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BONAFIDE CERTIFICATE

Certified that the report is based on the bonafide work of

Mr._____with Examination Register Number_____who carried out the project work under my supervision, during the year 2020-2021.

HEAD OF THE DEPARTMENT **PROJECT GUIDE**

Submitted for the Examination held on_____

INTERNAL EXAMINER **EXTERNAL EXAMINER**

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FABRICATION OF GESTURE CONTROLLED WHEEL CHAIR

CHAPTER-1

ABSTRACT

Nowadays, in India the number of disabled individuals is increasing every year. For patient's mobility aids are useful for transportation and a replacement for walking especially in indoor and outdoor environment as well. Wheelchairs and stretchers are commonly used medical equipment's for the transportation. There is always an issue faced by the attendant or nurse of transferring the patients from wheelchair to stretcher or to the medical bed. Understanding the various issues regarding the mobility equipment and introducing a better design will be an asset for the medical field for disabled individuals.

While the needs of many individuals with disabilities can be satisfied with power wheelchairs, some members of the disabled community find it difficult or impossible to operate a standard power wheelchair. To accommodate this population, several researchers have used technologies originally developed for mobile robots to create "smart wheelchairs" that reduce the physical, perceptual, and cognitive skills necessary to operate a power wheelchair. Normally a power wheelchair contains lots of sensors and laptops for various applications. It leads to more cost on the system. In this project we propose a prototype of a smart wheelchair system with low cost and easy control mechanism using RF and MEMS SENSOR wireless Communication.

CHAPTER-2

INTRODUCTION

A mobility aid is a device designed to assist walking or otherwise improve the mobility of people with mobility impairment. Engineering sciences have come up with numerous aids for the patients. Out of these, mechanical aids for physically impaired, especially for immobile patients are a major class. This paper is Stretcher to wheel chair convertible device. The wheel chair can be converted to a stretcher whenever necessary with patient onboard. The transformation is very smooth and can be made possible just with a press of a button.

This is made possible using a pneumatic system, which is first of its kind. Hydraulic based systems are already available in the market. However, due to its higher cost, complexity and maintenance requirements makes its usability sacrificed. The reason why the pneumatic system was not used in this system was its jerking behavior since air used in pneumatic system is compressible when compared to liquids. This drawback is overcome using a shock absorber system, which make the working smoother. So by making this system pneumatic, all the disadvantages of hydraulic based system is nullified and can make the system more user friendly.

Methodology and Materials

The course of our work begins with the planning phase involving initial research, literature survey and background study. It is followed by concept generation phase that includes evaluating existing wheel chair, customer requirements and concept designs. Prototyping the wheelchair into complete bed using pneumatic system by means of 2-5 bar pressure and we progress towards testing a feasible model. Collection of all the equipment's and materials required for overall wheel chair cum bed enhancement setup. Forming of a light weight wheel chair cum bed structure which would carry up to 80-90 kg.

Successfully coding of a specific program, which would run the device directionally by using Arduino board. Implementation and connection of all the equipments like motors, Arduino board, accelerometer and other sensors together. Implementation of pneumatic cylinders, which would converts the Wheel chair into Bed and lifts the wheel chair into adjustable height.

The major components that are involved in the fabrication of the wheel chair cum stretcher are as follows. Pneumatic cylinder, Wheel chair model, Lead screw arrangement, Motor, Rolling wheels, Battery, Arduino Board, Bluetooth Device.

CHAPTER-3

LITERATURE SURVEY

[1]. Sakurako Hamatani, Toshiyuki Murakami, "A novel steering mechanism of a two-wheeled wheelchair for stability improvement" on the proceeding of Industrial Electronics Society, IECON 2015 - 41st Annual Conference of the IEEE.

In this paper, a control method to improve the static stability of two-wheeled wheel chair is proposed. The two-wheeled wheel chair is the wheel chair without caster wheels, and moves and stabilizes with only two wheels. It has good operability and capability to go over a step. However, two-wheeled wheel chair has difficulty in statical stabilization because of the structure. In this paper, the steering system is introduced to the two-wheeled wheel chair. The effect of braking force from the higher inertia and the strain of tires are considered. A miniaturized two-wheeled wheel chair with steering motors is made to conduct experiments. The validity of proposed method is checked through experiment, and the results are evaluated by the movement distance and the change of pitch angle.

[2]. Rajesh Kannan Megalingam, G B Vishnu, Meera Pillai, "Development of intelligent wheelchair simulator for indoor navigation simulation and analysis" on the proceedings of Electrical and Computer Engineering (WIECON-ECE), 2015 IEEE International WIE Conference.

Disabilities affect majority of the world population nowadays. Autonomous wheelchair is one of the major assistive systems proposed for the disabled people to meet their daily locomotion challenges. Different algorithm and techniques can be used to find the optimal path in these types of intelligent wheelchair to navigate from a source to destination. Notable change in performance can be observed while testing with different algorithms and techniques. As the real-world scenarios are so dynamic, replication of different test cases each time with the changing specification of the intelligent wheelchair for study is a strenuous process. Simulation study helps to analyze the different characteristics and behavior of the intelligent wheelchair without much strain. In this paper we describe the detailed study of fixed path algorithm and behavior of the autonomous wheelchair using simulation technique. We hope that such systems would be of great help in the rehabilitation process of the people affected by disaster, conflicts etc. apart from supporting elders.

[3]. Mohammed Faeik Ruzaij, Sebastian Neubert, Norbert Stoll, Kerstin Thurow, "Design and testing of low-cost three modes of operation voice controller for wheelchairs and rehabilitation robotics" on the proceedings of Intelligent Signal Processing (WISP), 2015 IEEE 9th International Conference.

People who have lost their walking and moving ability need to use a wheelchair. In cases of losing complete control of the upper and lower limbs, intelligent solutions are required to ensure the autonomy and independence of those patients. The intelligent application must be designed carefully to use the available self-controlled electrical and

physical activity of the patient's body like sound, Electromyogram (EMG), Electrooculogram (EOG) and body movement as an input control signal. In this paper, we describe the design and implementation of three modes of operation for a voice controller: the sound dependent (SD) mode with dynamic time warping algorithm (DTW), the sound dependent (SD) mode with Hidden Markov Model algorithm (HMM) and the sound independent mode (SI) with text to sound independent algorithm (T2SI). The user voice command will be processed in parallel by the voice recognition (VR) algorithms and the output of the VR will be fed to the microcontroller unit (μC), which is responsible for controlling the movement and direction of the wheelchair or the rehabilitation robot.

[4]. Nida Riaz, Junaid Bin Aamir, "Electrical wheelchair with retractable solar panels" on the proceedings of Energy Systems and Policies (ICESP), 2014 International Conference.

Wheelchairs have evolved from just being a chair with wheels to completely automated personal mobility vehicles to assist the handicaps. This research highlights the importance of non-conventional energy source i.e. solar energy and uses it for the advancement of wheelchair technology; an electrically controlled wheelchair with retractable solar panels, a concept inspired by the design of retractable roofs of convertible automobiles. The research paper explains designing and fabricating a solar wheelchair based on two aspects of engineering: designing of electrical circuit and mechanical assembling of wheelchair. All the electrical and mechanical components are discussed with specifications in detail. Some innovations are made to provide a user-friendly experience for the disabled.

[5]. Rini Akmeliawati, Faez S. Ba Tis, Umar J Wani, "Design and development of a hand-glove controlled wheelchair" on the proceedings of Mechatronics (ICOM), 2011, 4th international conference.

Wheelchairs are a way of reincarnating the purpose of life in the lives of disabled people. Effective and efficient ways of delivering a cost-effective and affordable wheelchair to the common masses, which is not only at par with the present-day technology, but is much easier to use are presented herewith. Replacement of the popular joystick stick controlled wheel chair with a hand-glove control system for easier maneuvering by bending the fingers, is discussed in this paper. Intended users control the system by wearing an instrumented glove fitted with flex or bend sensors for controlling the movement and direction of the wheelchair. Uni-directional wireless communication exists between the instrumented gloves and the controller which is sandwiched between the user's seat and the wheels. Initial design results are also presented in this paper. The technologies presented in this paper suggest a wide domain of possibilities to a wide variety of users. In addition, it also aims at making a cost-effective chair so that more hi-tech wheelchairs are made use of, widely, by people with disabilities.

CHAPTER-4

EXISTING SYSTEM

Manual or traditional wheelchairs are the type of wheelchair that is mostly used by a layman. A middle-class person cannot afford power wheelchair so they use the traditional Manual wheelchair. These chairs are to be manually powered and this creates a big problem for the disabled to locomote from one place to another without an attendee.

Presently in market smart wheelchairs are available but are not affordable by common men. They are powered using high power battery and super torque motors so proportionally the cost of the product also increases. The motion provided to the chair is by the use of Joystick and Toggle switch and a person who is 90 – 95 % handicapped cannot drive the wheelchair. So, these types of peoples require an attendee or a care taker with them.

DISADVANTAGE

- The disabled to locomote from one place to another without an attendee.
- The motion provided to the chair is by the use of Joystick and Toggle switch and a person who is 90 – 95 % handicapped cannot drive the wheelchair.

CHAPTER-5

PROPOSED SYSTEM

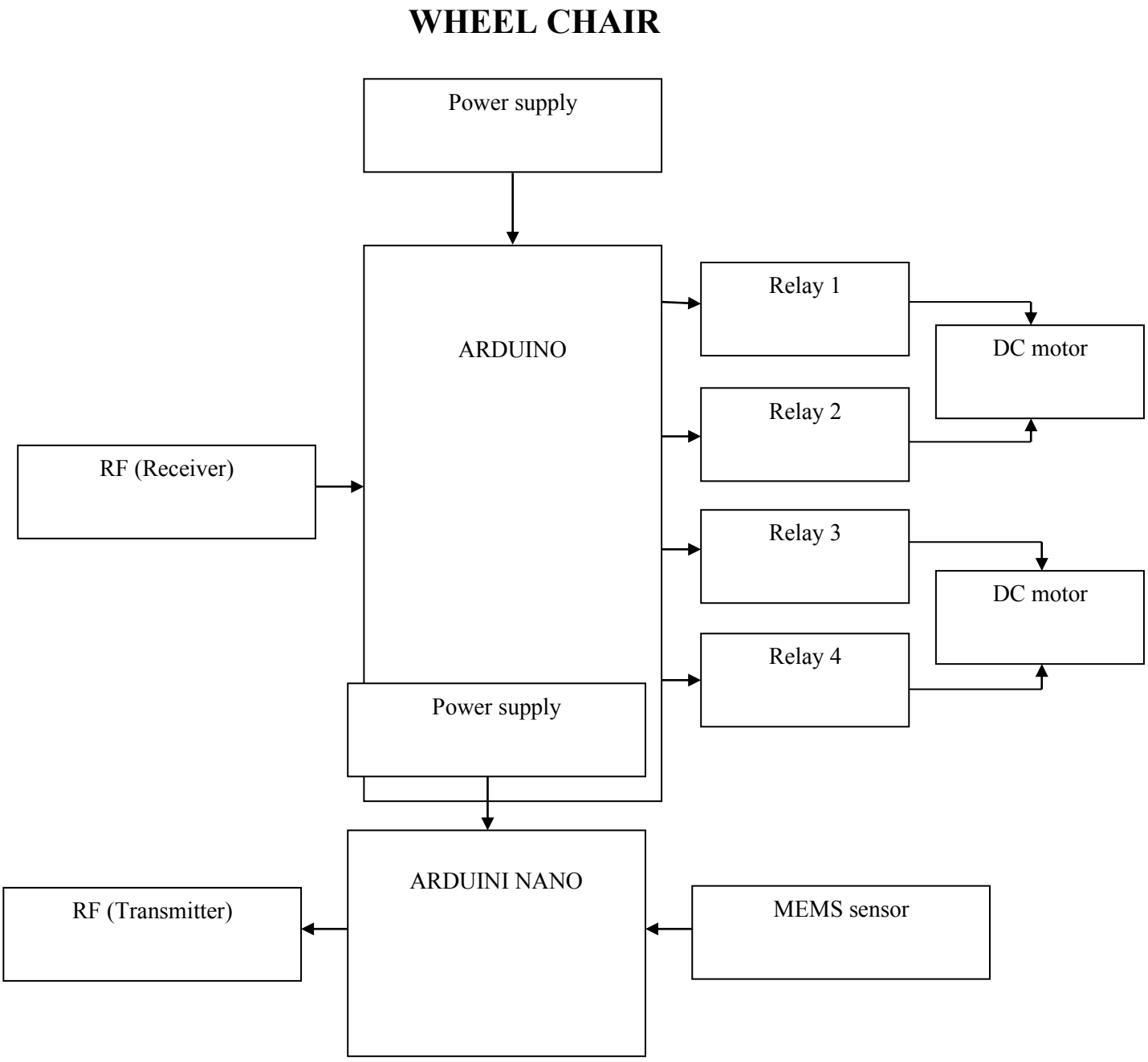
In a proposed system, we are hereby proposing a new advanced smart wheelchair for the physically disabled persons who are not financially sound for purchasing a power or smart wheelchair as the cost is very high. So we designed a wheelchair which is much more efficient, much smarter, more maneuverable, having précised control for motion, on chair room automation system, control using RF. As we are providing many options for a better motion, the type of drive is selected by the user depending upon the choice and requirement of the user. The system proposed is totally controlled by a microcontroller Arduino. Then From the hand movement through RF transmitter to RF receiver control the wheel chair which serves the purpose of transmission of the signal to Arduino attached in the switch board with the relay control circuit for the operation of the devices or equipment connected in the room. Here a four channel relay which is driven by the ULN 2003 driver connected to the microcontroller for the operation.

ADVANTAGE

- Easy to use.
- We can control the chair through Bluetooth.
- It is interactive and close to human.
- Easy to monitor the health of disabled person

CHAPTER-6

BLOCK DIAGRAM



HARDWARE REQUIREMENTS

- Power supply
- Arduino uno
- RF transmitter and receiver
- Relay board
- Dc motor
- Arduino nano
- Mems sensor

SOFTWARE REQUIREMETS

- ARDUINO_IDE
- EMBEDDED C

CHAPTER-7
HARDWARE DESCRIPTION
ARDUINO UNO

GENERAL DESCRIPTION

Arduino is an open-source project that created microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices. The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers. These systems provide sets of digital and analog input/output (I/O) pins that can interface to various expansion boards (termed shields) and other circuits. The boards feature serial communication interfaces, including Universal Serial Bus (USB) on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named Processing, which also supports the languages C and C++.

PRODUCT DESCRIPTION

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, 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. Arduino Uno has a number of facilities for communicating with a computer, another Arduino board, or other microcontrollers.



Arduino UNO

ATMEGA328P-PU microcontroller

The most important element in Arduino Uno R3 is ATMEGA328P-PU is an 8-bit Microcontroller with flash memory reach to 32k bytes. It's features as follow:

- High Performance, Low Power AVR

- Advanced RISC Architecture
    - 131 Powerful Instructions – Most Single Clock Cycle Execution
    - 32 x 8 General Purpose Working Registers
    - Up to 20 MIPS Throughput at 20 MHz
    - On-chip 2-cycle Multiplier

- High Endurance Non-volatile Memory Segments
    - 4/8/16/32K Bytes of In-System Self-Programmable Flash program memory
    - 256/512/512/1K Bytes EEPROM
    - 512/1K/1K/2K Bytes Internal SRAM
    - Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
    - Data retention: 20 years at 85°C/100 years at 25°C
    - Optional Boot Code Section with Independent Lock Bits
    - In-System Programming by On-chip Boot Program
    - True Read-While-Write Operation
    - Programming Lock for Software Security

- Peripheral Features
    - Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode
    - One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode

- Real Time Counter with Separate Oscillator
- Six PWM Channels
- 8-channel 10-bit ADC in TQFP and QFN/MLF package
- Temperature Measurement
- 6-channel 10-bit ADC in PDIP Package
- Temperature Measurement
- Programmable Serial USART
- Master/Slave SPI Serial Interface
- Byte-oriented 2-wire Serial Interface (Philips I2 C compatible)
- Programmable Watchdog Timer with Separate On-chip Oscillator
- On-chip Analog Comparator
- Interrupt and Wake-up on Pin Change

- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated Oscillator
  - External and Internal Interrupt Sources
  - Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby

- I/O and Packages
  - 23 Programmable I/O Lines
  - 28-pin PDIP, 32-lead TQFP, 28-pad QFN/MLF and 32-pad QFN/MLF

- Operating Voltage
  - 1.8 - 5.5V

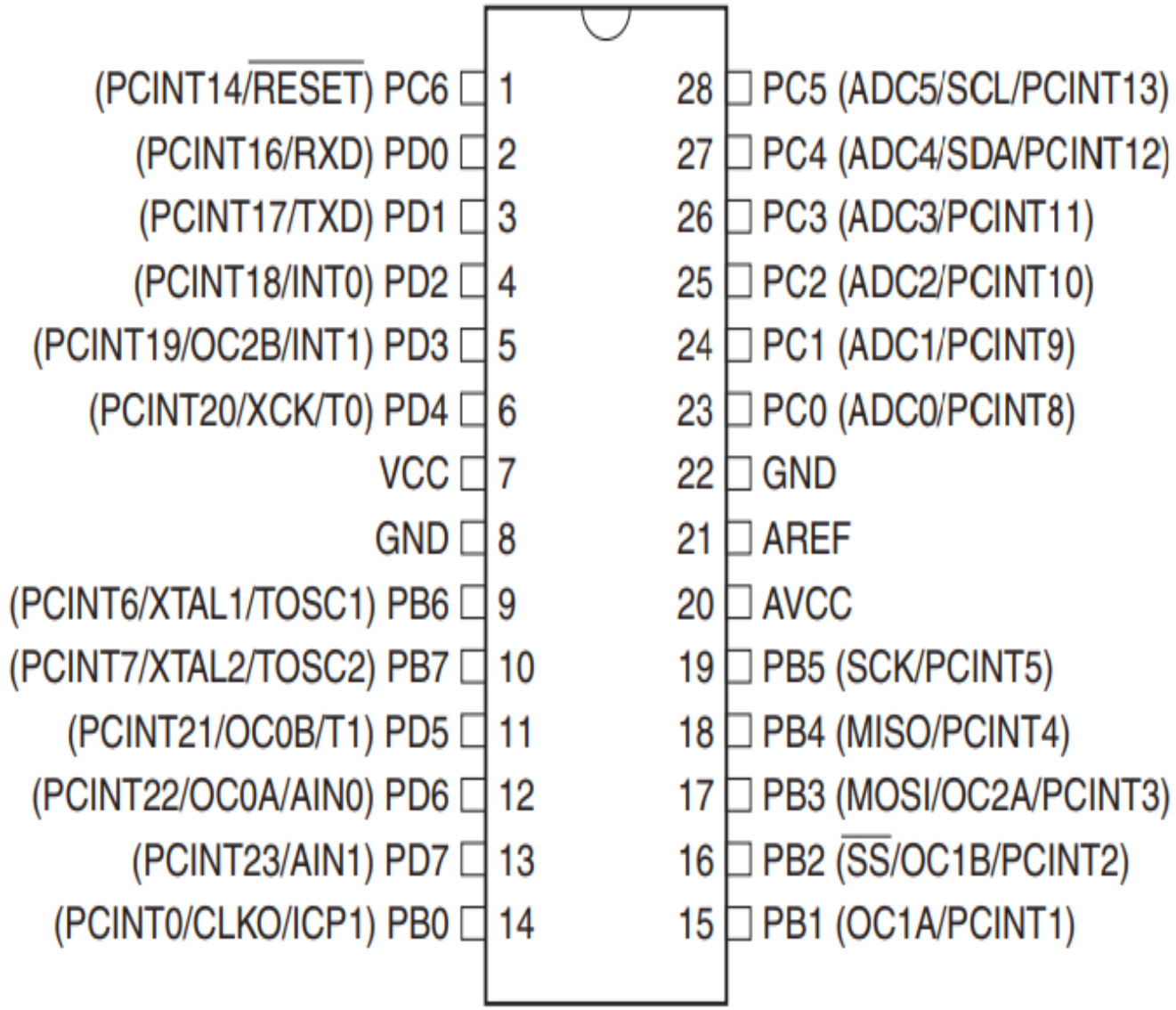
- Temperature Range

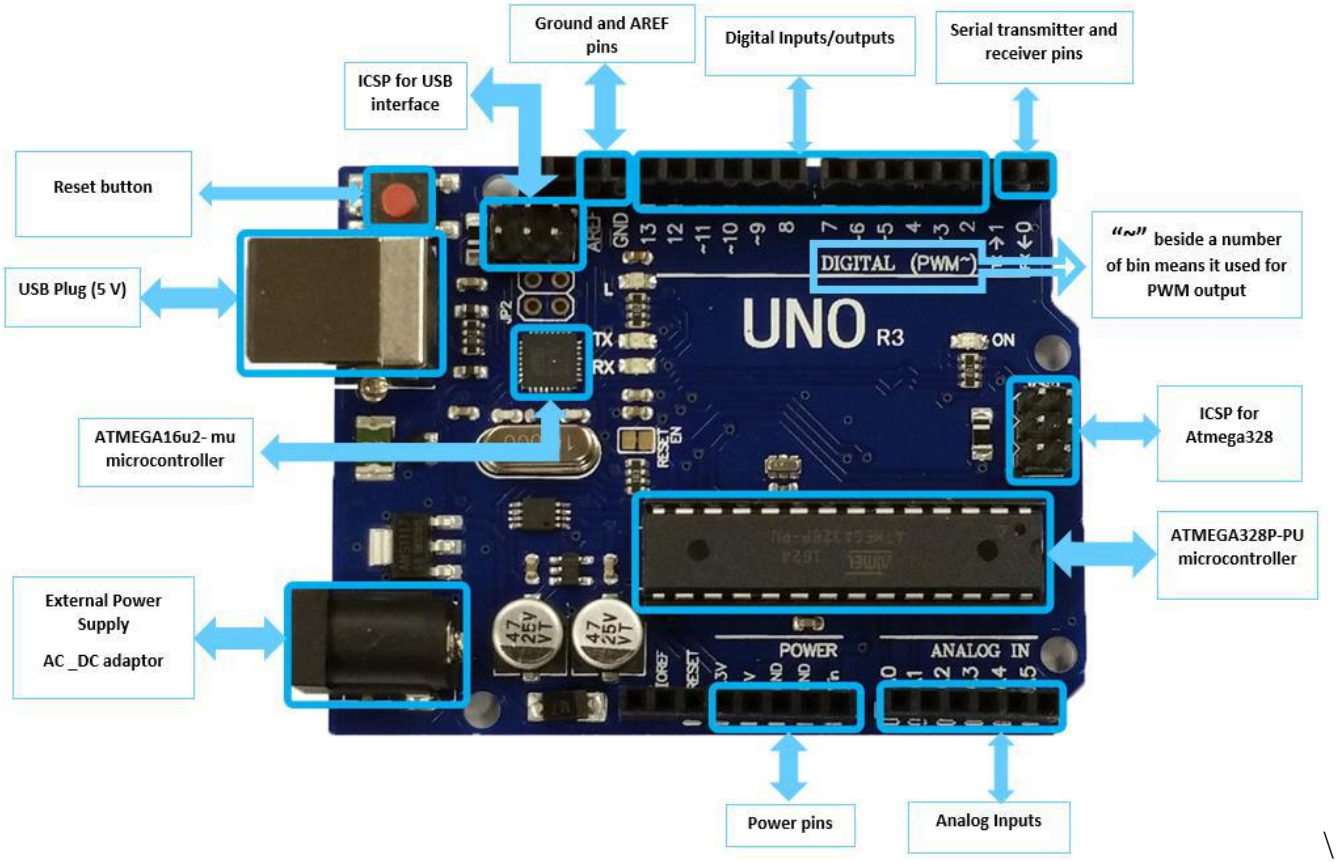
    - -40°C to 85°C

- Speed Grade
    - 0 - 4 MHz@1.8 - 5.5V, 0 - 10 MHz@2.7 - 5.5.V, 0 - 20 MHz @ 4.5 - 5.5V

- Power Consumption at 1 MHz, 1.8V, 25°C
    - Active Mode: 0.2 mA
    - Power-down Mode: 0.1 μA
    - Power-save Mode: 0.75 μA (Including 32 kHz RTC)

PIN CONFIGURATION





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FEATURES

- Microcontroller: ATmega328P
- Operating voltage: 5V
- Input voltage: 7-12V
- Flash memory: 32KB
- SRAM: 2KB
- EEPROM: 1KB

APPLICATIONS

- Real time biometrics
- Robotic applications
- Academic applications

16×2 LCD

GENERAL DESCRIPTION

LCD stands for liquid crystal display. They come in many sizes 8x1 , 8x2 , 10x2 , 16x1 , 16x2 , 16x4 , 20x2 , 20x4 ,24x2 , 30x2 , 32x2 , 40x2 etc . Many multinational companies like Philips Hitachi Panasonic make their own special kind of LCD'S to be used in their products. All the LCD'S performs the same functions (display characters numbers special characters ASCII characters etc).Their programming is also same and they all have same 14 pins (0-13) or 16 pins (0 to 15). Alphanumeric displays are used in a wide range of applications, including palmtop computers, word processors, photocopiers, point of sale terminals, medical instruments, cellular phones, etc.

PRODUCT DESCRIPTION

This is an LCD Display designed for E-blocks. It is a 16 character, 2-line alphanumeric LCD display connected to a single 9-way D-type connector. This allows the device to be connected to most E-Block I/O ports. The LCD display requires data in a serial format, which is detailed in the user guide below. The display also requires a 5V power supply. Please take care not to exceed 5V, as this will cause damage to the device. The 5V is best generated from the E-blocks Multi programmer or a 5V fixed regulated power supply.

The 16 x 2 intelligent alphanumeric dot matrix displays is capable of displaying 224 different characters and symbols. A full list of the characters and symbols is printed on pages 7/8 (note these symbols can vary between brand of LCD used). This booklet provides all the technical specifications for connecting the unit, which requires a single power supply (+5V).



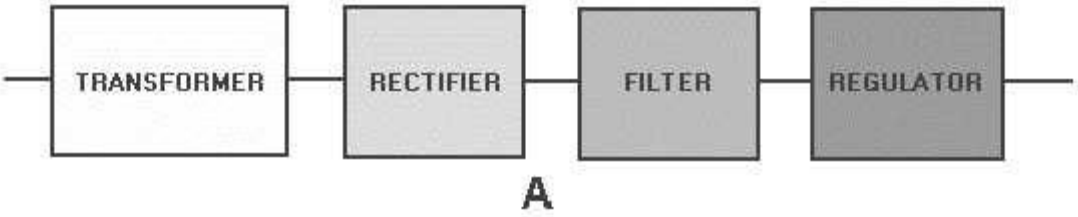
FEATURES

- Input voltage: 5v
- E-blocks compatible
- Low cost
- Compatible with most I/O ports in the E-Block range
- Ease to develop programming code using Flow code

POWER SUPPLY

DEFINITION

A power supply (sometimes known as a power supply unit or PSU) is a device or system that supplies electrical or other types of energy to an output load or group of loads. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.



Block diagram of a basic power supply

The transformer steps up or steps down the input line voltage and isolates the power supply from the power line. The RECTIFIER section converts the alternating current input signal to a pulsating direct current. However, as you proceed in this chapter you will learn that pulsating dc is not desirable. For this reason a FILTER section is used to convert pulsating dc to a purer, more desirable form of dc voltage.

The final section, the REGULATOR, does just what the name implies. It maintains the output of the power supply at a constant level in spite of large changes in load current or input line voltages. Now that you know what each section does, let's trace an ac signal through the power supply. At this point you need to see how this signal is altered within each section of the power supply. Later on in the chapter you will see how these changes take place. In view B of figure 4-1, an input signal of 115 volts ac is applied to the primary of the transformer. The transformer is a step-up transformer with a turns ratio of 1:3. You can calculate the output for this transformer by multiplying the input voltage by the ratio of turns in the primary to the ratio of turns in the secondary; therefore, 115 volts ac ´ 3 = 345 volts ac (peak-to- peak) at the output. Because each diode in the rectifier section conducts for 180 degrees of the 360-degree input, the output of the rectifier will be one-half, or approximately 173 volts of pulsating dc. The filter section, a network of resistors, capacitors, or inductors, controls the rise and fall time of the varying signal; consequently, the signal remains at a more constant dc level. You will see the filter process more clearly in the discussion of the actual filter circuits. The output of the filter is a signal of 110 volts dc, with ac ripple riding on the dc. The reason for the lower voltage (average voltage) will be explained later in this chapter. The regulator maintains its output at a constant 110-volt dc level, which is used by the electronic equipment (more commonly called the load).

Simple 5V power supply for digital circuits

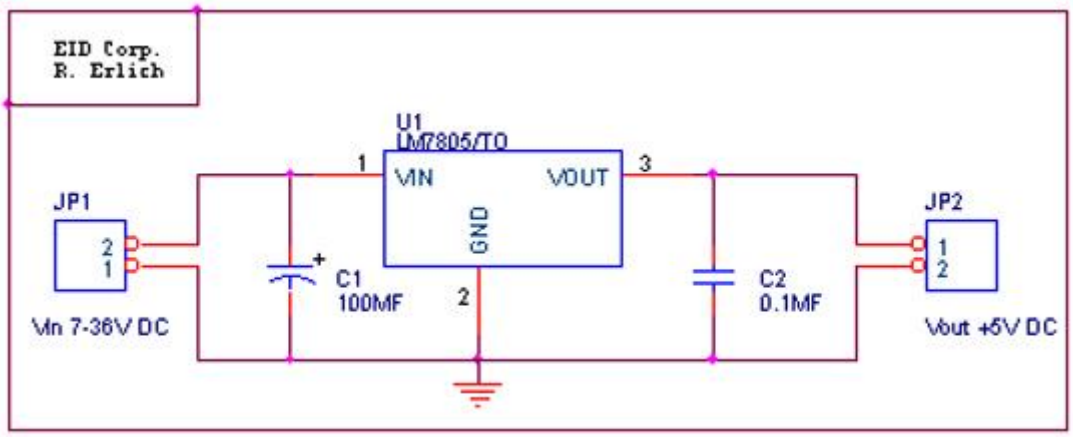
- Brief description of operation: Gives out well regulated +5V output, output current capability of 100 mA
- Circuit protection: Built-in overheating protection shuts down output when regulator IC gets too hot
- Circuit complexity: Very simple and easy to build
- Circuit performance: Very stable +5V output voltage, reliable operation
- Availability of components: Easy to get, uses only very common basic components
- Design testing: Based on datasheet example circuit, I have used this circuit successfully as part of many electronics projects

- Applications: Part of electronics devices, small laboratory power supply
- Power supply voltage: Unregulated DC 8-18V power supply
- Power supply current: Needed output current + 5 mA
- Component costs: Few dollars for the electronics components + the input transformer cost

CIRCUIT DESCRIPTION

This circuit is a small +5V power supply, which is useful when experimenting with digital electronics. Small inexpensive wall transformers with variable output voltage are available from any electronics shop and supermarket. Those transformers are easily available, but usually their voltage regulation is very poor, which makes then not very usable for digital circuit experimenter unless a better regulation can be achieved in some way. The following circuit is the answer to the problem.

This circuit can give +5V output at about 150 mA current, but it can be increased to 1 A when good cooling is added to 7805 regulator chip. The circuit has over overload and therminal protection.



Circuit diagram of the power supply

The capacitors must have enough high voltage rating to safely handle the input voltage feed to circuit. The circuit is very easy to build for example into a piece of Vero board.

Pinout of the 7805 regulator IC

- Unregulated voltage in
- Ground
- Regulated voltage out

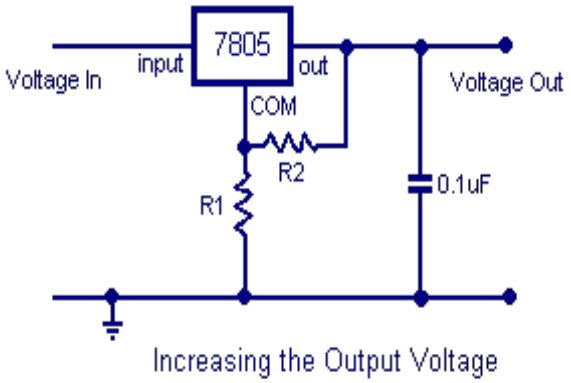
Component list

- 7805 regulator IC
- 100 uF electrolytic capacitor, at least 25V voltage rating
- 10 uF electrolytic capacitor, at least 6V voltage rating
- 100 nF ceramic or polyester capacitor
-

More output current

If you need more than 150 mA of output current, you can update the output current up to 1A doing the following modifications:

- Change the transformer from where you take the power to the circuit to a model which can give as much current as you need from output
- Put a heat sink to the 7805 regulator (so big that it does not overheat because of the extra losses in the regulator)



RF (RADIO FREQUENCY)

GENERAL DESCRIPTION

nRF24L01 is a single chip radio transceiver for the world wide 2.4 - 2.5 GHz ISM band. The transceiver consists of a fully integrated frequency synthesizer, a power amplifier, a crystal oscillator, a demodulator, modulator and Enhanced ShockBurst™ protocol engine. Output power, frequency channels, and protocol setup are easily programmable through a SPI interface. Current consumption is very low, only 9.0mA at an output power of -6dBm and 12.3mA in RX mode. Built-in Power Down and Standby modes makes power saving easily realizable.



BLOCK DIAGRAM

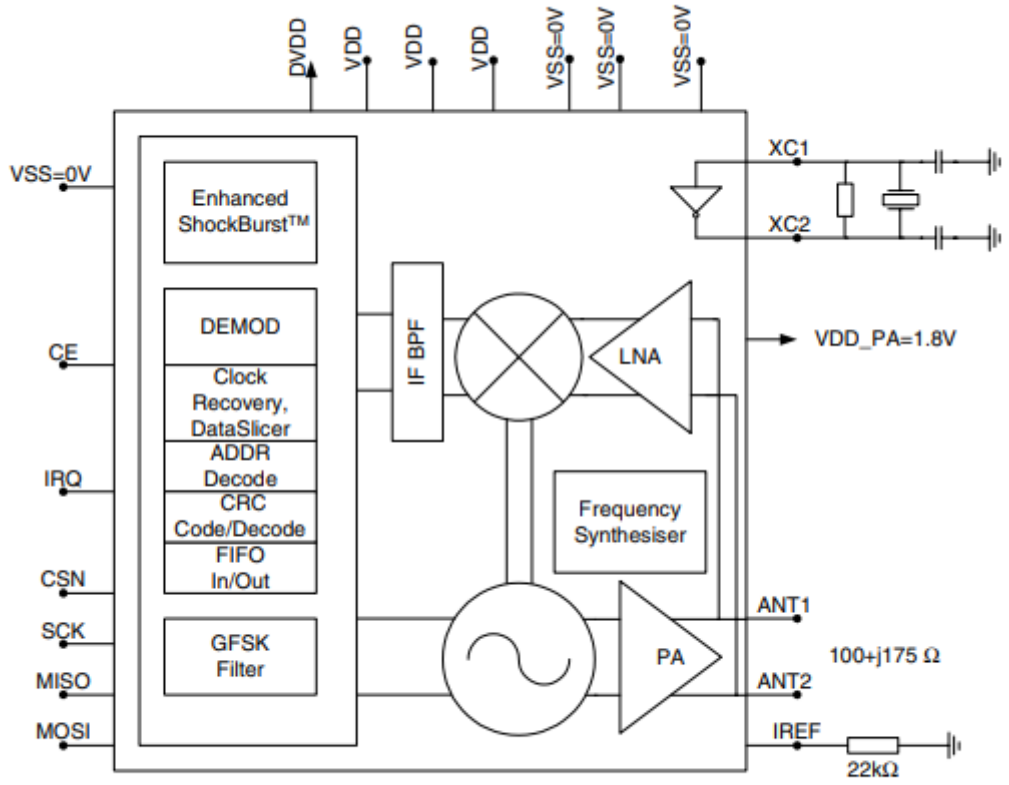
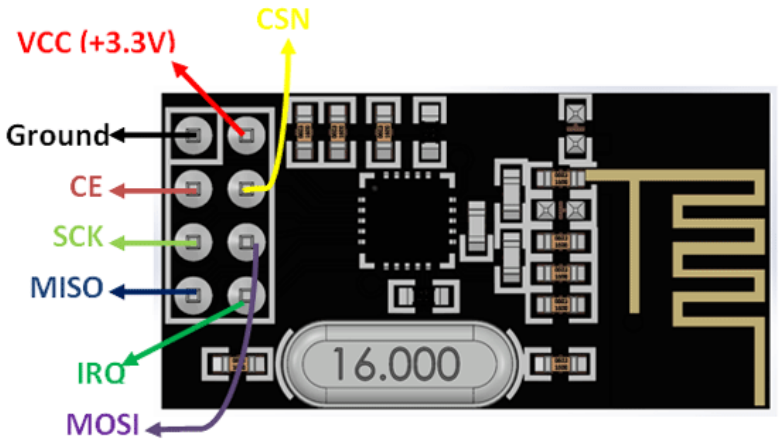


Figure 1 nRF24L01 with external components.



nRF24L01 Pin Configuration

Pin Number	Pin Name	Abbreviation	Function
1	Ground	Ground	Connected to the Ground of the system
2	Vcc	Power	Powers the module using 3.3V

3	CE	Chip Enable	Used to enable SPI communication
4	CSN	Ship Select Not	This pin has to be kept high always, else it will disable the SPI
5	SCK	Serial Clock	Provides the clock pulse using which the SPI communication works
6	MOSI	Master Out Slave In	Connected to MOSI pin of MCU, for the module to receive data from the MCU
7	MISO	Master In Slave Out	Connected to MISO pin of MCU, for the module to send data from the MCU
8	IRQ	Interrupt	It is an active low pin and is used only if interrupt is required

FEATURES

- 2.4GHz RF transceiver Module
- Operating Voltage: 3.3V
- Nominal current: 50mA
- Range : 50 – 200 feet
- Operating current: 250mA (maximum)
- Communication Protocol: SPI
- Baud Rate: 250 kbps - 2 Mbps.
- Channel Range: 125
- Maximum Pipelines/node : 6
- Low cost wireless solution

APPLICATIONS

- Wireless mouse, keyboard, joystick
- Keyless entry
- Wireless data communication
- Alarm and security systems
- Home automation
- Surveillance
- Automotive

- Telemetry
- Intelligent sports equipment
- Industrial sensors
- Toys

RELAY BOARD

GENERAL DESCRIPTION

Relays are simple switches which are operated both electrically and mechanically. Relays consist of an electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits. They were used to switch the signal coming from one source to another destination. The high end applications of relays require high power to be driven by electric motors and so on. Such relays are called contactors.



PRODUCT DESCRIPTION

A relay is an electromechanical switch which is activated by an electric current. A four relay board arrangement contains driver circuit, power supply circuit and isolation circuit. A relay is assembled with that circuit. The driver circuit contains transistors for switching operations. The transistor is use for switching the relay. An isolation circuit prevents reverse voltage from the relay which protects the controller and transistor from damage. The input pulse for switching the transistor is given from the microcontroller unit. It is used for switching of a four device.

FEATURES

- Input voltage: 12VDC
- Driver unit: ULN2003A
- Isolation unit: In4007
- Fast switching
- Motor forward and reverse operation

APPLICATIONS

- Ac load Switching applications
- Dc load Switching applications
- Motor switching applications

WIPER MOTOR (PERMANENT MAGNET D.C. MOTOR)

DESCRIPTION OF DC MOTOR

An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left-hand rule.

When a motor is in operation, it develops torque. This torque can produce mechanical rotation. DC motors are also like generators classified into shunt wound or series wound, or compound wound motors.

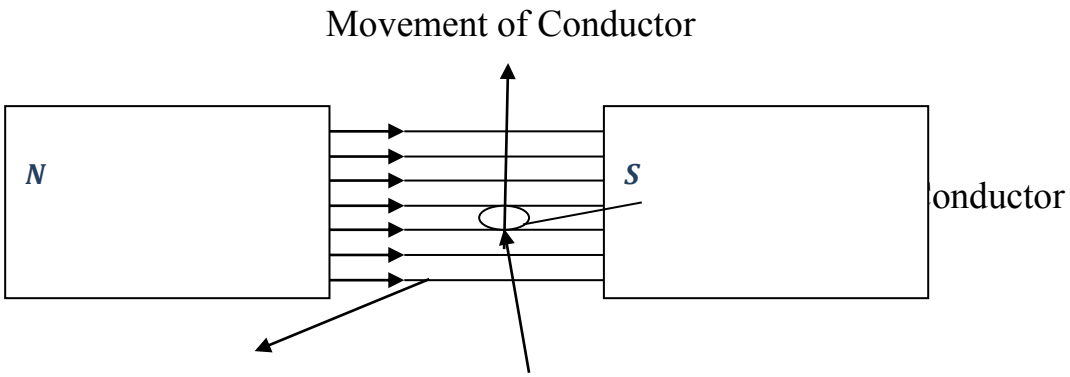
FLEMING'S LEFT HAND RULE

Keep the force finger, middle finger and thumb of the left hand mutually perpendicular to one another. If the fore finger indicates the direction of magnetic field and middle finger indicates direction of current in the conductor, then the thumb indicates the direction of the motion of conductor.

PRINCIPLE OF OPERATION OF DC MOTOR

Figure I show a uniform magnetic field in which a straight conductor carrying no current is placed. The conductor is perpendicular to the direction of the magnetic field.

In figure II the conductor is shown as carrying a current away from the viewer, but the field due to the N and S poles has been removed. There is no movement of the conductor during the above two conditions. In figure III the current carrying conductor is placed in the magnetic field. The field due to the current in the conductor supports the main field above the conductor, but opposes the main field below the conductor.





The result is to increase the flux density in to the region directly above the conductor and to reduce the flux density in the region directly below the conductor. It is found that a force acts on the conductor, trying to push the conductor downwards as shown by the arrow. If the current in the conductor is reversed, the strengthening of flux lines occurs below the conductor, and the conductor will be pushed upwards (figure-IV).

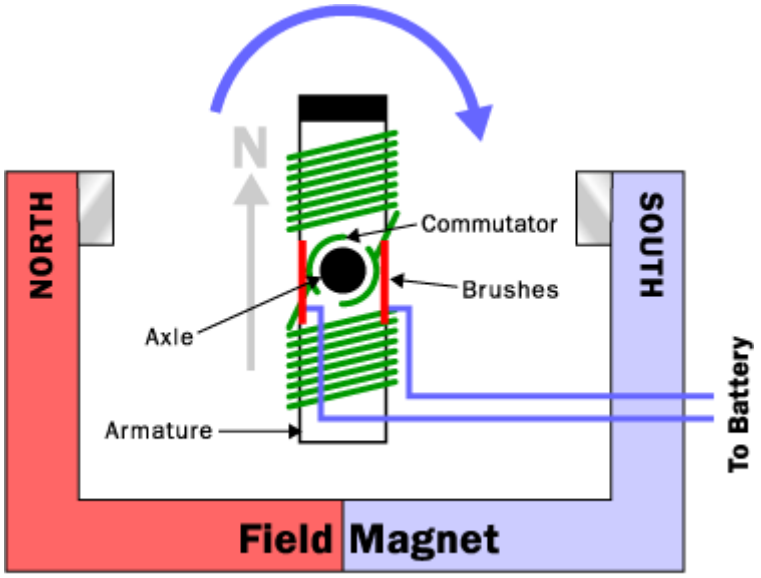
Now consider a single turn coil carrying a current as shown in the above figure. in view of the reasons given above, the coil side A will be forced to move downwards, whereas the coil side B will be forced to move upwards. The forces acting on the coil sides A and B will be of same magnitude. But their direction is opposite to one another. As the coil is wound on the armature core which is supported by the bearings, the armature will now rotate. The commutator periodically reverses the direction of current flow through the armature. Therefore the armature will have a continuous rotation.

A simplified model of such a motor is shown in figure VI. The conductors are wound over a soft iron core. DC supply is given to the field poles for producing flux. The conductors are connected to the DC supply through brushes

Let's start by looking at the overall plan of a simple 2-pole DC electric motor. A simple motor has 6 parts, as shown in the diagram below.

- An armature or rotor
- A commutator
- Brushes

- An axle
- A field magnet
- A DC power supply of some sort



An electric motor is all about magnets and magnetism: a motor uses magnets to create motion. If you have ever played with magnets you know about the fundamental law of all magnets: Opposites attract and likes repel.

So if you have 2 bar magnets with their ends marked north and south, then the North end of one magnet will attract the South end of the other. On the other hand, the North end of one magnet will repel the North end of the other (and similarly south will repel south). Inside an electric motor these attracting and repelling forces create rotational motion.

In the diagram above and below you can see two magnets in the motor, the armature (or rotor) is an electromagnet, while the field magnet is a permanent magnet (the field magnet could be an electromagnet as well, but in most small motors it is not to save power).

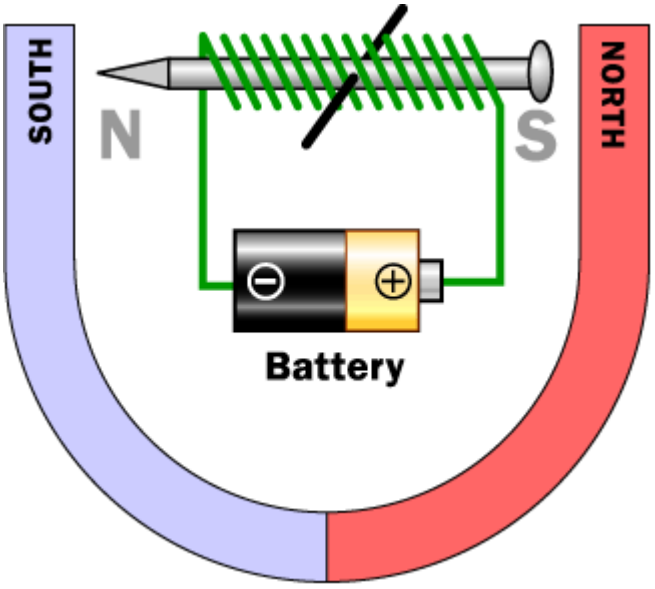
Electromagnets and Motors

To understand how an electric motor works, the key is to understand how the electromagnet works. An electromagnet is the basis of an electric motor. You can understand how things work in the motor by imagining the following scenario. Say that you created a simple electromagnet by wrapping 100 loops of wire around a nail and connecting it to a battery. The nail would become a magnet and have a North and South pole while the battery is connected.

Now say that you take your nail electromagnet, run an axle through the middle

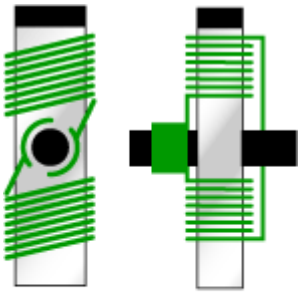
of it, and you suspended it in the middle of a horseshoe magnet as shown in the figure below. If you were to attach a battery to the electromagnet so that the North end of the nail appeared as shown, the basic law of magnetism tells you what would happen: The North end of the electromagnet would be repelled from the north end of the horseshoe magnet and attracted to the south end of the horseshoe magnet.

The South end of the electromagnet would be repelled in a similar way. The nail would move about half a turn and then stop in the position shown.



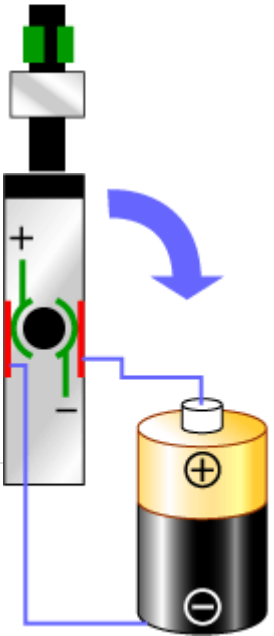
You can see that this half-turn of motion is simple and obvious because of the way magnets naturally attract and repel one another. The key to an electric motor is to then go one step further so that, at the moment that this half-turn of motion completes, the field of the electromagnet flips. The flip causes the electromagnet to complete another half-turn of motion.

You flip the magnetic field simply by changing the direction of the electrons flowing in the wire (you do that by flipping the battery over). If the field of the electromagnet flipped at just the right moment at the end of each half-turn of motion, the electric motor would spin freely.



The Armature

The armature takes the place of the nail in an electric motor. The armature is an electromagnet made by coiling thin wire around two or more poles of a metal core. The armature has an axle, and the commutator is attached to the axle. In the diagram above you can see three different views of the same armature: front, side and end-on. In the end-on view the winding is eliminated to make the commutator more obvious. You can see that the commutator is simply a pair of plates attached to the axle. These plates provide the two connections for the coil of the electromagnet.



The Commutator and brushes

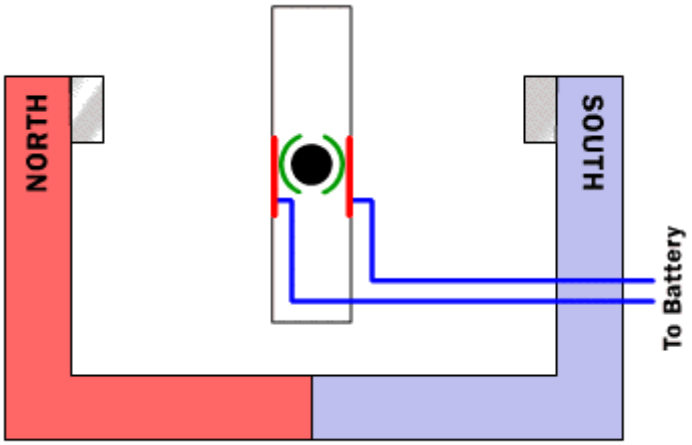
The "flipping the electric field" part of an electric motor is accomplished by two parts: the commutator and the brushes. The diagram at the right shows how the commutator and brushes work together to let current flow to the electromagnet, and also to flip the

direction that the electrons are flowing at just the right moment.

The contacts of the commutator are attached to the axle of the electromagnet, so they spin with the magnet. The brushes are just two pieces of springy metal or carbon that make contact with the contacts of the commutator.

Putting It All Together

When you put all of these parts together, what you have is a complete electric motor:



In this figure, the armature winding has been left out so that it is easier to see the commutator in action. The key thing to notice is that as the armature passes through the horizontal position, the poles of the electromagnet flip. Because of the flip, the North pole of the electromagnet is always above the axle so it can repel the field magnet's North pole and attract the field magnet's South pole.

If you ever take apart an electric motor you will find that it contains the same pieces described above: two small permanent magnets, a commutator, two brushes and an electromagnet made by winding wire around a piece of metal. Almost always, however, the rotor will have three poles rather than the two poles as shown in this article. There are two good reasons for a motor to have three poles:

It causes the motor to have better dynamics. In a two-pole motor, if the electromagnet is at the balance point, perfectly horizontal between the two poles of the field magnet when the motor starts; you can imagine the armature getting "stuck" there. That never happens in a three-pole motor.

Each time the commutator hits the point where it flips the field in a two-pole motor, the commutator shorts out the battery (directly connects the positive and negative terminals) for a moment. This shorting wastes energy and drains the battery needlessly. A three-pole motor solves this problem as well.

It is possible to have any number of poles, depending on the size of the motor and the specific application it is being used in.

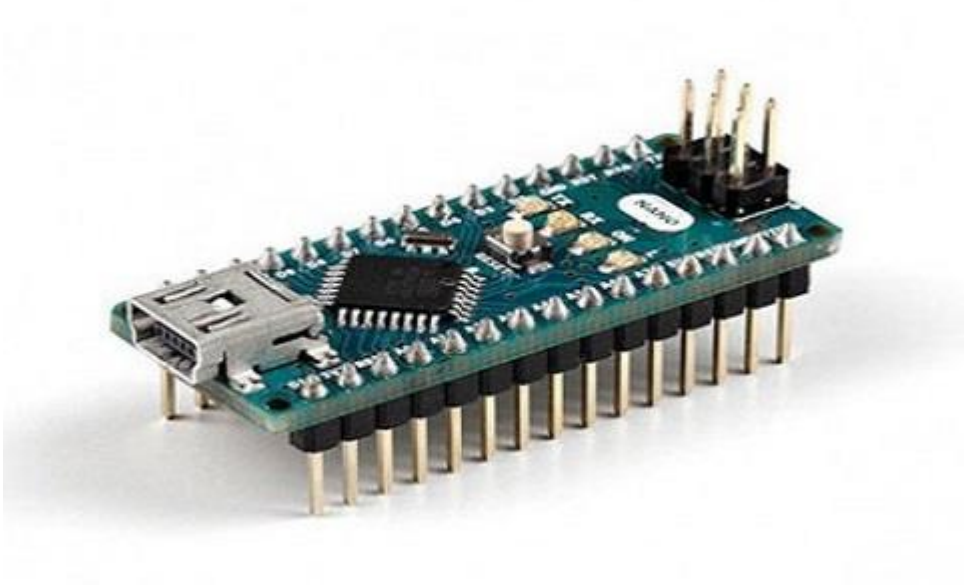
ARDUINO NANO

Arduino Nano is one type of microcontroller board, and it is designed by Arduino.cc. It can be built with a microcontroller like Atmega328. This microcontroller is also used i**n** Arduino UNO. It is a small size board and also flexible with a wide variety of applications. Other Arduino boards mainly include Arduino Mega, Arduino Pro Mini, Arduino UNO, Arduino YUN, Arduino Lilypad, Arduino Leonardo, and Arduino Due. And other development boards are AVR Development Board, PIC Development Board, Raspberry Pi, Intel Edison, MSP430 Launchpad, and ESP32 board.

This board has many functions and features like an Arduino Duemilanove board. However, this Nano board is different in packaging. It doesn't have any DC jack so that the power supply can be given using a small USB port otherwise straightly connected to the pins like VCC & GND. This board can be supplied with 6 to 20volts using a mini USB port on the board.

ARDUINO NANO FEATURES

The features of an Arduino nano mainly include the following.

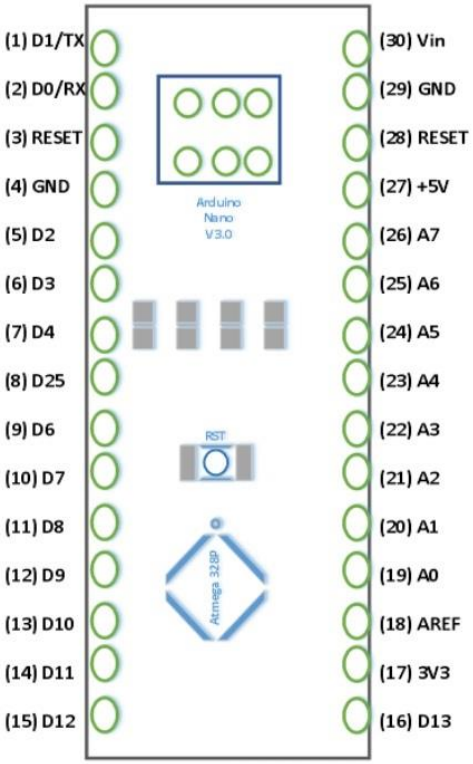


- ATmega328P Microcontroller is from 8-bit AVR family
- Operating voltage is 5V
- Input voltage (Vin) is 7V to 12V
- Input/Output Pins are 22
- Analog i/p pins are 6 from A0 to A5
- Digital pins are 14
- Power consumption is 19 mA
- I/O pins DC Current is 40 mA

- Flash memory is 32 KB
- SRAM is 2 KB
- EEPROM is 1 KB
- CLK speed is 16 MHz
- Weight-7g
- Size of the printed circuit board is 18 X 45mm
- Supports three communications like SPI, IIC, & USART

ARDUINO NANO PINOUT

Arduino nano pin configuration is shown below and each pin functionality is discussed below.



Power Pin (Vin, 3.3V, 5V, GND): These pins are power pins
RST Pin(Reset): This pin is used to reset the microcontroller
Analog Pins (A0-A7): These pins are used to calculate the analog voltage of the board within the range of 0V to 5V
I/O Pins (Digital Pins from D0 – D13): These pins are used as an i/p otherwise o/p pins. 0V & 5V
Serial Pins (Tx, Rx): These pins are used to transmit & receive TTL serial data.
External Interrupts (2, 3): These pins are used to activate an interrupt.

PWM (3, 5, 6, 9, 11): These pins are used to provide 8-bit of PWM output.
SPI (10, 11, 12, & 13): These pins are used for supporting SPI communication.
Inbuilt LED (13): This pin is used to activate the LED.
IIC (A4, A5): These pins are used for supporting TWI communication.
AREF: This pin is used to give reference voltage to the input voltage

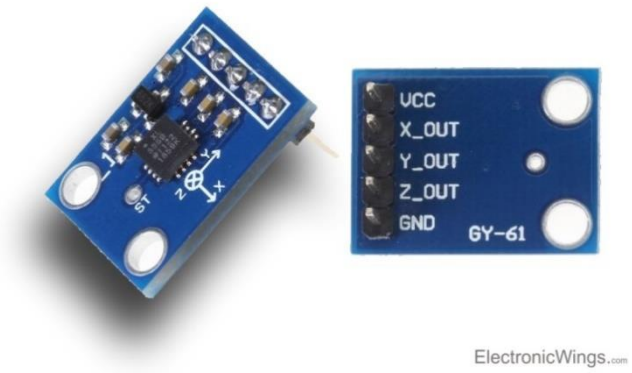
MEMS SENSOR

GENERAL DESCRIPTION

A gyroscope is a spinning wheel or disc in which the axis of rotation is free to assume any orientation by it. When rotating, the orientation of this axis is unaffected by tilting or rotation of the mounting, according to the conservation of angular momentum. Because of this, gyroscopes are useful for measuring or maintaining orientation. Due to their precision, gyroscopes are also used in gyro theodolites to maintain direction in tunnel mining. Thus, the center of gravity of the rotor and the center of suspension of the rotor may not coincide.

PRODUCT DESCRIPTION

Gyro sensors are used to correct hand movement when using digital cameras and video cameras. Dual-axis angular rate sensor (gyroscope) conventionally, two detection sensors are adopted to detect hand movement in the vertical and horizontal directions; peripheral circuits for the amplifier, etc. also require two sensors. It uses Intenseness's proprietary and patented MEMS technology with vertically driven, vibrating masses to make a functionally complete, low-cost, etc. this result in a unique, integrated dual-axis gyro with guaranteed-by-design vibration rejection and high cross-axis isolation. It is specifically designed for demanding consumer applications requiring low cost, small size and high performance.



FEATURES

- Operating voltage: 5v
- Dynamic range: ±300 deg/s
- Frequency response: up to 150Hz
- Output: Analog.

APPLICATIONS

- General Motion Sensing
- Vehicle Motion Analysis
- Platform Stabilization
- Inertial Measurement Units

CHAPTER-8

SOFTWARE DESCRIPTION

ARDUINO IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino board.

The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. Its products are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form or as do-it-yourself (DIY) kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

The Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats and motion detectors.

The name Arduino comes from a bar in Ivrea, Italy, where some of the founders of the project used to meet. The bar was named after Arduin of Ivrea, who was the margrave of the March of Ivrea and King of Italy from 1002 to 1014.

EMBEDDED C

Embedded C is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different embedded systems.

Historically, embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations. In 2008, the C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere to. It includes a number of features not available in normal C, such as fixed-point arithmetic, named address spaces and basic I/O hardware addressing. Embedded C uses most of the syntax and semantics of standard C, e.g., main() function, variable definition, data type declaration, conditional statements (if, switch case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, etc

CHAPTER-9

CONCLUSION

Thus the prototype of smart wheelchair is designed successfully. The motion of prototype is controlled using gesture movement, MEMS sensor and RF. Most modern-day technologies use sensors such as gyroscope, to take interactive input and in this project also we have tried to make the robot interactive and close to human. Though some difficulties aroused and many remodeling was needed and the chair had some limitations which we learned while building it, at last the Smart Wheel Chair created very close to the adapted design philosophy.

CHAPTER-10

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