risks when extinguishing the fire, especially in a hazardous area. A one-stop solution for all fire-related accidents like fire outbreak, smoke and combustible gas leakage is hereby considered. This study presents the development of a fire extinguishing robot with an SMS and call alert feature that can sound an alarm to occupants of the building, send an alert SMS message to the registered phone number, and also sends call alert to the registered phone number and also proceed to extinguish the fire unmanned.It is designed to be compact for ease of movement into narrow spaces. The robot is equipped with an flame sensor to detect the fire, while the flame sensor alongside a smoke sensor, was used to detect the fire. This developed autonomous system demonstrates the capabilities of identifying fire locations automatically and extinguishes the fire using the stored water in the container on it.

Keywords: fire alarm, SMS, SIM800l, robot, flame sensor, smoke sensor.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Firefighting is a very dangerous and high-risk job in saving human life. A fire-fighter has to be alert and well prepared at any time so that they are able to reach the fire in a short time and safely extinguish the fire. The quick action by them can prevent further damage and reduce fatalities of a burning area (Wang et al., 2011). A house is a place for shelter, and certainly not a place where a person has tragically been taken away from his life. With the advanced technology, the gap between firefighting and machines have been finally bridged allowing for a more effective and operative method of fire extinguishing (Xin et al., 2018).Over the years, fire cases in Malaysia from all aspects have grown rapidly. Majority of all the cases that involved domestic buildings had very catastrophic effect such as assets losses,serious injuries to fire victims, and death (Woodrow, 2010; Ramsay et al., 2018). Moreover,according to the Director-General of Fire and Rescue Department Malaysia, about 6,000 premises are destroyed by fire every year with 40 percent of these involve private houses (Muhamading, 2016). The increase of death counted due to fire accidents mainly in residential buildings is enough to trigger us to be aware not only of robbery but also on fire safety. The contribution to the causes of fire in the household includes cooking, smoking, and candles (Ahrens, 2018; Kobes, 2017; Ahrens, 2017a).Therefore, the main purpose of this project is to contribute to the growth of automation systems by developing an automatic fire extinguisher robot. The robot is to protect human life, wealth, and environment from fire accidents. This is very crucial whenever unexpected fire accident occurs while people who live in the house is either sleeping or not present in the house. The robot will not only help in detecting fire but also notify the user so that they will be prepared with another alternative such as calling the firemen. Fire spread is very fast and it doubled every minute (Wrack, 2010). This eventually will lead to the forming of smoke rapidly causing to why most victims cannot survive. Hence, the initial detection of fire plays an important role since it gives a higher chance of survival.

1.2 WORKING PRINCIPLE

The main brain of this project is the Arduino, but in-order to sense fire we use the Fire sensor module (flame sensor).As you can see these sensors have an IR Receiver (Photodiode) which is used to detect the fire. How is this possible? When fire burns it emits a small amount of Infra-red light, this light will be received by the IR receiver on the sensor module. Then we use an Op-Amp to check for change in voltage across the IR Receiver, so that if a fire is detected the output pin (DO) will give 0V(LOW) and if the is no fire the output pin will be 5V(HIGH).

So, we place three such sensors in three directions of the robot to sense on which direction the fire is burning .We detect the direction of the fire we can use the motors to move near the fire by driving our motors through the L293D module. When near a fire we have to put it out using water. Using a small container we can carry water, a 5V pump is also placed in the container and the whole container is placed on top of a servo motor so that we can control the direction in which the water has to be sprayed. Let’s proceed with the connections now

1.3 BASIC CIRCUIT DIAGRAM

An overview of the required circuit of Fire fighting robot with sms and call alert.

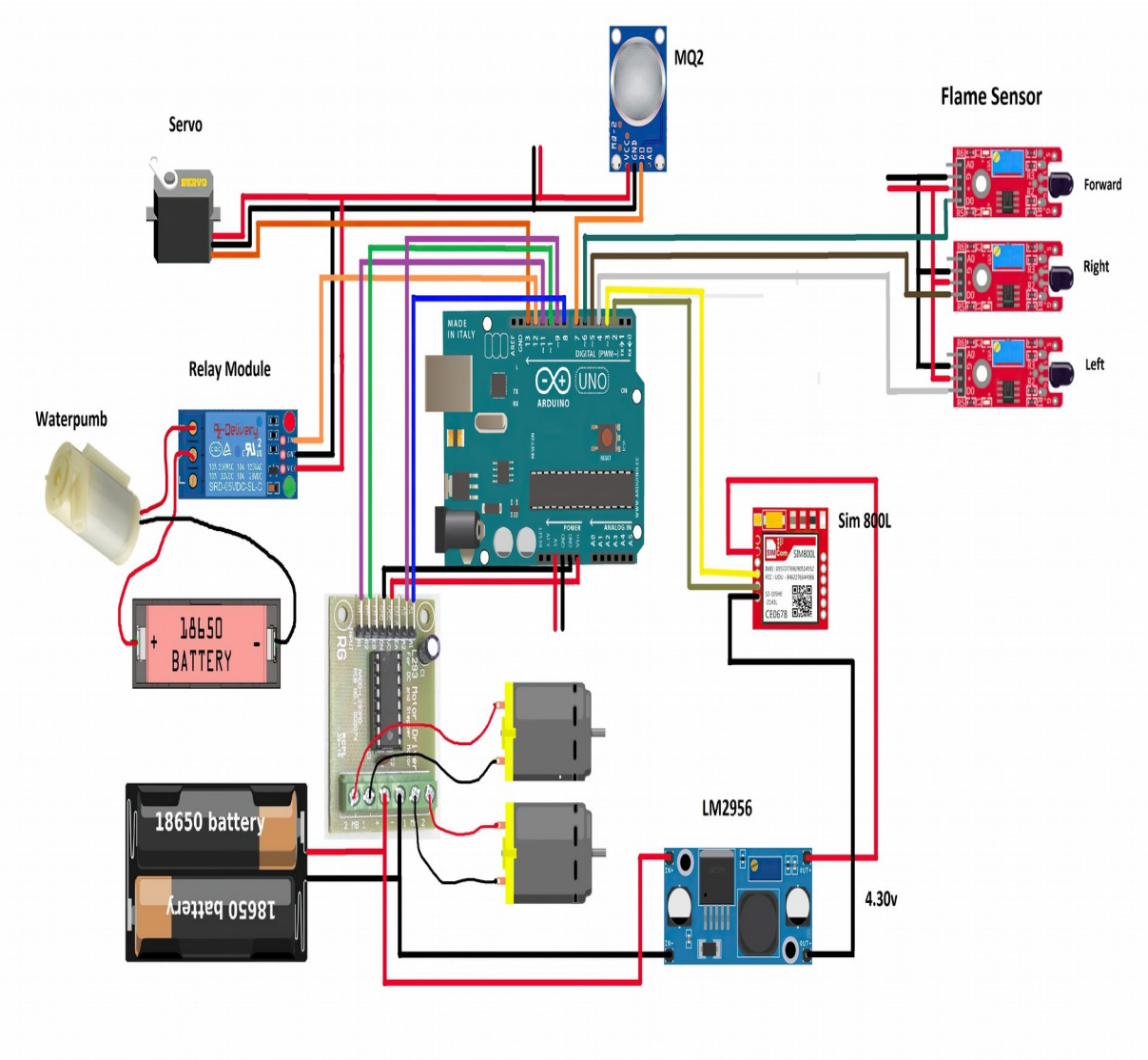


fig 1.3.1 Fire fighting robot withsms and call alert

1.4 Flowchart

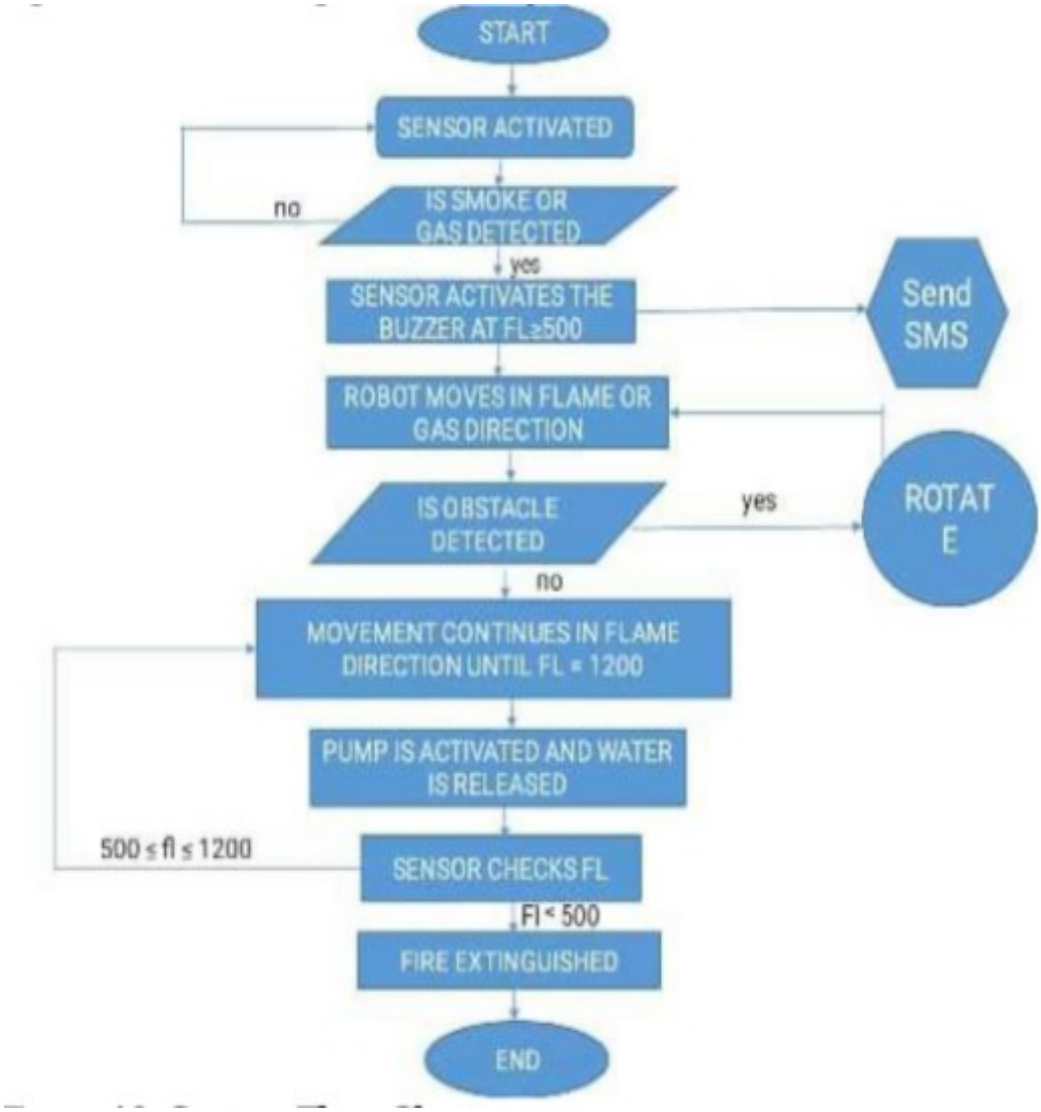


fig 1.4.1 Flowchart of FIRE FIGHTING VEHICLE WITH SMS AND CALL ALERT

CHAPTER 2
METHODOLOGY

2.1 HARDWARE:

The project is controlled by Arduino Mega 2560, a microcontroller where different sensors are connected. This project uses two lithium ion batteries to dissipate required and enough power to all the components of the robot. In addition to the two, the project also uses Four (4) decelerated 280 RPM DC motors extendable up to 4wheels if needed that are controlled by L298 H-Bridge Motor Driver. The researchers also used different sensors to detect flame like flame sensors and smoke sensor. The presence of ultrasonic sensor was needed for theavoidance of obstacles. And the presence of the piezo speaker and light-emitting diode (LED) will stand as alarm system while the GSM/GPRS works in notifying through SMS to the owner. All the mentioned components above were connected to respective boards and modules where all grounds were connected in a common and 5 to 12 volts were in common.

The succeeding part of this project will introduce the different components that were used in building the robot.

2.2 SOFTWARE:

To make the hardware parts work or run, it should be programmed through the required software like Arduino IDE . Since the microcontroller at first will not be having any program, if we also build up the hard ware it will not have the capability to work or run due to lack of instructions which is provided by a program.there fore we need a software to upload the program on any microcontroller. To implement the task all three section are taking and giving information. Sensor module parts it sense data and provide it to the microcontroller chip.

Microcontroller part software take all data from the all sensor and saving to the corrected path. According to the data input the microcontroller parts giving the necessary input for the motor control section to guiding and run the motor for working. Since we are using Arduino microcontroller we have to use Arduino IDE software to write and upload program in microcontroller

CHAPTER 3
HARDWARE MODEL AND REQUIREMENTS

3.1 BLOCK DIAGRAM OF FIRE FIGHTING VEHICLE WITH SMS AND CALL ALERT

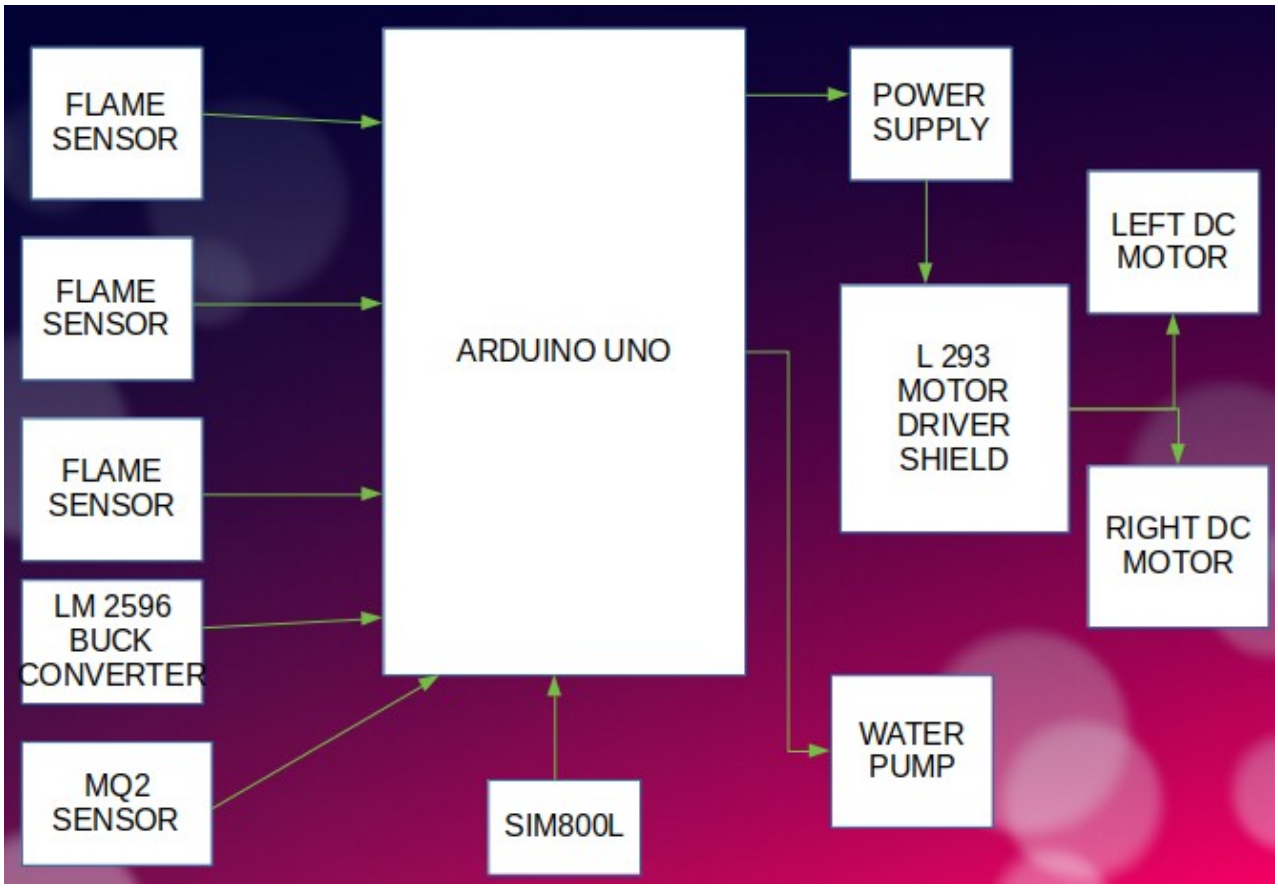


fig 3.1.1 Block Diagram of Human Following Robot

3.1.1 EXPLANATION OF THE BLOCK DIAGRAM:

Here firstly, we chose a configuration to develop a Fire fighting vehicle only using three flame sensors with connection of Arduino Uno through L293 Motor driver shield. We followed a block diagram on the regard.The block diagram illustrates the connection for the development of the Fire fighting vehicle with sms and call alert.

After that, we have used the following block diagram for connecting three flame sensors with our Fire fighting vehicle for detection purpose of fire and smoke and then it sends sms and call alert and pump water on the fire.

Our system consists of a four wheel robotic vehicle mounted with a separate microprocessor and control unit along with different sensors and modules i.e. flame sensor,L293 motor driver shield,MQ2 sensor,Sim 800l and LM 2596 buck converter which helps to send a SMS and call alert when fire are smoke is detected. The above sensors work in unison with each other and helps the vehicle in its operation and to navigate its path by avoiding the obstacles and maintaining a specific distance from the object. We used MQ2 sensor for smoke detection and flame sensors for fire detection.We used sevo motors, DC motors and wheels for moving the vehicle in the direction of fire,so that thw vehicle pump some water on the fire with the help of a 5v waterpump.Here sim800l and buck converter are used for sending SMS and call alert to mobile of a specific person.Here Arduino uno ,motor shield ,relay module sends instructions to DC motors to which direction the vehicle should be rotate.

3.2 REQUIRED COMPONENTS

3.2.1 ARDUINO UNO

The **Arduino Uno** is a microcontroller board based on the ATmega328. Arduino is an open-source, prototyping platform and its simplicity makes it ideal for hobbyists to use as well as professionals. The Arduino Uno has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 Analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Arduino Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 microcontroller chip programmed as a USB-to-serial converter.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Arduino Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.

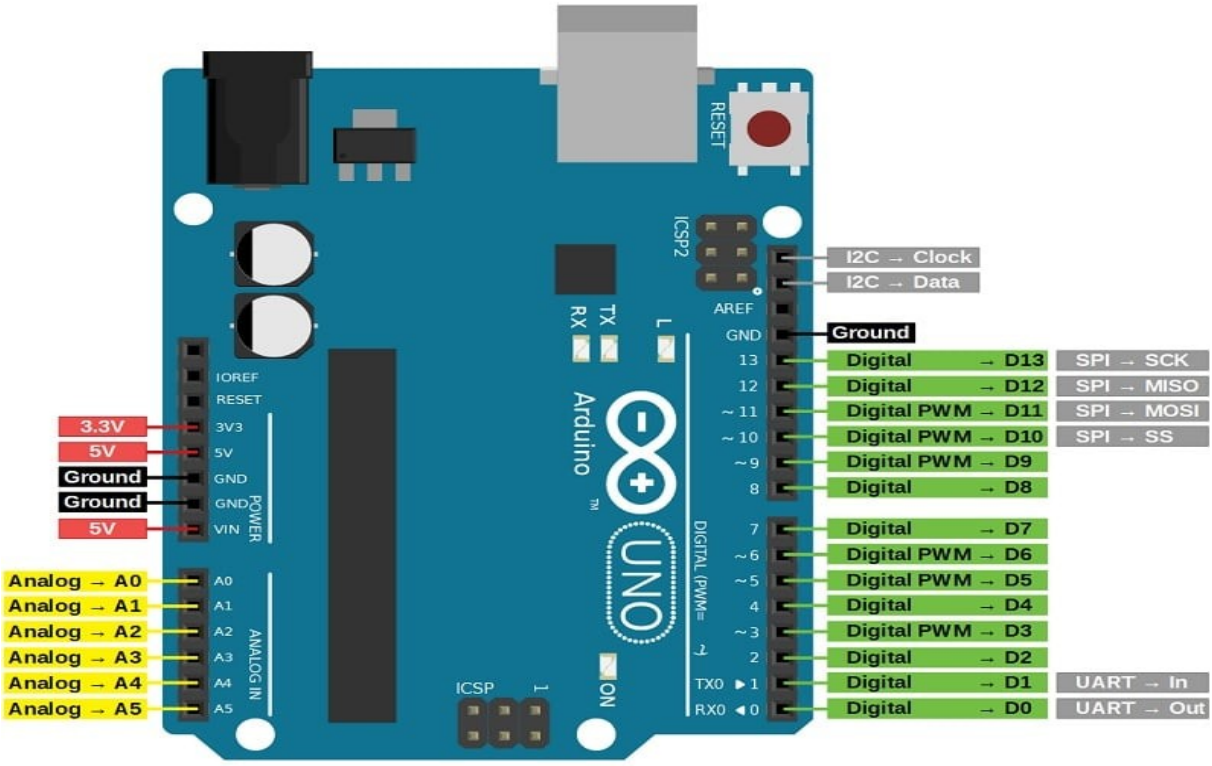


fig:3.2.1.1 Arduino uno

Pin layout of ATmega328p is showed below:

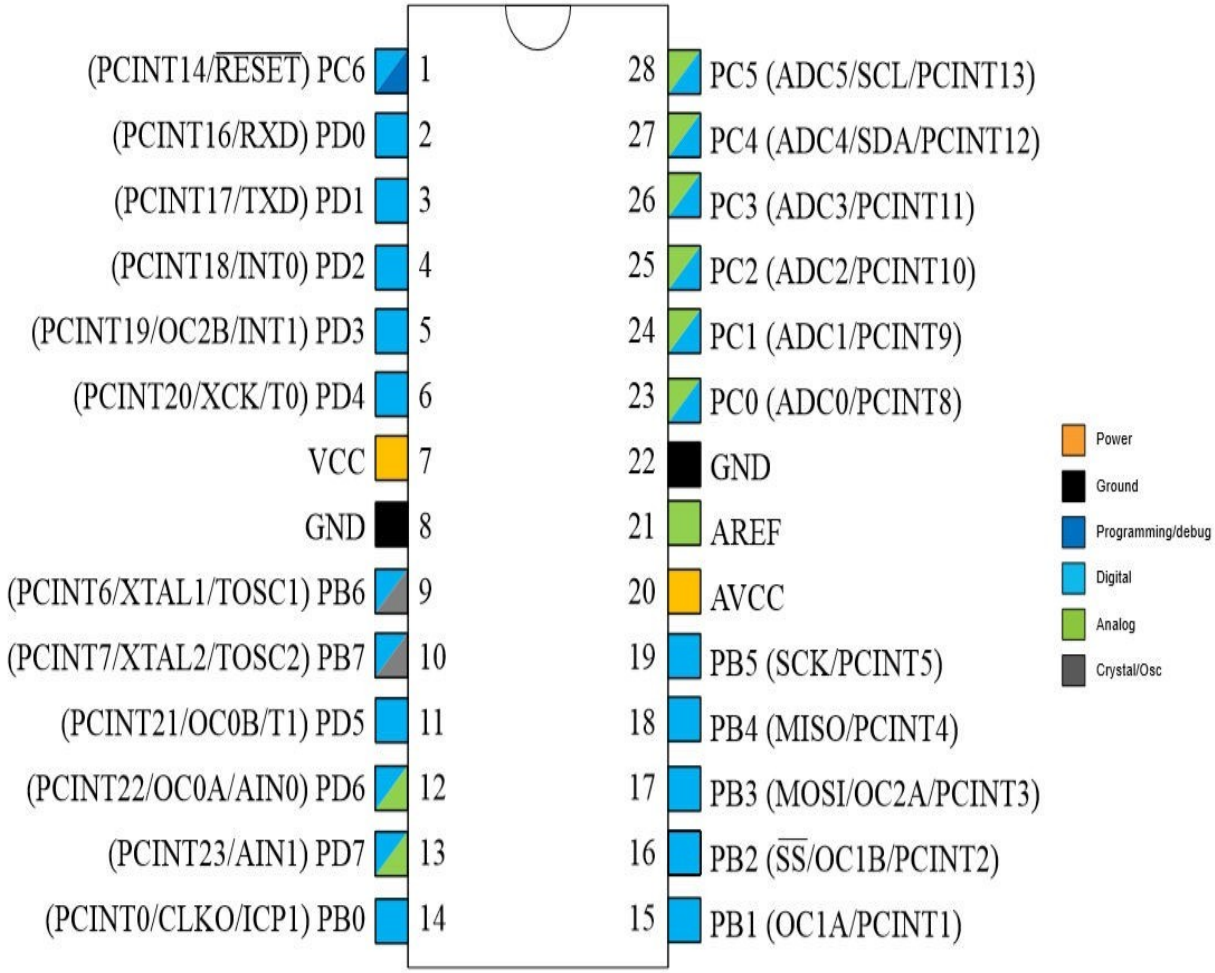


fig:3.2.1.2 Pin layout

FEATURES OF ARDUINO UNO

Microcontroller: ATMEGA 328P

The Atmel pico power is a low power CMOS 8-bit microcontroller based on the AVR architecture.

FEATURES:

High Performance, Low Power Atmel AVR 8-Bit Microcontroller Family

- Advanced RISC Architecture

131 Powerful Instructions

Most Single Clock Cycle Execution

32 x 8 General Purpose Working Registers

Fully Static Operation

Up to 20 MIPS Throughput at 20MHz

On-chip 2-cycle Multiplier

- High Endurance Non-volatile Memory Segments

32KBytes of In-System Self-Programmable Flash program Memory

1KBytes EEPROM

2KBytes Internal SRAM

Write/Erase Cycles: 10,000 Flash/100,000 EEPROM

Data Retention: 20 years at 85°C/100 years at 25°C(1)

Optional Boot Code Section with Independent Lock Bits

- In-System Programming by On-chip Boot Program
- True Read-While-Write Operation

DC Current for 3.3V Pin: 50 mA

Flash Memory: 32 KB of which 0.5 KB used by bootloader SRAM: 2 KB

Clock Speed: 16 Mhz

ADC CONCEPT IN ARDUINO UNO

Arduino uno board has 6 ADC input ports. Among those any one or all of them can be used as inputs for analog voltage. The **Arduino Uno ADC** is of 10 bit resolution (so the integer values from (0-(2^10) 1023)). This means that it will map input voltages between 0 and 5 volts into integer values between 0 and 1023. So, for every (5/1024= 4.9mV) per unit.

The UNO ADC channels have a default reference value of 5V. This means we can give a maximum input voltage of 5V for ADC conversion at any input channel. Since some sensors provide voltages from 0-2.5V, with a 5V reference we get lesser accuracy, so we have a instruction that enables us to change this reference value. So for changing the reference value we have ("analogReference();").

As default we get the maximum board ADC resolution which is 10bits, this resolution can be changed by using instruction ("analogReadResolution(bits);").

Arduino UNO is neither a microprocessor nor a microcontroller. It is actually a development board that uses a microcontroller called Atmega328p to perform various functions. You can say, atmega328p is the brain of the Arduino UNO development board.

Microcontroller VS Development board

Microcontroller:A microcontroller is made up of a Microprocessor and other units required to perform certain functions like Memory units, Inputs/Outputs, ADCs, etc. That's why a Microcontroller can execute commands by itself. But it's not easy to program a Microcontroller directly due to the absence of a USB port, GPIO header, etc., and hence it is not recommended to beginners.

Development board:A development board makes it easy to connect the external peripherals to the Microcontroller. It is easy to program and createprojects using a development board like the ArduinoUNO.

3.2.2 L293D MOTOR DRIVE SHIELD:

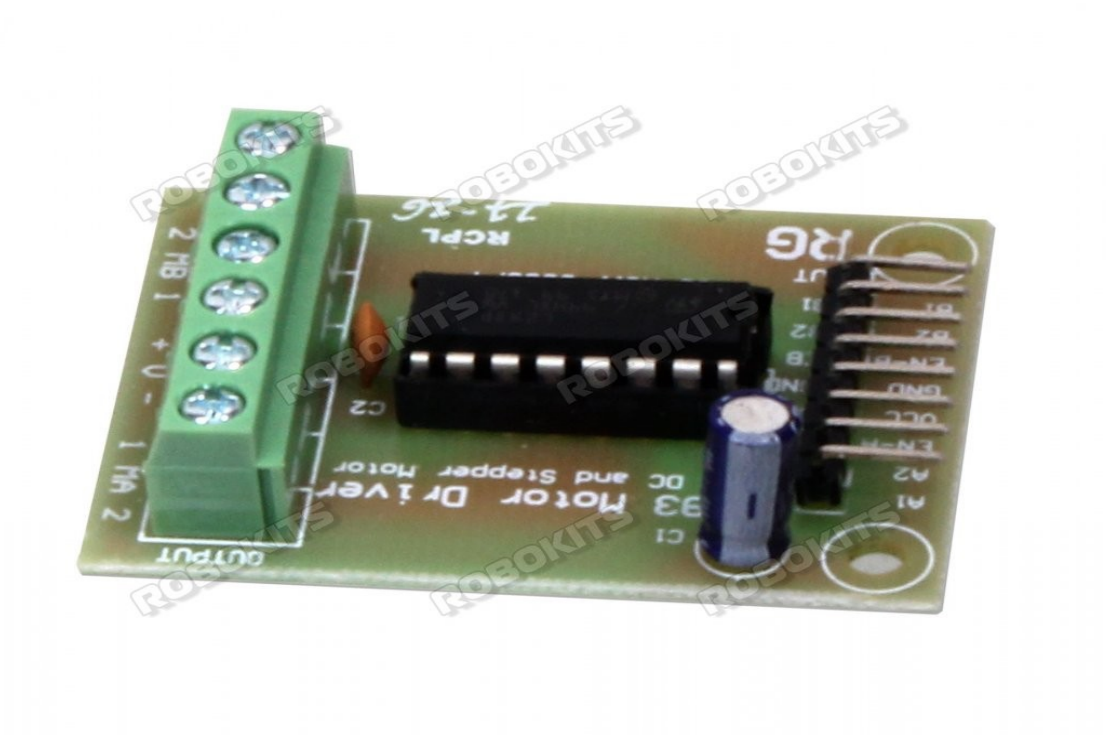


fig:3.2.2.1 L293D Motor Drive Shield

The Motor Shield is a driver module for motors that allows you to use Arduino to control the working speed and direction of the motor. . The Motor Shield can either be powered by Arduino directly or by an external 6V~15V power supply via the terminal input. Here Motor Driver Board is designed to Work with L293D IC.

L293d motor driver IC

The L293D is a dual-channel H-Bridge motor driver. A single IC is able to control two DC motors or one stepper motor. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. and Peak Output Current 1.2 A Per Channel. This IC has two enable inputs, these are provided to enable or disable the device independently of the input signals. The motor driver shield has two L293D motor driver IC. So, the L293d shield able to control four DC motors or one stepper motor.

74HC595 shift register IC

The 74HC595 is a shift resistor IC. This IC has an 8-bit shift register and an 8-bit D-type latch with three state parallel outputs. This shift register can accept serial data and provides a serial output. Also, it can provide parallel data to the 8-bit latch. The shift register and latch have independent clock inputs.

The shield has a 74HC595 shift register that extends Arduino 4 digital pins to the 8 direction control pins of two L293D chips.

Reset Switch

The RESET is nothing but the Arduino reset button. This switch works same as the Arduino reset and it is used to reset the Arduino board. It just brought up top for easy to use purpose.

Power LED

The on-board Power LED indicates the motor's power supply. If the power supply is on the LED is turned on, the motor will work well. If the LED will not ON, it means the power supply is OFF. So, the motors will not be working.

Resistor Array

The shield comes with a pulldown resistor array, that keeps motors switched off during power-up.

External Power Supply

The shield has a 2-pin terminal block for External Power Supply. It used to DC power supply for motors.

It also can be used to the power supply to the Arduino board, it possible by the "Power Supply Selection Jumper".

Power Supply Selection Jumper

•Single DC power supply for both Arduino and motors

If you want to provide a single DC power supply for both Arduino and motors. So, Place the power jumper on the motor shield. Now you can simply connect the power supply to the DC_jack on the Arduino or the 2-pin External Power Supply terminal block on the shield. But, this method only used when the motor supply voltage is less than 12V.

•Arduino powered through USB and motors through an External Power Supply pin

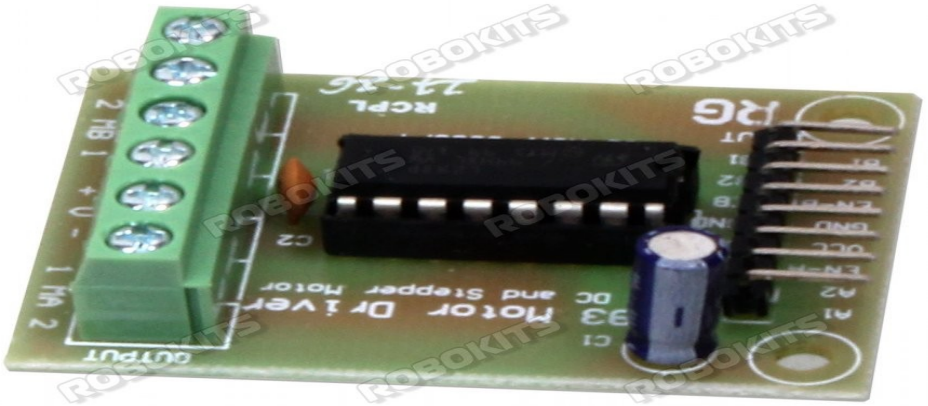
If you want to powered the Arduino board through the USB and the motors powered through the DC power supply. At first, plug in the USB cable, then connect the motor supply to the external Power. Now you can turn on the power supply one by one (first the Arduino power supply then the motor power supply). In this condition do not place the jumper on the shield.

•Two separate DC power supplies for the Arduino and motors

If you want to use two separate power supplies for the Arduino boards and motors. So, at first, you need to connect the power supply to the DC jack on the Arduino, Then connect the motor power supply to the 2-pin External Power Supply terminal block on the shield. Make sure the jumper is removed from the motor shield.

L293D Motor Driver Shield PinOut:

•PinOut for DC motors



SL. NO	Pin Name	Description
1	**M1-A, M1-B, GND, M2-A, M2-B**	Output for**Stepper Motor 1**, connect stepper motors (unipolar or bipolar) with single coil, double coil, or interleaved stepping
2	**M3-A, M3-B, GND, M4-A, M4-B**	Output for**Stepper Motor 2**, connect stepper motors (unipolar or bipolar) with single coil, double coil, or interleaved stepping

•PinOut for Servo motor

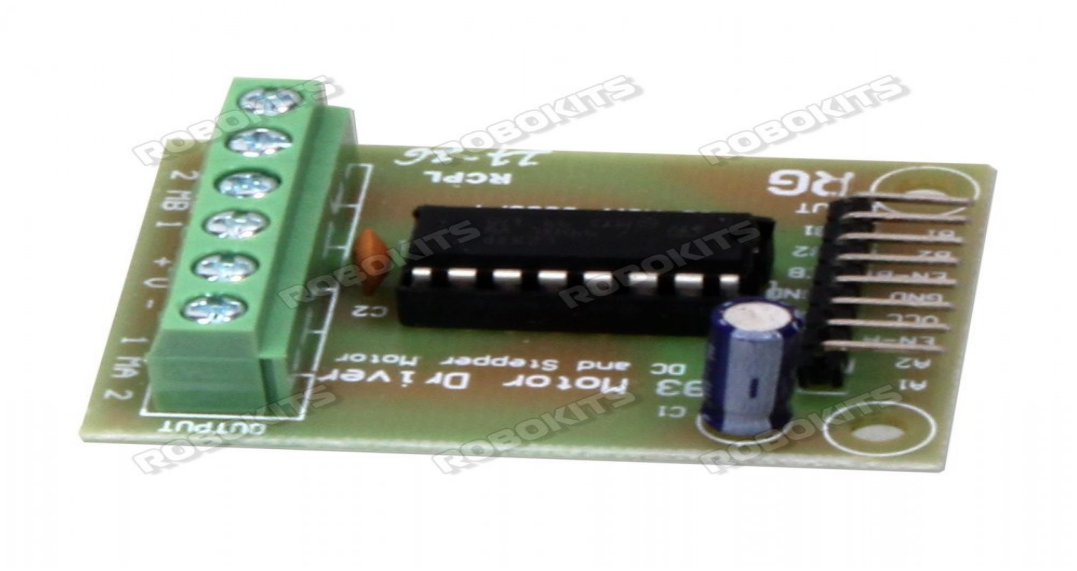


fig:3.2.2.4 pinout for driver shield motor

SL. NO	Pin Name	Description
1	**Servo 1 Pin (-, +,s)**	Output for **Servo motor 1,**Connect the servo motor pin **GND, VCC, SIGNAL**respectively
2	**Servo 2 Pin (-, +,s)**	Output for**Servo motor 2,**Connect the servo motor pin**GND, VCC, SIGNAL**respectively

Note: Digital pins**D2, D13**and analog pins**A0-A5**are not used by the shield. It can be used to connect other sensors or circuits.

Applications

•DC motors Control.

•Stepping motors Control.

•Servo Motor Control.

•In many Robotics projects.

•CNC projects.

Motor Driver Shield Features

•2 connections for 5V ‘hobby’ servos connected to the Arduino’s high-resolution dedicated timer

•4 H-Bridges: L293D chipset provides 0.6A per bridge (1.2A peak) with thermal shutdown protection, internal kickback protection diodes. Can run motors on 4.5VDC to 25VDC.

•Up to 4 bi-directional DC motors with individual 8-bit speed selection (so, about 0.5% resolution)

•Up to 2 stepper motors (unipolar or bipolar) with single coil, double coil, or interleaved stepping.

•Pull-down resistors keep motors disabled during power-up

•Big terminal block connectors to easily hook up wires (18-26AWG) and power

•Arduino reset button brought up top

•2-pin terminal block and jumper to connect external power, for separate logic/motor supplies

•Tested compatible with Arduino Mega 1280 & 2560, Diecimila, Duemilanove, and UNO

3.2.3 SERVO MOTOR:

A DC servo motor consists of a small DC motor, feedback potentiometer, gearbox, motor drive electronic circuit and electronic feedback control loop. It is more or less similar to the normal DC motor.The stator of the motor consists of a cylindrical frame and the magnet is attached to the inside of the frame.A brush is built with an armature coil that supplies the current to the commutator. At the back of the shaft, a detector is built into the rotor in order to detect the rotation speed.

With this construction, it is simple to design a controller using simple circuitry because the torque is proportional to the amount of current flow through the armature.

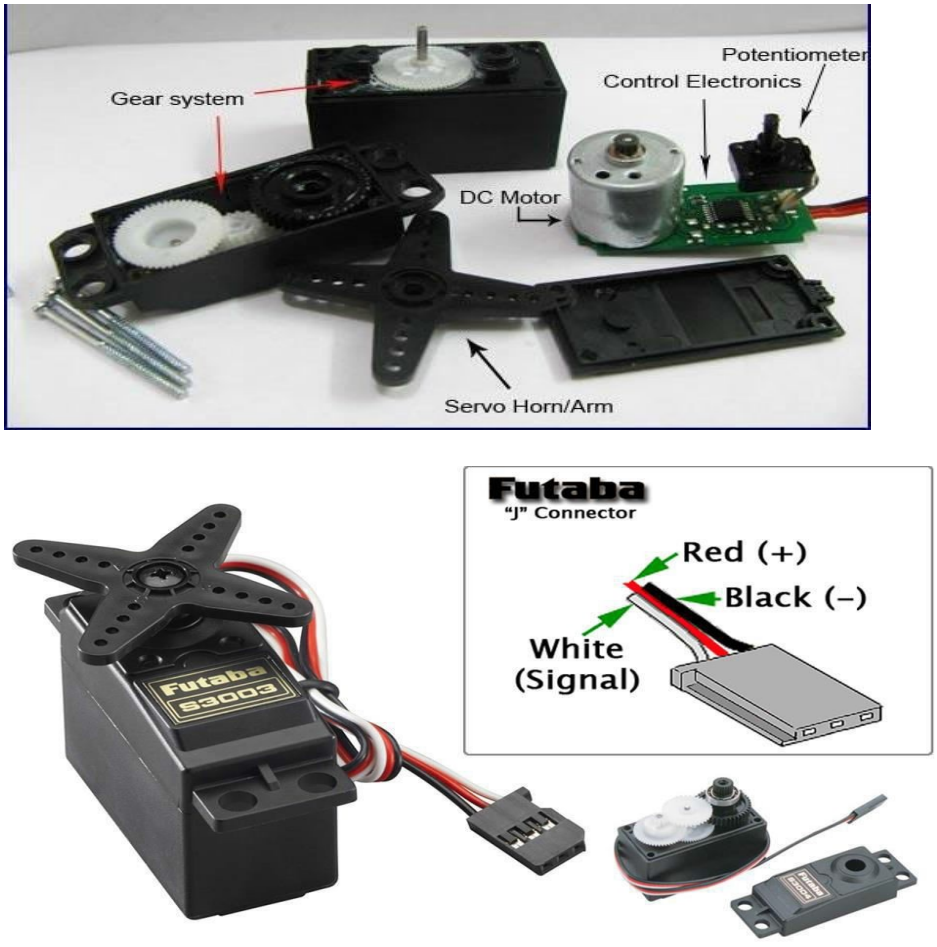


Fig.3.2.3.1 Servo Motors

A **servo motor** is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a

simple motor which runs through a servo mechanism. If motor is powered by a DC power supply then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor. For this tutorial, we will be discussing only about the DC servo motor working.Apart from these major classifications, there are many other types of servo motors based on the type of gear arrangement and operating characteristics. A servo motor usually comes with a gear arrangement that allows us to get a very high torque servo motor in small and lightweight packages. Due to these features, they are being used in many applications like toy car, RC helicopters and planes, Robotics, etc.

Servo motors are rated in kg/cm (kilogram per centimeter) most hobby servo motors are rated at 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells you how much weight your servo motor can lift at a particular distance. For example: A 6kg/cm Servo motor should be able to lift 6kg if the load is suspended 1cm away from the motors shaft, the greater the distance the lesser the weight carrying capacity. The position of a servo motor is decided by electrical pulse and its circuitry is placed.

Servo Motor Working Mechanism

It consists of three parts:

1. Controlled device
2. Output sensor
3. Feedback system

It is a closed-loop system where it uses a positive feedback system to control motion and the final position of the shaft. Here the device is controlled by a feedback signal generated by comparing output signal and reference input signal.Here reference input signal is compared to the reference output signal and the third signal is produced by the feedback system. And this third signal acts as an input signal to the control the device. This signal is present as long as the feedback signal is generated or there is a difference between the reference input signal and reference output signal. So the main task of servomechanism is to maintain the output of a system at the desired value at presence of noises .

Servo Motor Working Principle

A servo consists of a Motor (DC or AC), a potentiometer, gear assembly, and a controlling circuit. First of all, we use gear assembly to reduce RPM and to increase torque of the motor. Say at initial position of servo motor shaft, the position of the potentiometer knob is such that there is no electrical signal generated at the output port of the potentiometer. Now an electrical signal is given to another input terminal of the error detector amplifier. Now the difference between these two signals, one comes from the potentiometer and another comes from other sources, will be processed in a feedback mechanism and output will be provided in terms of error signal. This error signal acts as the input for motor and motor starts rotating. Now motor shaft is connected with the potentiometer and as the motor rotates so the potentiometer and it will generate a signal. So as the potentiometer's angular position changes, its output feedback signal changes. After sometime the position of potentiometer reaches at a position that the output of potentiometer is same as external signal provided. At this condition, there will be no output signal from the amplifier to the motor input as there is no difference between external applied signal and the signal generated at potentiometer, and in this situation motor stops rotating.

InterfacingServoMotors with Microcontroller:

Interfacing hobby Servo motors like s90 servo motor with MCU is very easy. Servos have three wires coming out of them. Out of which two will be used for Supply (positive and negative) and one will be used for the signal that is to be sent from the MCU. An MG995 Metal Gear Servo Motor which is most commonly used for RC cars humanoid bots etc. The picture of MG995 is shown below:

The color coding of your servo motor might differ hence check for your respective datasheet.All servo motors work directly with your +5V supply rails but we have to be careful on the amount of current the motor would consume if you are planning to use more than two servo motors a proper servo shield should be designed.

Controlling Servo Motor:

All motors have three wires coming out of them. Out of which two will be used for Supply (positive and negative) and one will be used for the signal that is to be sent from the MCU.

Servo motor is controlled by PWM (Pulse with Modulation) which is provided by the control wires. There is a minimum pulse, a maximum pulse and a repetition rate. Servo motor can turn 90 degree from either direction form its neutral position. The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns. For example, a 1.5ms pulse will make the motor turn to the 90° position, such as if pulse is shorter than 1.5ms shaft moves to 0° and if it is longer than 1.5ms than it will turn the servo to 180°.

Servo motor works on PWM (Pulse width modulation) principle, means its angle of rotation is controlled by the duration of applied pulse to its Control PIN. Basically servo motor is made up of DC motor which is controlled by a variable resistor (potentiometer) and some gears. High speed force of DC motor is converted into torque by Gears. We know that WORK= FORCE X DISTANCE, in DC motor Force is less and distance (speed) is high and in Servo, force is High and distance is less. The potentiometer is connected to the output shaft of the Servo, to calculate the angle and stop the DC motor on the required angle.

Servo motor can be rotated from 0 to 180 degrees, but it can go up to 210 degrees, depending on the manufacturing. This degree of rotation can be controlled by applying the Electrical Pulse of proper width, to its Control pin. Servo checks the pulse in every 20 milliseconds. The pulse of 1 ms (1 millisecond) width can rotate the servo to 0 degrees, 1.5ms can rotate to 90 degrees (neutral position) and 2 ms pulse can rotate it to 180 degree.

All servo motors work directly with your +5V supply rails but we have to be careful about the amount of current the motor would consume if you are planning to use more than two servo motors a proper servo shield should be designed.

Servo Motor – Working, Advantages & Disadvantages

Servo implies an error sensing feedback control which is utilized to correct the performance of a system. It also requires a generally sophisticated controller, often a dedicated module designed particularly for use with servomotors. Servo motors are DC motors that allow for precise control of the angular position. They are DC motors whose speed is slowly lowered by the gears. The servo motors usually have a revolution cut off from 90° to 180°. A few servo motors also have a revolution cutoff of 360° or more. But servo motors do not rotate constantly. Their rotation is limited between the fixed angles.

Working of a Servo Motor:

Servo Motor consists of a DC Motor, a Gear system, a position sensor, and a control circuit. The DC motors get powered from a battery and run at high speed and low torque. The Gear and shaft assembly connected to the DC motors lower this speed into sufficient speed and higher torque. The position sensor senses the position of the shaft from its definite position and feeds the information to the control circuit. The control circuit accordingly decodes the signals from the position sensor and compares the actual position of the motors with the desired position and accordingly controls the direction of rotation of the DC motor to get the required position. Servo Motor generally requires a DC supply of 4.8V to 6 V.

3.2.4. TT GEAR MOTOR:

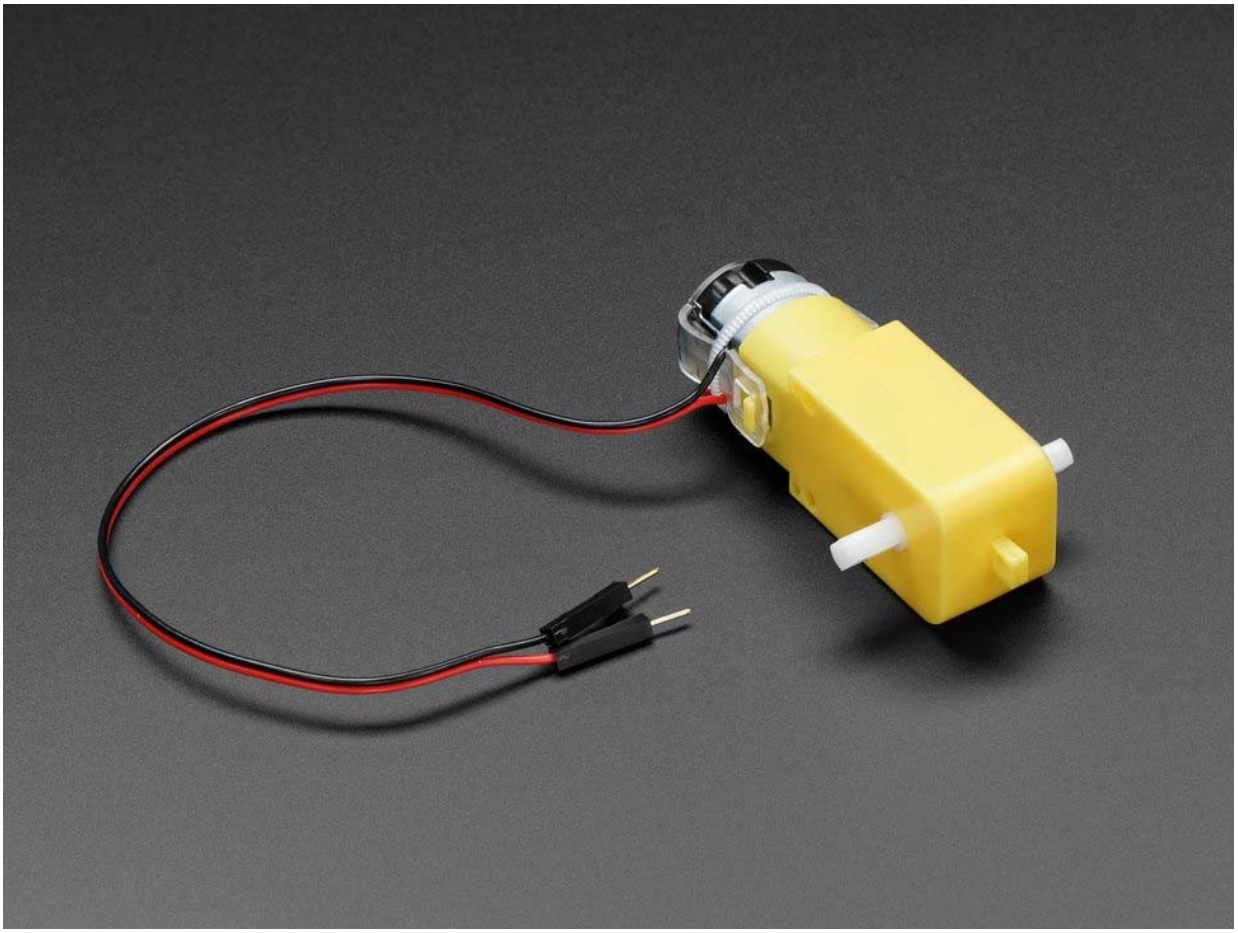


fig:3.2.4.1 TT Gear Motor

Perhaps you've been assembling a new robot friend, adding a computer for a brain and other fun personality touches. Now the time has come to let it leave the nest and fly on its own wings– err, wheels!

These durable (but affordable!) plastic gearbox motors (also known as 'TT' motors) are an easy, low-cost way to get your projects moving. This is a TT DC Gearbox Motor with a gear ratio of 1:48, and it comes with 2 x 200mm wires with breadboard-friendly 0.1" male connectors. Perfect for plugging into a breadboard or terminal blocks.

You can power these motors with 3VDC up to 6VDC, they'll of course go a little faster at the higher voltages. We grabbed one motor and found these stats when running it from a bench-top supply.

At 3VDC we measured 150mA @ 120 RPM no-load, and 1.1 Amps when stalled

At 4.5VDC we measured 155mA @ 185 RPM no-load, and 1.2 Amps when stalled

At 6VDC we measured 160mA @ 250 RPM no-load, and 1.5 Amps when stalled

Note that these are very basic motors, and have no built-in encoders, speed control or positional feedback. Voltage goes in, rotation goes out! There will bevariation from motor to motor, so a separate feedback system is required if you need precision movement.

Comes 1 x per order, with just the motor + wires. You cannot drive these directly from a microcontroller, a high-current motor driver is required! We recommend our DRV8833 motor driver for these motors, as it works well down to 3V and can be set up with current limiting since the stall current on these can get high. The TB6612 can also be used, it's on our shields and wings, but you'll

need to supply at least 4.5V - which is what you'll likely want to run these motors at anyhow! We have a range of wheels, add-ons and accessories for these motors so you can bling out your bot just the way you like.

TECHNICAL DETAILS

Rated Voltage: 3~6V

Continuous No-Load Current: 150mA +/- 10%

Min. Operating Speed (3V): 90+/- 10% RPM

Min. Operating Speed (6V): 200+/- 10% RPM

Torque: 0.15Nm ~0.60Nm

Stall Torque (6V): 0.8kg.cm

Gear Ratio: 1:48

Body Dimensions: 70 x 22 x 18mm

Wires Length: 200mm & 28 AWG

Weight: 30.6g

Product Weight: 30.6g / 1.1oz

3.2.5 FLAME SENSOR:

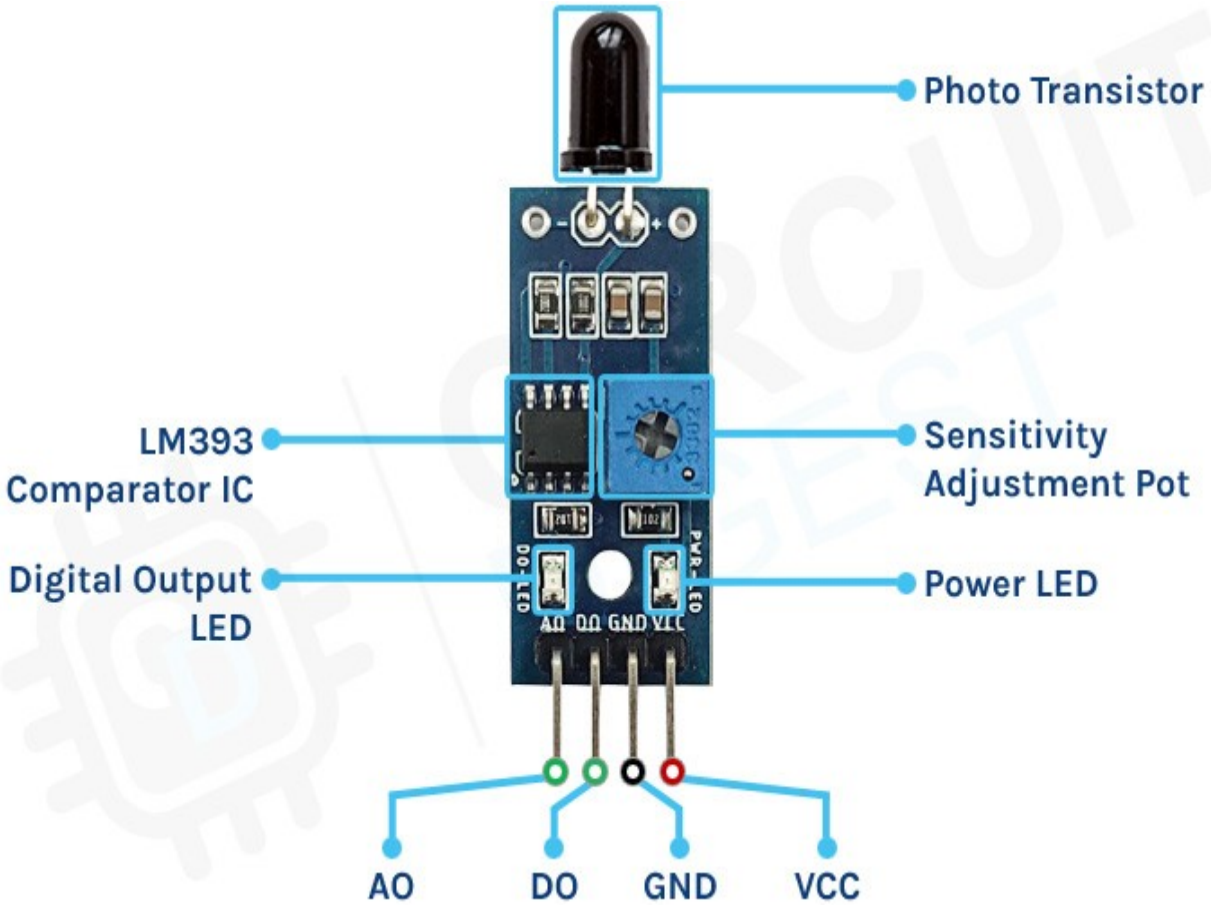


fig3.2.5.1 Flame Sensor

This module is sensitive to the flame and radiation.It also can detect ordinary light source in the range of wavelength760nm-1100nm.The detection distance is upto 100cm. A flame sensor module that detects flame or a light source of a wavelength in the range of 760 nm – 1100 nm interfacing with Arduino board's MCU. By reading the Digital output of the sensor, 0 – if there's a flame, 1 - no flame detected.

The flame sensor can output digital or analog signal.It can be used as a fire alarm or in fire fighting robots.

The specifications of flame sensor module are as follows:

- Detection Distance: 1 meter (max sensitive adjustment)
- Detection Angle: 60 Degrees
- Operating Voltage: +5VDC

Features

1) Equipped with power light and a signal output indicator
2) Support a detection angle of appr. 60 degrees; particularly sensitive to flame spectrum.
3) Contain an adjustable precision potentiometer for sensitivity adjustment .
4) With a comparator LM393 to output both digital and analog signals at the same time
5) Connected directly with I/O port of MCU, needless of external circuit
6) Sensitive to flame, also responsive to general light; generally used for flame
7) Detect flame or light of a wavelength ranging from 760 to 1100 nm.
8) Output clean signals by a comparator, with good waveform and driving capability as strong as more than 15mA
9) Working voltage: 3.3V - 5V; PCB size: 2.3 x 2.3 cm

Specification

- Spectrum range: 760nm ~ 1100nm
- Detection angle: 0 - 60 degree
- Power: 3.3V ~ 5.3V
- Operating temperature: -25℃ ~ 85℃
- Dimension: 27.3mm * 15.4mm
- Mounting holes size: 2.0mm

Pinout

PIN	Description
DOUT	Digital data output
AOUT	Analog data output
GND	Ground
VCC	Power input (3.3V~5.3V)

HARDWARE CONNECTION:

Flame	Pico	Description
VCC	3.3V	Power input
GND	GND	Ground
AOUT	GP26	Analog data output
DOUT	GP22	Digital data output

3.2.6 JUMPER WIRES:

fig:3.2.6.1 Jumper Wires

Generally, jumpers are tiny metal connectors used to close or open a circuit part. They have two or more connection points, which regulate an electrical circuit board. Their function is to configure the settings for computer peripherals, like the motherboard. Suppose your motherboard supported intrusion detection. A jumper can be set to enable or disable it. Jumper wires are electrical wires with connector pins at each end. They are used to connect two points in a circuit without soldering. You can use jumper wires to modify a circuit or diagnose problems in a circuit. Further, they are best used to bypass a part of the circuit that does not contain a resistor and is suspected to be bad. This includes a stretch of wire or a switch. Suppose all the fuses are good and the component is not receiving power; find the circuit switch. Then, bypass the switch with the jumper wire. Although jumper wires come in a variety of colours, they do not actually mean anything. The wire colour is just an aid to help you keep track of what is connected to which. It will not affect the operation of the circuit. This means that a red jumper wire is technically the same as the black one. Even so, the colours can be used to your advantage to differentiate the types of connections. For instance, red as ground and black as power. Literally, what works for you.

3.2.7 MQ2 SENSOR:

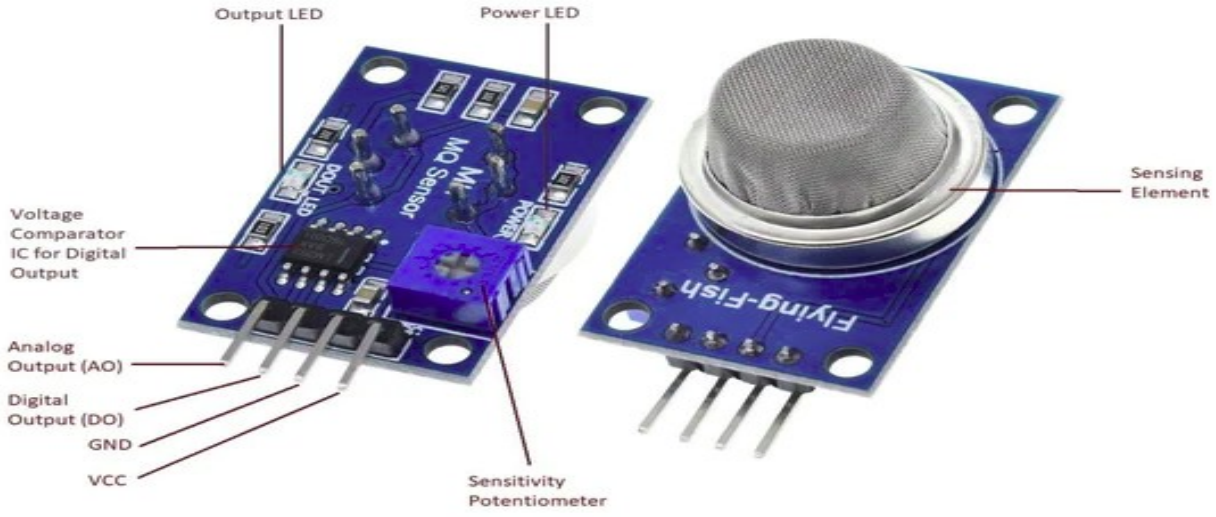


fig3.2.7.1 MQ2sensor

The sensor is made of 6 pins with a stainless steel mesh cover on the outside. This mesh is designed so that only air particles can pass through. Also, this iron mesh connects to the sensor body using a stainless steel ring. These sensors belong to the metal oxide semiconductor type. That is, when a gas enters the sensor, the concentration of the gas is detected according to the degree to which the resistance of the sensor element changes.

Main Features

- Detected Gas: Combustible Gas, Smoke
- Detection Intensity: 300～10000ppm(Combustible Gas)
- Working Voltage: 5.0V±0.1V AC or DC

When this sensor is powered on, the tin dioxide heats up to a high temperature. At that point, oxygen is absorbed to the surface. Then, when the gas we are measuring is brought close to this sensor, it reacts with the tin dioxide to reduce the surface absorption of oxygen. After, the electrons are released into the tin dioxide. Then the current flows freely. In this case, the resistance difference can be received as an analog or digital value through the voltage divider circuit in the module to which this sensor is connected.

The gas sensitive material used in the MQ-2 gas sensor is SnO2, a low electrically conductive material in clean air. When there is combustible gas in the surrounding air, the electrical conductivity of the sensor will increase with the higher intensity of the combustible gas. Here, we can convert the changing electrical conductivity into output signal by building a simple circuit.

Introduction of the Pins

- VCC: 5V Working Voltage
- GND: Ground.
- D0: Output Interface of Digital Switch (0 and 1).
- A0: Analog Output Interface

WORKING PRINCIPLE:

After wiring VCC and GND, the Power LED of the module lights up. Before your using, the power supply preheats for at least 2 minutes. It is normal for the sensor to generate heat slightly, because there is heating wire inside. But it is abnormal that the sensor becomes overheating. When there is no impact of the sensible gas or the gas concentration is not more than the preset threshold, the digital interface D0 outputs high level and the voltage of the analog interface A0 is around 0V. When the gas concentration is beyond the threshold, the digital interface D0 outputs low level and the digital indicator light is on. And the output voltage of the analog interface A0 increases with the raising of the gas concentration,A0 Output: 0.1-0.3V (relatively non-polluted). With the gas concentration being higher, the voltage can reach up to 4V. Rotate the knob of the potentiometer clockwise, you can get the sensing range of the gas concentration wider (only for the sensitivity of the TTL output). The digital output D0 can drive the relay module directly, which can form a gas switch. The digital output D0 can also drive the positive buzzer module and this module can be used to make up a gas alarm. The analog output A0 can be connected to AD module and get the approximate values of the ambient gas concentration via AD conversion.

A **gas detector** is a device that detects the presence of gasesin an area, often as part of a safety system. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals.

Gas detectors can be used to detect combustible, flammable and toxic gases, and oxygen depletion. This type of device is used widely in industry and can be found in locations, such as on oil rigs, to monitor manufacturing processes and emerging technologies such as photovoltanic. They may be used in firefighting.

Gas leak detection is the process of identifying potentially hazardous gas leaks by sensors. Additionally a visual identification can be done using a thermal camera These sensors usually employ an audible alarm to alert people when a dangerous gas has been detected. Exposure to toxic gases can also occur in operations such as painting, fumigation, fuel filling, construction, excavation of contaminated soils, landfill operations, entering confined spaces, etc. Common sensors include combustible gas sensors, photoionization detectors, infrared point sensors,ultrasonic sensor, electrochemical gas sensors, and metal-oxide-semiconductor (MOS) sensors. More recently, infrared imaging sensors have come into use. All of these sensors are used for a wide range of applications and can be found in industrial plants, refineries, pharmaceutical manufacturing, fumigation facilities, paper pulp mills, aircraft and shipbuilding facilities, hazmat operations, waste-water treatment facilities, vehicles, indoor air quality testing and homes.

APPLICATIONS:

These sensors are used to detect the presence of gases in the air such as methane, butane, LPG and smoke but they are unable to distinguish between gases. Thus, they cannot tell which gas it is.

Module version of this sensor can be used without interfacing to any microcontroller and is useful when detecting only one particular gas. This can only detect the gas. But if ppm has to be calculated then the sensor should be used without module.

This sensor is also used for Air quality monitoring, Gas leak alarm and for maintaining environmental standards in hospitals. In industries, these are used to detect the leakage of harmful gases.

3.2.8 SIM 800L :

FIG:3.2.8.1:SIM 800L

SIM800L is a miniature cellular module which allows for GPRS transmission, sending and receiving SMS and making and receiving voice calls. Low cost and small footprint and quad band frequency support make this module perfect solution for any project that require long range connectivity. After connecting power module boots up, searches for cellular network and login automatically. On board LED displays connection state (no network coverage - fast blinking, logged in - slow blinking).

NOTICE: Be prepared to handle huge power consumption with peek up to 2A. Maximum voltage on UART in this module is 2.8V. Higher voltage will kill the module.

Two antennas!

This module have two antennas included. First is made of wire (which solders directly to NET pin on PCB) - very useful in narrow places. Second - PCB antenna - with double sided tape and attached pigtail cable with IPX connector. This one have better performance and allows to put your module inside a metal case - as long the antenna is outside.

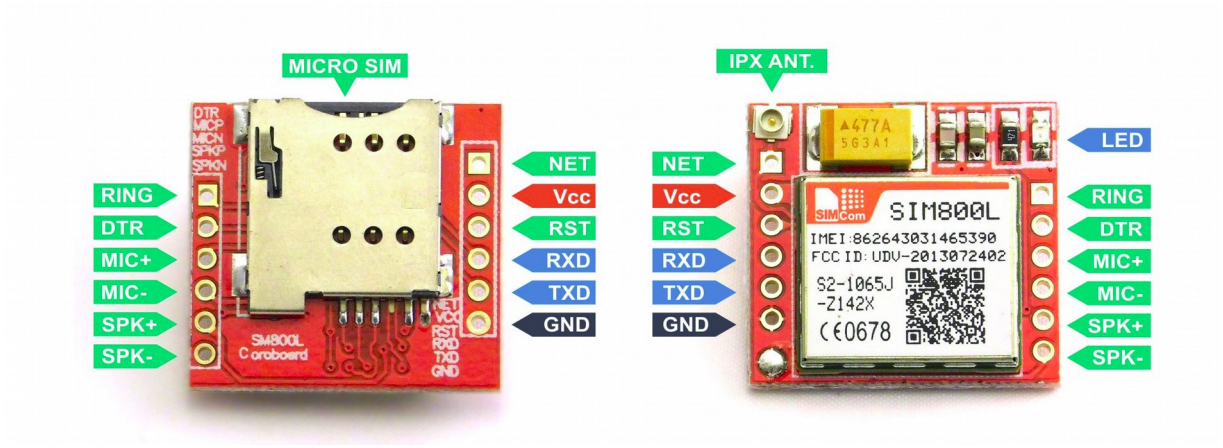
Specification

- Supply voltage: 3.8V - 4.2V
- Recommended supply voltage: 4V
- Power consumption:
    - sleep mode < 2.0mA
    - idle mode < 7.0mA
    - GSM transmission (avg): 350 mA
    - GSM transmission (peek): 2000mA
- Module size: 25 x 23 mm
- Interface: UART (max. 2.8V) and AT commands
- SIM card socket: microSIM (bottom side)
- Supported frequencies: Quad Band (850 / 950 / 1800 /1900 MHz)
- Antenna connector: IPX
- Status signaling: LED
- Working temperature range: -40 do + 85 ° C

Set includes:

- SIM800L module
- goldpin headers
- wire antenna
- PCB antenna with pigtail and IPX connector

PINOUT:



Pinout (bottom side - left):

- RING (not marked on PBC, first from top, square) - LOW state while receiving call
- DTR - sleep mode. Default in HIGH state (module in sleep mode, serial communication disabled). After setting it in LOW the module will wake up.
- MICP, MICN - microphone (P + / N -)
- SPKP, SPKN - speaker (P + / N -)

Pinout (bottom side - right):

- NET - antenna
- VCC - supply voltage
- RESET - reset
- RXD - serial communication
- TXD - serial communication
- GND - ground

3.2.9:LM 2596 BUCK CONVERTER:

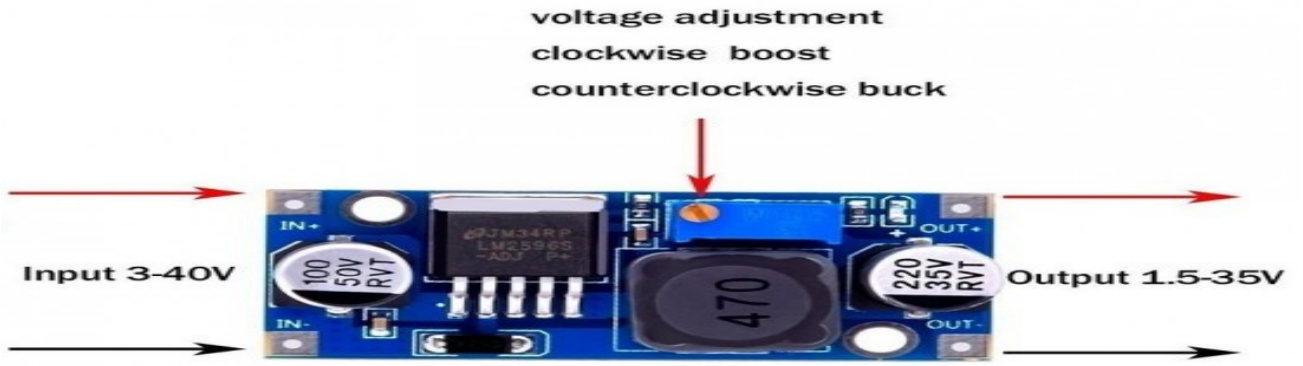


Fig:3.2.9.1:LM 2596 BUCK CONVERTER

A **buck converter** or **step-down converter** is a DC to DC converterwhich steps down voltage (while stepping up current) from its input (supply) to its output (load). It is a class of switched-mode power supply. Switching converters (such as buck converters) provide much greater power efficiency as DC-to-DC converters than linear regulators, which are simpler circuits that lower voltages by dissipating power as heat, but do not step up output current.The efficiency of buck converters can be very high, often over 90%, making them useful for tasks such as converting a computer's main supplyvoltage, which is usually 12 v, down to lower voltages needed by USB,DRAM and the CPU, which are usually 5, 3.3 or 1.8 V.

Buck converters typically contain at least two semiconductors (a diode and a transistors, although modern buck converters frequently replace the diode with a second transistor used for syncronous rectifications) and at least one energy storage element (a capacitor,indector or the two in combination). To reduce voltage ripple, filters made of capacitors (sometimes in combination with inductors) are normally added to such a converter's output (load-side filter) and input (supply-side filter). Its name derives from the inductor that “bucks” or opposes the supply voltage.

Buck convertors typically operate with a switching frequency range from 100 kHz to a few MHz. A higher switching frequency allows for use of smaller inductors and capacitors, but also increases lost efficiency to more frequent transistor switching.

This is a 20W DC-DC buck converter power module with 7~24V input and 5V/4A output(Max). The high conversion efficiency and on-board 6 output ports make it suitable for connecting multiple devices like, large current servos, programmable LED strip, etc.

The module integrates durable ceramic chip capacitors of large capacity on the ports and large inductor that can reduce heat generation. It is ideal for power supply scenarios like mechanical arm, servo robot, and programmable RGB LED strip, etc

Introduction to LM2596

- LM2596is a voltage regulator mainly used to step down the voltage or to drive load under 3A.
- It is also known as DC-to-DC power converter or buck converter which is used to step down the voltage from its input supply to the output load. The current goes up during this voltage step down process.
- LM2596 comes with a remarkable load and line regulation. It is available in both versions: fixed output voltage version with 3.3V, 5V, 12V, and customized output version where you can choose the output as per your requirement.
- This regulator is incorporated with a fixed-frequency oscillator and an internal frequency compensation method.
- Frequency compensation is applied by adjusting both phase and gain characteristics of the open-loop output to avoid oscillation and vibration in the circuit. This is achieved with the help of resistance-capacitance networks.
- A minimum number of external components are required for this regulator that works at a fixed frequency of 150 kHz.
  It is available in surface mount package TO-263 and standard 5-pin package TO-220.

LM2596 FEATURES:

- Fixed versions i.e. 3.3-V, 5-V, 12-V, and customizable output versions
- Customizable output version with voltage range: 1.2-V to 37-V ±4% maximum over load and line conditions
- Available in two packages including TO-263 and TO-220 packages.
- Can drive load under 3A.
- 40 V is the input voltage range
- 4 external components are needed
- Remarkable load and line regulations
- Internal oscillator with a fixed frequency of 150 kHz
- TTL shutdown capability
- Comes with low power standby mode, commonly 80 µA
- High efficient and readily available

Specifications:

- Input Voltage: 7~24V
- Output Voltage: 5V
- Output Current: 0-4A(Max 5A, heat dissipation is necessary)
- Conversion Efficiency: 90%
- Output Ripple: ＜100mV
- Output Accurancy: ±0.1V
- No-load Current: ＜1mA
- Operating Temperature: -40°~+85°C
- Operating Humidity: 20%~90%
- Dimension: 43.5x20.3x5.5mm / 1.71x0.80x0.22”

LM2596 APPLICATIONS:

- Used to step down voltage
- Can drive load under 3A
- Provide remarkable load and line regulation.

LM2596 POWER SETTINGS

The following table represents the absolute maximum ratings of regulator LM2596.

Absolute Maximum Ratings LM2596

No.	Rating	Value	Unit
1	Maximum Supply Voltage	45	V
2	SD/SS Input Voltage	6	V
3	Delay Pin Voltage	1.5	V
4	Flag Pin Voltage	45	V
5	Feedback Pin Voltage	25	V
6	Output Voltage to Ground	-1	V
7	Storage Temperature	-65 to 150	C

- While working with this component, make sure stresses don’t exceed the absolute maximum ratings, else they can permanently damage the component.
- Plus, if stresses are applied for more than the required time, they can affect device reliability.

3.2.10:RELAY MODULE:

Fig:3.2.10.1:RELAY MODULE

A **relay** is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

The traditional form of a relay uses an electromagnet to close or open the contacts, but relays using other operating principles have also been invented, such as in solid state relays, which use semiconductors properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called *protective relays*.

Latching relays require only a single pulse of control power to operate the switch persistently. Another pulse applied to a second set of control terminals, or a pulse with opposite polarity, resets the switch, while repeated pulses of the same kind have no effects. Magnetic latching relays are useful in applications when interrupted power should not affect the circuits that the relay is controlling.

A relay is an electrically operated device. It has a control system and (also called input circuit or input contactor) and controlled system (also called output circuit or output cont actor). It is frequently used in automatic control circuit. To put it simply, it is an automatic switch to controlling a high-current circuit with a low-current signal.

The advantages of a relay lie in its lower inertia of the moving, stability, long-term reliability and small volume. It is widely adopted in devices of power protection, automation technology, sport, remote control, reconnaissance and communication, as well as in devices of electromechanics and power electronics. Generally speaking, a relay contains an induction part which can reflect input variable like current, voltage, power, resistance, frequency, temperature, pressure, speed and light etc. It also contains an actuator module (output) which can energize or de-energize the connection of controlled circuit. There is an intermediary part between input part and output part that is used to coupling and isolate input current, as well as actuate the output. When the rated value of input (voltage, current and temperature etc.) is above the critical value, the controlled output circuit of relay will be energized or de-energized.

NB: input into a relay can be divided into two categories: electrical quantities (including current, voltage, frequency, power etc.) and non- electrical quantities(including temperature, pressure, speed, etc.)

Relays are electrically operated switches that open and close the circuits by receiving electrical signals from outside sources. Some people may associate “relay” with a racing competition where members of the team take turns passing batons to complete the race.The “relays” embedded in electrical products work in a similar way; they receive an electrical signal and send the signal to other equipment by turning the switch on and off.

For example, when you push the button on a TV remote to watch TV, it sends an electrical signal to the “relay” inside the TV, turning the main power ON. There are various types of relays used in many applications to control different amounts of currents and number of circuits.

Relay is an electric device that uses an electric current to open or close the contacts of switch. Single-channel relay module is much more than just a plain relay, it comprises of components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active or not.

Features

The features of 1-Channel Relay module are as follow:

1) Good in safety. In power system and high voltage system, the lower current can control the higher one.

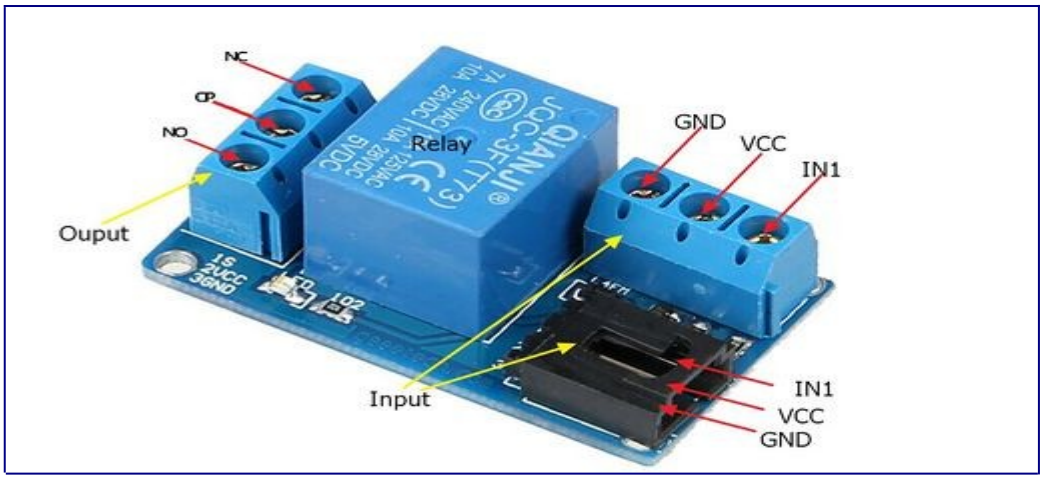
2) 1-channel high voltage system output, meeting the needs of single channel control

3) Wide range of controllable voltage.

4) Being able to control high load current, which can reach 240V, 10A

5) With a normally-open (NO) contact and a normally-closed (NC) contacts.

Interface Layout



Single-Channel Relay Module Pin Description

Pin Number	Pin Name	Description
1	Relay Trigger	Input to activate the relay
2	Ground	0V reference
3	VCC	Supply input for powering the relay coil
4	Normally Open	Normally open terminal of the relay
5	Common	Common terminal of the relay
6	Normally Closed	Normally closed contact of the relay

Single-Channel Relay Module Specifications

- Supply voltage – 3.75V to 6V
- Quiescent current: 2mA
- Current when the relay is active: ~70mA
- Relay maximum contact voltage – 250VAC or 30VDC
- Relay maximum current – 10A

How Does A Relay Work?

The relay uses an electric current to open or close the contacts of a switch,this is usually done using the help of a coil that attracts the contacts of a switch and pulls them together when activated, and a spring pushes them apart when the coil is not energized.

There are two advantages of this system – First, the current required to activate the relay is much smaller than the current that relay contacts are capable of switching, and second, the coil and the contacts are isolated, meaning there is no electrical connection between them. This means that the relay can be used to switch mains current through an isolated low voltage digital system.

The single-channel relay module is much more than just a plain relay,it contains components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active.

First is the screw terminal block. This is the part of the module that is in contact with mains so a reliable connection is needed. Adding screw terminals makes it easier to connect thick mains cables, which might be difficult to solder directly. The three connections on the terminal block are connected to the normally open, normally closed, and common terminals of the relay.

The second is the relay itself, which, in this case, is a blue plastic case. Lots of information can be gleaned from the markings on the relay itself. The part number of the relay on the bottom says “05VDC”, which means that the relay coil is activated at 5V minimum – any voltage lower than this will not be able to reliably close the contacts of the relay. There are also voltage and current markings, which represent the maximum voltage and current, the relay can switch. For example, the top left marking says “10A 250VAC”, which means the relay can switch a maximum load of 10A when connected to a 250V mains circuit. The bottom left rating says “10A 30VDC”, meaning the relay can switch a maximum current of 10A DC before the contacts get damaged.

Single-Channel Relay Module Basic Trouble Shooting

If the relay does not switch on, no audible clicking sound is heard:

- The contacts might be stuck - Check by physically shaking the relay, if a light clicking sound is not heard, then tap the relay hard, in most cases, this should both the contacts.
- If the contacts do click when the relay is shaken, then the transistor or the diode might be damaged and must be replaced.

Single-Channel Relay Module Applications

- Mains switching
- High current switching
- Isolated power delivery
- Home automation

3.2.11:WATER PUMP:

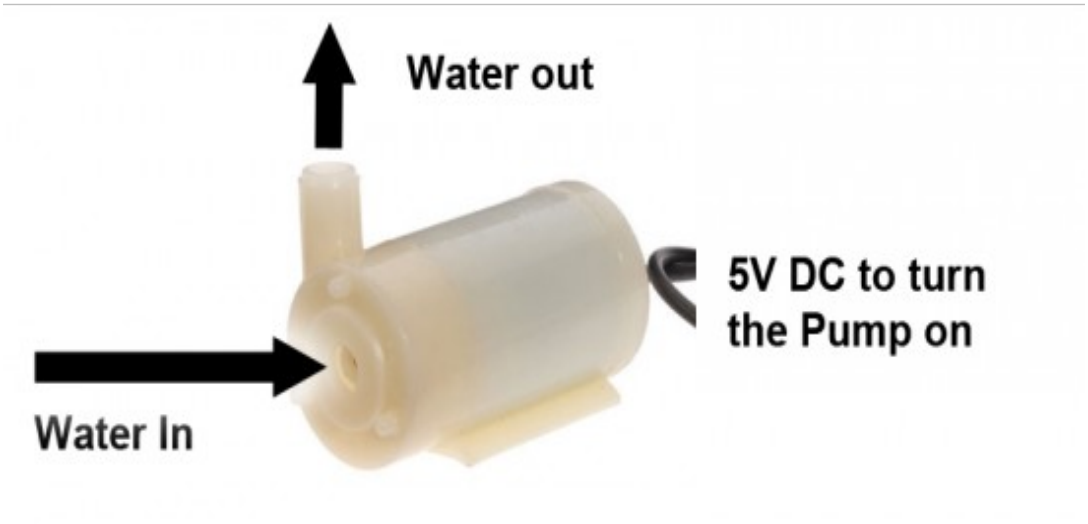


Fig:3.2.11.1:water pump

A pump is a device that moves fluids (liquids or gases), or sometimes slurries.by mechanical action, typically converted from electrical energy into hydraulic energy.

Mechanical pumps serve in a wide range of applications such as pumping water from wells aquaring filtering and pond filtering and aeration, in the car industry for water-cooling and fuel injection, in the energu industry for pumping oil and natural gas or for operating cooling towers and other components of heating ventilation and air conditioning systems. In the medical industry, pumps are used for biochemical processes in developing and manufacturing medicine, and as artificial replacements for body parts, in particular the artifical heart,and pencile protheosis.

When a pump contains two or more pump mechanisms with fluid being directed to flow through them in series, it is called a *multi-stage pump*. Terms such as *two-stage* or *double-stage* may be used to specifically describe the number of stages. A pump that does not fit this description is simply a *single-stage pump* in contrast.

In biology, many different types of chemical and biomechanical pumps have evolved biomimicry is sometimes used in developing new types of mechanical pumps.

Applications:

The spiral pump, as many low lift pumps, is commonly used for irrigation purposes and for drainage of lands. Based on the same principle as the Archimedeanscrew it consists of a rotating tube or plane (screw) to move a liquid. Unlike the Archimedean screw, it can pump while horizontal. The Archimedean screw must be tilted at an angle. The spiral pump, if fitted with a suitable rotating seal, can deliver water to a greater height than the coil pump, typically 5-10m, above their discharge opening. Its main drawback is that the output is small - an output proportional to the volume of the largest coil being moved each revolution.

Despite the emergence of new pumps that operate on other principles, the spiral pump remains an important tool as it can be built and repaired easily at a very low cost. This is possible as all the components can be built from local resources such as sheet metal bent into the desired form with or without machine tools.

- Controlled fountain water flow
- Controlled Garden watering systems
- Hydroponic Systems
- Fresh water intake or exhaust systems for fish acquarium

FEATURES:

- Voltage 2.5-6V
- Maximum lift 40-110cm/15.75“-43.3“
- Flow rate:80-120L/H
- Outside diameter:7.5mm/0.3“
- Inside diameter:5mm/0.2“
- Diameter:Approx.24mm/0.95“
- Length:Approx 45mm/1.2“
- Height:Approx 30mm/1.2“
- Material:Engineering plastic
- Driving mode:DC design,magneticdriving

3.2.12 Lithium ion Batteries :

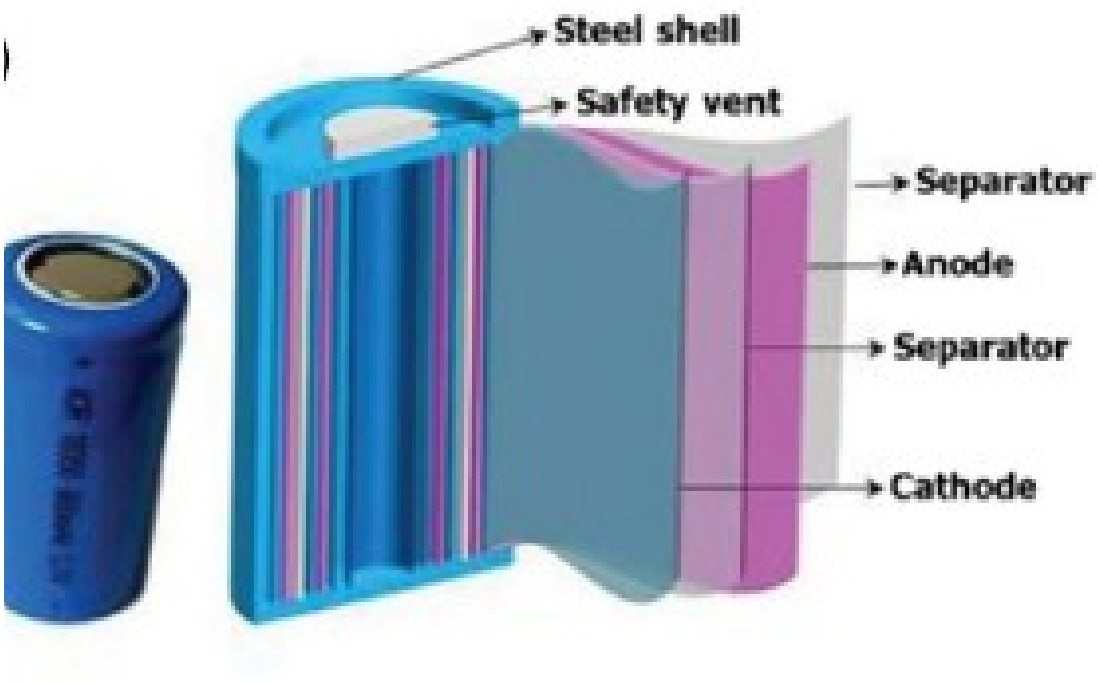


fig:3.2.12.1:lithium ion batteries

Lithium-ion is the most popular rechargeable battery chemistry used today. Lithium-ion batteries power the devices we use every day, like our mobile phones and electric vehicles.

Lithium-ion batteries consist of single or multiple lithium-ion cells, along with a protective circuit board.They are referred to as batteries once the cell, or cells, are installed inside a device with the protective circuit board.

Electrodes:The positively and negatively charged ends of a cell. Attached to the current collectors

- **Anode:**The negative electrode
- **Cathode:**The positive electrode
- **Electrolyte:**A liquid or gel that conducts electricity
- **Current collectors:**Conductive foils at each electrode of the battery that are connected to the terminals of the cell. The cell terminals transmit the electric current between the battery, the device and the energy source that powers the battery
- **Separator:**A porous polymeric film that separates the electrodes while enabling the exchange of lithium ions from one side to the other.

How does a lithium-ion cell work?

In a lithium-ion battery, lithium ions (Li+) move between the cathode and anode internally. Electrons move in the opposite direction in the external circuit. This migration is the reason the battery powers the device—because it creates the electrical current.While the battery is discharging, the anode releases lithium ions to the cathode, generating a flow of electrons that helps to power the relevant device.When the battery is charging, the opposite occurs: lithium ions are released by the cathode and received by the anode.

A lithium-ion (Li-ion) battery is an advanced battery technology that uses lithium ions as a key component of its electrochemistry. During a discharge cycle, lithium atoms in the anode are ionized and separated from their electrons. The lithium ions move from the anode and pass through the electrolyte until they reach the cathode, where they recombine with their electrons and electrically neutralize. The lithium ions are small enough to be able to move through a micro-permeable separator between the anode and cathode. In part because of lithium's small size (third only to hydrogen and helium), Li-ion batteries are capable of having a very high voltage and charge storage per unit mass and unit volume.

Li-ion batteries can use a number of different materials as electrodes. The most common combination is that of lithium cobalt oxide (cathode) and graphite (anode), which is most commonly found in portable electronic devices such as cellphones and laptops. Other cathode materials include lithium manganese oxide (used in hybrid electric and electric automobiles) and lithium iron phosphate. Li-ion batteries typically use ether (a class of organic compounds) as an electrolyte.

Some Advantages of lithium ion batteries

Compared to the other high-quality rechargeable battery technologies (nickel-cadmium or nickel-metal-hydride), Li-ion batteries have a number of advantages. They have one of the highest energy densities of any battery technology today (100-265 Wh/kg or 250-670 Wh/L). In addition, Li-ion battery cells can deliver up to 3.6 Volts, 3 times higher than technologies such as Ni-Cd or Ni-MH. This means that they can deliver large amounts of current for high-power applications, which has Li-ion batteries are also comparatively low maintenance, and do not require scheduled cycling to maintain their battery life. Li-ion batteries have no memory effect, a detrimental process where repeated partial discharge/charge cycles can cause a battery to 'remember' a lower capacity. This is an advantage over both Ni-Cd and Ni-MH, which display this effect. Li-ion batteries also have low self-discharge rate of around 1.5-2% per month. They do not contain toxic cadmium, which makes them easier to dispose of than Ni-Cd batteries.

3.2.13 WHEELS:

fig:3.2.13.1:wheels

A wheel is a circular component that is intended to rotate on an axle bearing,The wheel is one of the key components of the wheel and axle which is one of the six simple machines. Wheels, in conjunction with axles, allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labor in machines. Wheels are also used for other purposes, such as a ship's wheel, steering wheel, potter's wheel, and flywheel.

Common examples are found in transport applications. A wheel reduces friction by facilitating motion by rolling together with the use of axles. In order for wheels to rotate, a moment needs to be applied to the wheel about its axis, either by way of gravity or by the application of another external force or torque. Using the wheel, sumerias invented a device that spins clay as a potter shapes it into the desired object.

A drive wheel is a wheel of a motor vehicle that transmits force, transforming torque into tractive form from the tires to the road, causing the vehicle to move. The power train delivers enough torque to the wheel to overcome stationary forces, resulting in the vehicle moving forwards or backwards.

A two wheel drive vehicle has two driven wheels, typically both at the front or back, while a four wheel drive has four.

A steering wheel is a wheel that turns to change the direction of a vehicle. A trailer wheel is one that is neither a drive wheel, nor a steer wheel.Front wheel drive vehicles typically have the rear wheels as trailer wheels.

3.2.14 BATTERY HOLDER :

fig:3.2.14.1:battery holder

A battery holder is one or more compartments or chambers for holding a battery. For dry cells, the holder must also make electrical contact with the battery terminals. For wet cells, cables are often connected to the battery terminals as is found in automobiles or emergency lighting equipment.

A battery holder is either a plastic case with the shape of the housing moulded as a compartment or compartments that accepts a battery or batteries, or a separate plastic holder that is mounted with screws, eyelets, glue, double-sided tape, or other means. Battery holders may have a lid to retain and protect the batteries or may be sealed to prevent damage to circuitry and components from battery leakage. Coiled spring wire or flat tabs that press against the battery terminals are the two most common methods of making the electrical connection inside a holder. External connections on battery holders are usually made by contacts with pins, surface mount feet, solder lugs, or wire leads.

Where the battery is expected to last over the life of the product, no holder is necessary, and a tab welded to the battery terminals can be directly soldered to a printed circuit board.

CHAPTER 4
SOFTWARE MODEL

4.1 INTRODUCTION OF ARDUINO IDE SOFTWARE

The Arduino IDE (Integrated Development Environment) is used to write the computer code and upload this code to the physical board. The Arduino IDE is very simple and this simplicity is probably one of the main reason Arduino became so popular. We can certainly state that being compatible with the Arduino IDE is now one of the main requirements for a new microcontroller board. Over the years, many useful features have been added to the Arduino IDE and you can now managed third-party libraries and boards from the IDE, and still keep the simplicity of programming the board. The main window of the Arduino IDE is shown below, with the simple simple Blink example.

What is the Arduino IDE?

As we know we need a text/code editor to write the code, a compiler to convert that code to machine code or binary files so that the microcontroller can understand, and also programming software to load these firmware files onto the microcontroller. When we combine all these with some additional features like debugging support, console support, etc, that's what we call an IDE (Integrated Development Environment) or in simple terms the Arduino Software. Arduino IDE, as the name states, is a development IDE for the Arduino boards. It consists of a feature-rich code editor, compiler, programmer, serial console, serial plotter, and many other features. It is simple and easy to use.

Arduino IDE is cross-platform, and it can run on operating systems from Microsoft, Linux, and Windows. Furthermore, you can program the boards using the Arduino IDE and Arduino Language, which is a derivative of C/C++.

How to Install Arduino IDE?

Installing Arduino IDE is pretty straightforward. Go to Arduino IDE to download the recent version of Arduino IDE. There are multiple versions available for different operating systems such as Windows, Mac, and Linux. Not only that, nowadays Arduino IDE comes in two variants Arduino IDE 1.x and Arduino IDE 2.x. For this tutorial, we will be talking about the Classic 1.X variant. Basically, both have almost same functionality with a different GUI plus some additional features such as auto code completion.

- Download the installer for your operating system from the above-given link.
- Once the download is done open the .exe file.
- Agree to the licence agreement and select if the IDE should be installed to all users or not and click on “Next” to continue.
- Select the location in which you want the IDE to install if you want to change the location or keep it default and click on “Install”
- Wait for the installer to finish installation, and click on “Close”.

4.2 OUTPUTS:

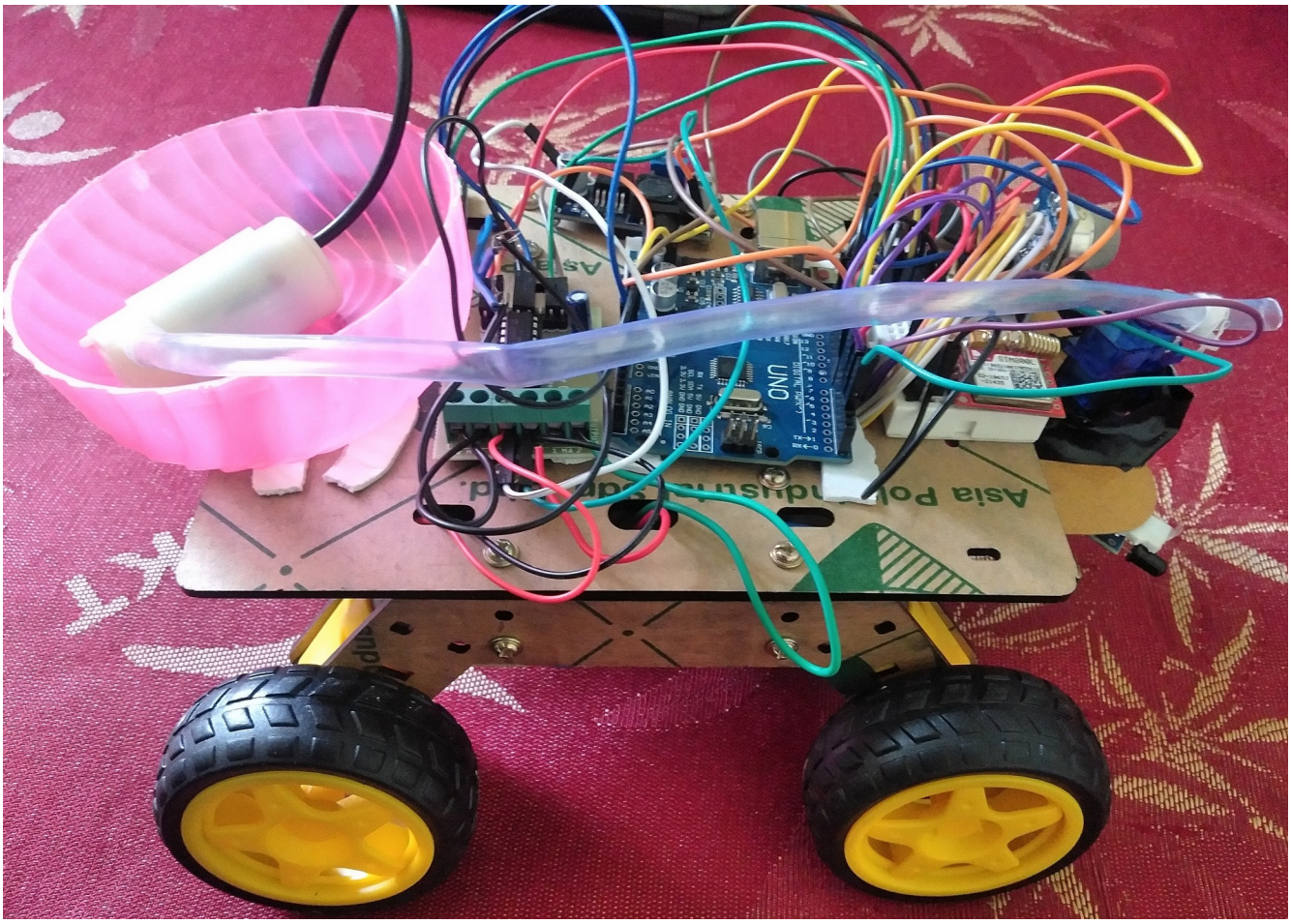


fig 4.2.1 fire fighting vehicle with sms and call alert

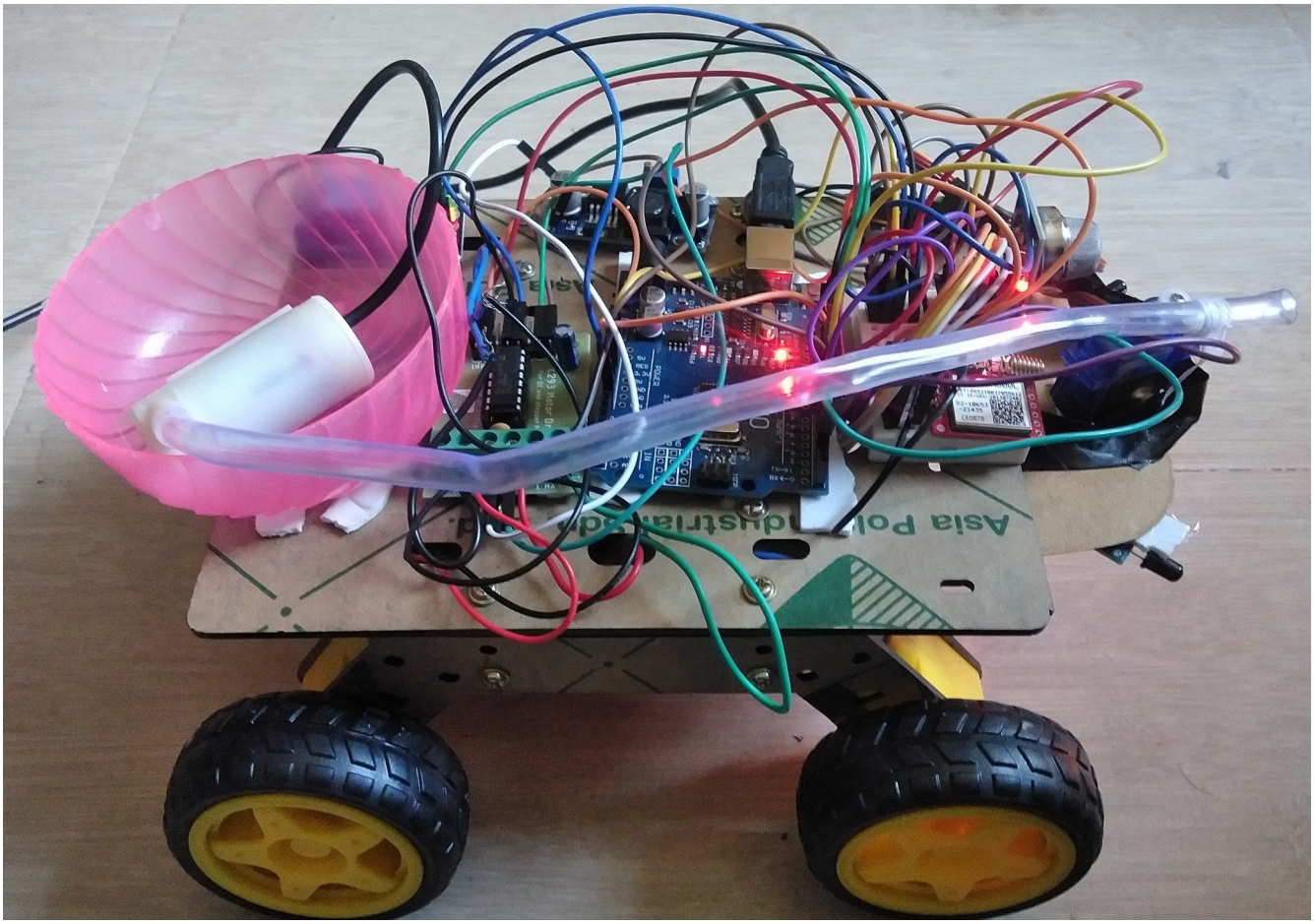


fig 4.2.2 fire fighting vehicle with sms and call alert

When fire detected at flame sensores then the vehicle move to that place and pumps water on that fire and sends a SMS and call alert to specified phone number.

The vehicle detects the smoke with help of MQ2 sensor and then sends an SMS and call alert to the specified phone number.

Here we placed three flame sensors in front of the vehicle ,if middle sensor detects the fire then vehicle moves to straight and if right sensor detects the fire the vehicle moves right side and pumps water then sends SMS and call alert.If left sensor detects the fire the vehicle moves to left side and pumps water and then sends a SMS and call alert to phone.

The vehicle sends SMS and call alert with Sim 800l module and buck converter.In code we mentioned phone number to that number the sms and call alert sends the sim800l when fire is detected.

CHAPTER 5
RESULTS AND ANALYSIS

5.1 BENEFITS AND DEMERITS OF FIRE FIGHTING VEHICLE WITH SMS AND CALL ALERT

There are several benefits that Fire fighting vehicle with sms and call alert uses.

Benefits:

- These two sensors can automatically detect fire and smoke & the robot navigates itself to the source of the fire & start extinguishing it by using the fire extinguishing system.
- This robot also consists with a container on top of the servo motor in order to control the path where water is being sprayed on.
- Prevention from dangerous incidents.
- Minimization of o ecological consequences.
- financial loss can be prevented.
- A threat to a human life can be minimized.
- No supervision is required to control robot

Demerits:

- Firefighting robots have limited reach and may not be able to get close enough to put out the fire.
- Firefighting robots have limited sensors to detect the fire, making it difficult to determine the exact location and size of the fire.
- It is applicable only for shorter distances
- Doesn’t predict nor interfere with operator’s thoughts.
- Cannot force directly the operator to work.

5.2 Applications:

- Can be used in extinguishing fire where probability of explosion is high. For eg. Hotel kitchens, LPG/CNG gas stores, etc.
- Can be used in Server rooms for immediate action in case of fire
- Can be used in extinguishing fire where probability of explosion is high. For eg.
- Hotel kitchens, LPG/CNG gas stores, etc.
- Every working environment requiring permanent operator's attention, At power
- plant control rooms
- Can be used in serach and rescue operation
- Can Used in domestic cold storage places
- Can be used in server rooms.
- Extinguishes fire where probability of explosion is high.
- Disaster area monitoring and rescue.
- Usable in power plant control rooms,captain bridges,Flight control centers.
- Can Used in domestic cold storage places

5.3 Advantages:

- Code compatibility and expandability across different Arduino boards.
- Cost is less as Arduino is open source.
- The schematic of Arduino is open source. So for future enhancement of the project the board can be extended to add more hardware features.
- Flame sensors detect the fire and MQ2 sensor detect smoke.
- It can be used for rescue of people by implementing more.
- In vehicle can be used in anywhere to outbreak the fire.

5.4 OBSERVATION AND RESULTS

Different experiments were conducted and the performance of the Fire fighting vehicle was tested. Test was performed on the flame and MQ2 sensor. It was noted that the sensor was working accurately within a range . Then we performed the test to check whether the vehicle sending the SMS and call alert properly to the specified mobile number.

Then we checked the serial communication between Arduino, L293 motor shield and various motors. On the basis of results obtained from these tests and experiments, we made the necessary changes in the processing and control algorithm. After the completion, we observed that the results produced were very satisfying the vehicle was perfectly detecting the fire and smoke and also pumping the water with the help of waterpump and also sending SMS and call alert to mobile number.

Hence the objective of implementing a good Fire fighting vehicle with SMS and call alert was achieved.

5.5 CONCLUSION

The development of firefighting vehicle with an SMS alert and call alert feature has been developed and implemented. This study has therefore provided a solution to the problem of a sudden fire outbreak by developing an extinguishing robot for a fire outbreak.The sensors used in this design can sense both gas leakages and fire with high sensitivity. In the case of a fire outbreak, the system is designed to work for three hours provided the 18650 lithium-ion battery is fully charged. The major drawback of the system from the test is the dependence on the SIM800L module, in places with no network coverage the SIM800L won't be able to send an SMS notification.

5.6 FUTURE SCOPE

The project has been motivated by the desire to design a system that can detect fires and take appropriate action, without any human intervention. The development of sensor networks and the maturity of robotics suggests that we can use mobile agents for tasks that involve perception of an external stimulus and reacting to the stimulus, even when the reaction involves a significant amount of mechanical actions. This provides us the opportunity to pass on to robots tasks that traditionally humans had to do but were inherently life- threatening. Fire-fighting is an obvious candidate for such automation.Given the number of lives lost regularly in fire- fighting, the system we envision is crying for adoption. Our experience suggests that designing a fire-fighting system with sensors and robots is within the reach of the current sensor network and mobile agent technologies.Furthermore, we believe that the techniques developed in this work will carry over to other areas involving sensing and reacting to stimulus, where we desire to replace the humanwith an automated mobile agent.However, there has been research on many of these pieces in different contexts,

e.g. coordination among mobile agents, techniques for detecting and avoiding obsta cles,on-thefly communication between humans and mobile agents, etc. It will be bothinteresting and challenging to put all this together into a practical, autonomous fire-fighting service.

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