CONSTRUCTION AN AUTOMATIC METAL NONMETAL PRODUCT DETECTION AND SORTING SYSTEM USING CONVEYOR BELT

A Thesis

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Department of Mechanical Engineering

SONARGAON UNIVERSITY (SU)

January, 2025

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Submitted to the

DEPARTMENT OF MECHANICAL ENGINEERING

SONARGAON UNIVERSITY (SU)

In partial fulfillment of the requirements for the award of the degree

of

Bachelor of Science in Mechanical Engineering

January, 2025

APPROVAL

This is to certify that the project on "**Automatic Metal Nonmetal Product Detection and Sorting System Using Conveyor Belt**." By Md.Tarikul Islam, (ID: ME2102024450), Ikbal Hassan, (ID: ME2102024453), Md. Asadul Islam, (ID: ME2102024455),Abdullah-Al-Masud,(ID: ME2102024568), Md.Mamunur Rashid, (ID: ME2102024487) has been carried out under our supervision. The project has been carried out in partial fulfillment of the requirements of the degree of Bachelor of Science (B.Sc.) in Mechanical Engineering of years of 2024 and has been approved as to its style and contents.

……..
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DECLERATION

We, hereby, declare that the work presented in this project is the outcome of the investigation and research work performed by us under the supervision of Md. Mahafujul Islam, Lecturer, Department of Mechanical Engineering, Sonargaon University (SU). We also declare that no part of this project and thesis has been or is being submitted elsewhere for the award of any degree.

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ACKNOWLEDGEMENT

At first, we would like to express our gratitude to Almighty Allah for giving us the strength and opportunity to complete our dissertation within the scheduled time successfully. The presentation of the project paper represents the collaborative efforts and generous support of a number of individuals. The Department of Mechanical Engineering (ME), Sonargaon University (SU) provided important subject expertise and information technology services to carry out the project work successfully. We feel proud to express our deep sense of gratitude to our reverend teacher, guideand supervisor, for his day to day supervision, dexterous management, adept analysis, keen interest, optimistic counseling, and unremitting backup. We are very much indebted to Mahafujul Islam, Lecturer, Department of Mechanical Engineering, Sonargaon University, for including a dissertation as accurse in B.Sc. in Engineering to strengthen eligibility of students. We would also like to thank those persons of Department of Mechanical, Sonargaon University, for their encouragement and help in our project work.

Abstract

The developed automated sorting machine is able to incorporate flexibility and separate pieces of nonmetal object and at the same time move object automatically to the bucket as define buy the regulation of the micro-controller with a capacitive proximity sensor to detect a value rang of object. The result obtained shows that metal and nonmetal were sorted in to their respective and correct position with a good average time. The projected system involves Arduino Pro Mini, SMPS, Relay. sensing element, IR sensor, Proximity sensor, Servo motor, Gear motor, for sensing product exactly.

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Chapter 1

METHODOLOGY

1.1 Introduction

The sorting of materials in garbage industries square measure created manually at this time day. There could also be likelihood of errors in sorting. We've enforced an answer for substitution human by automatic management while not manual power. The project detects the objects completely different of various} materials and segregate in 3 different boxes. By usage of sensors decreases the errors in sorting and reduces the person power. The projected system involves detector, IR sensor, mini limit switch for sensing weight and for sorting purpose linear motion electrical actuators square measure used. The motor shaft is connected to the roller and also the conveyer belt is placed on the roller these provides sensible tension over the belt. The conveyor motors input gets from electrical device. The negative feedback circuit consists of ARDUINO board, relay interfacing board, transformer, input interfacing board, DC motors. The logic used for sensors for characteristic materials is finished in program by weight and inductive means that it's sorted as metal. By weight and reflection, it's sorted as glass and if solely reflection it's known as plastic. The material sorter has been designed in such the simplest way it will fulfill all the wants of the packaging industries wherever merchandise of various materials square measure factory-made. It has innumerous application like garbage industries, packaging fields. The project is intended in such the simplest way that may manufacture high productivity and may type materials while not smashup. By this packaging system becomes easier.

1.2 Objective:

The objectives of this project are:

a) To study about metal non-metal product sorting system.

b) To test the performance of the Metal Non-metal sorting system with Conveyor belt.

Chapter 2

Literature Review

2.1 Introduction

In this section topics related to metal nonmetal product sorting systems are included. These provide a sampling of problems appropriate for application of a Metal & Nonmetal Product Sorting System with conveyor belt system. The references are summarized below.

2.2 Literature Survey

The concept of automatic sorting arose due to the difficulties faced by the packaging industries. The idea of sorting has existed for quite a while after there have been advancements in the technology. Shen and Hassan [1] states that an approach for continuous recognition and the sorting of objects into their respective and desired location can be implemented as an image of color processing that can attract an enormous attention leading to a possible widening scope of application in a different field in a modern technology.

A color-sorting robot is designed and developed using an Arduino Uno micro-controller, SG90 Tower Pro Servo Motor, TCS3200D color sensor and several other electronic components. The system has the potential to sort the objects according to their colors into their relevant color station in a less time. A distinct code for this system is developed. According to Yunardi et al. [2], a 3D volume of the packed box is well quantified from the 2D images using the techniques of image processing. The 2D image consists of two images captured on the camera with a horizontal view and a vertical view. With the parameters, that is, the length, width and the height, a multiplication program is used to obtain the result of the volume. Consequently, contour-based object detection can be appertained to the automatic sorting system to measure the volume of an object in a computer-based vision.

According to Babita [3], sensors are embedded at several places that detects and senses the materials of various sizes that gets sorted at different stations based on their sizes. For sensing, the material used is an infrared sensor that is so sensitive. All the process is controlled and handled by a PLC. Kulkarni et al. [4] has implemented the sorting of the boxes using a barcode, which is decoded by raspberry pi.

This raspberry pi sends a signal to the motor driver to start and stop the motor accordingly. Proximity switches are implanted on every cylinder to sense the box position, which again sends back the signal to raspberry pi. Relay is used as an interface for the motor driver and motor. The relay used is of solid relay type. Raspberry pi uses cameras of five megapixels to capture the image, which will then be decoded. The sorting process is controlled and handled by Arduino Micro-controller. Automating every sector of industry is an important step towards increasing efficiency and reducing human related errors, here we try to automate the sorting process by using Controller. The program fed in the Arduino controls the entire process. [5]

2.3 History

This metal non-metal sorting system is so effective and safe process. It is mainly used in factory and industrial area. After it used, we reduce the manpower and time. That's way we get good efficiency. Where very difficult to move company product from here to another location perfectly that moment we can easily use this machine. This machine is very easy to use and it works very effectively. A relevant picture is added below –

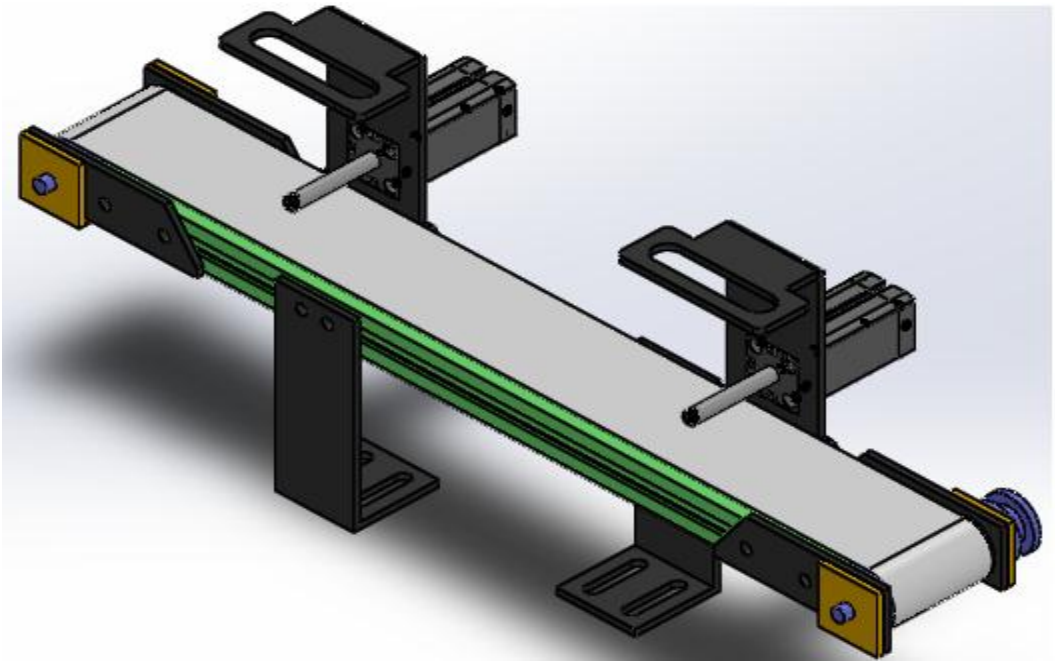


Figure 2.1: Metal Non-metal sorting system with conveyor belt 3d image.

Chapter 3

Theory and Working Principle

3.1 Methodology

- Creating an idea for design and construction of a metal non-metal product sorting machine.
- Collecting the all components/materials for construct the system.
- Finally, we made this system & checked it finally that working very well.

3.2 Block Diagram:

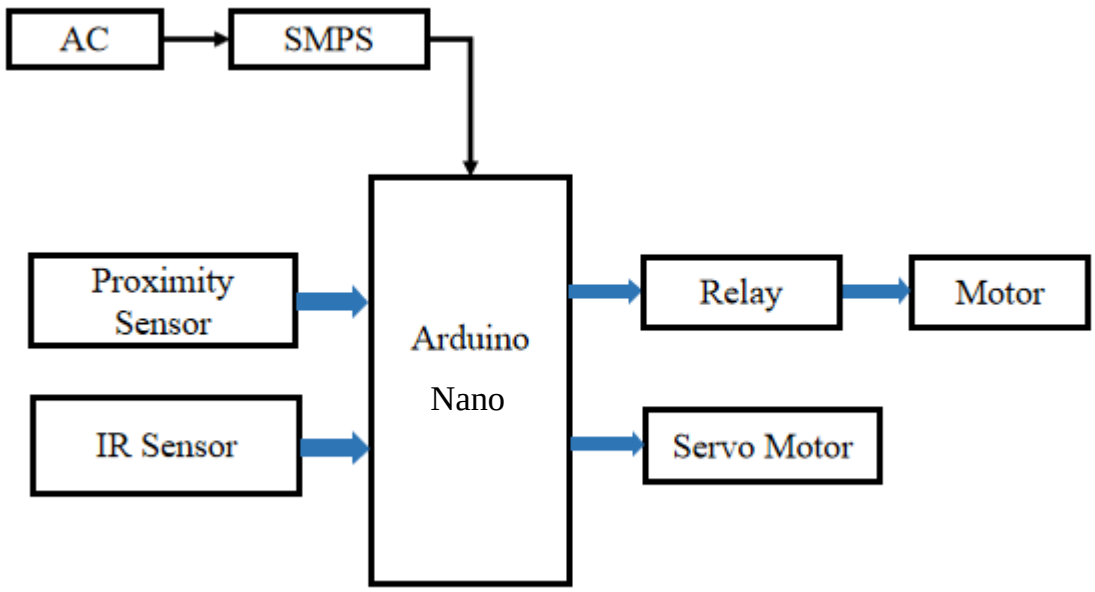


Figure 3.1: Block Diagram of metal non-metal product sorting system with conveyor belt

3.3 Circuit Diagram

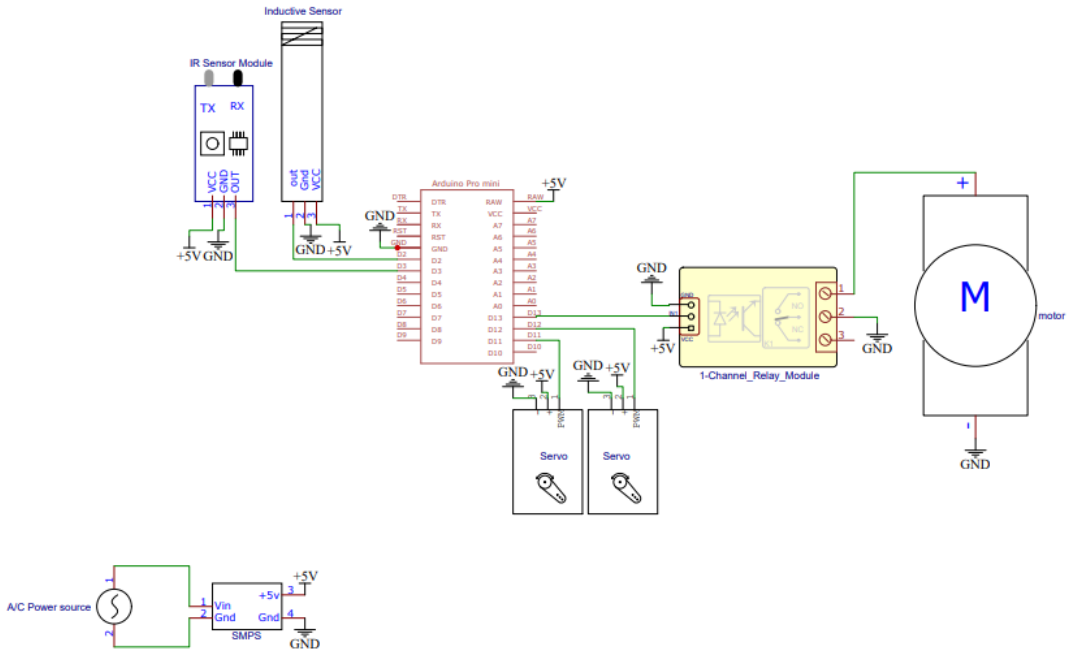


Figure 3.2: Circuit Diagram of our Project

3.4 Working Principle

Our project is designed to separate metal non-metal objects. We are using Arduino Pro Mini for controlling our project, which is acting as the main controller here. Also used here sensors, relays, valves, motors and air cylinders. Everything comes connected with Arduino. Here the current from AC is entering the circuit at 12 volts via SMPS. The Arduino Pro Mini is equipped with two sensors. They are proximity sensor and IR Sensor. This proximity sensor and IR sensor are useful for sensing the product. The IR sensor senses the object and the proximity sensor detects whether it is metal or not. If the conveyor belt rotates, the belt will stop when the object comes in front of the IR sensor. We are also use equipment's Servo motor, Gear motor, and Relay. In this way we can easily distinguish between metal and non-metal objects in this machine.

3.5 Complete Project Prototype Image:

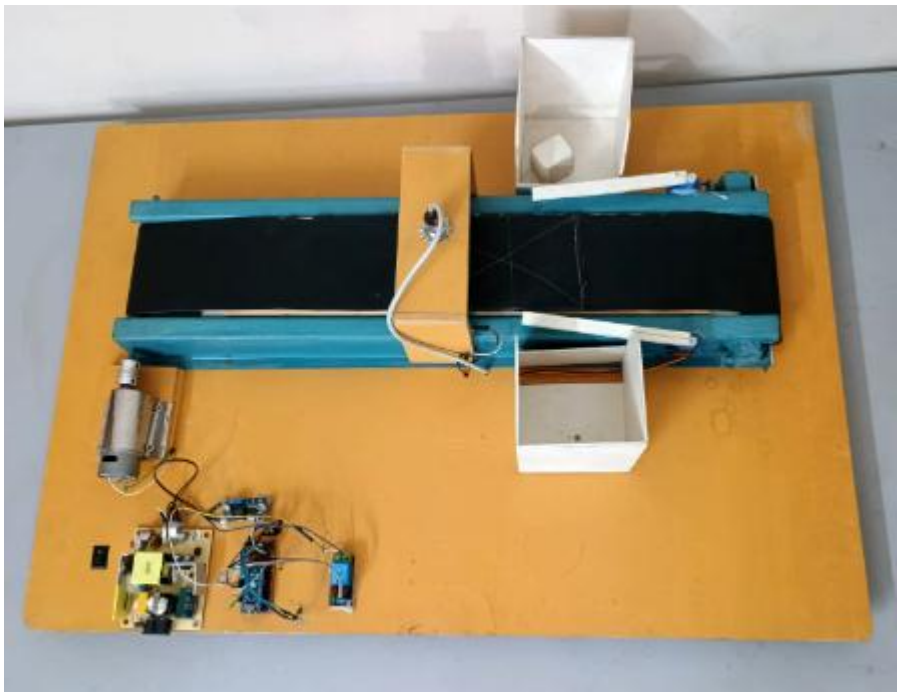


Figure 3.3: Complete Project prototype

3.6 Components List:

1. Arduino Pro Mini
2. SMPS
3. Servo Motor
4. DC Gear Motor.
5. IR Sensor.
6. Proximity Sensor.
7. Relay

Software:

1. Arduino IDE
2. Easy EDA

3.6.1 Arduino Nano

Arduino is open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling Lights, motors, and other actuators.

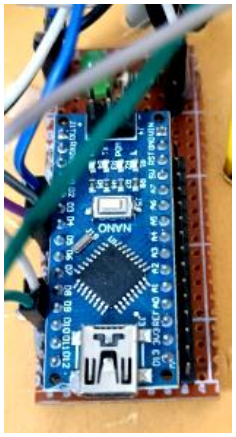


Figure 3.4: Arduino Nano

The micro-controller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software on running on a computer (e.g. Flash, Processing, Maxims'). Arduino Nano is a surface mount breadboard embedded version with integrated USB. It is a small, complete, and breadboard friendly component. It has everything that Decimal/ Duemilanove has (electrically) with more analog input pins and onboard +5V AREF jumper. Physically, it is missing power jack. The Nano can automatically sense and switch to the higher potential source of power.

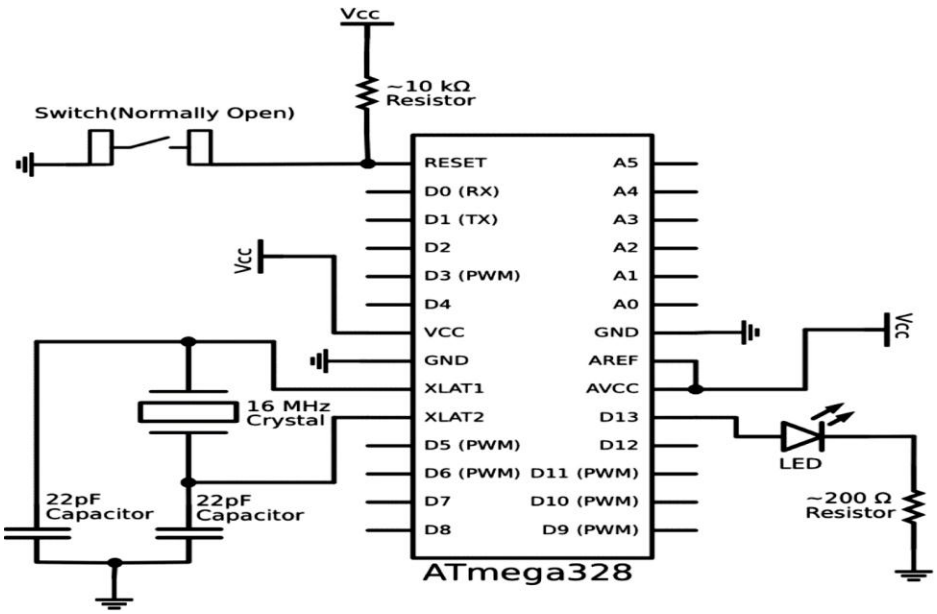


Figure 3.5: Arduino Nano Schematic Diagram

Nanos got the breadboard-ability of the Boarding and the Minibus with smaller footprint than either, so users have more breadboard space. It's got a pin layout that works well with the Mini or the Basic Stamp (TX, RX, ATN, and GND on one top, power and ground on the other). This new version 3.0 comes with ATMEGA328 which offer more programming and data memory space. It has two layers. That make it easier to hack and more affordable. One of the best features of Arduino Nano is, it's easy to use, compact and also small.

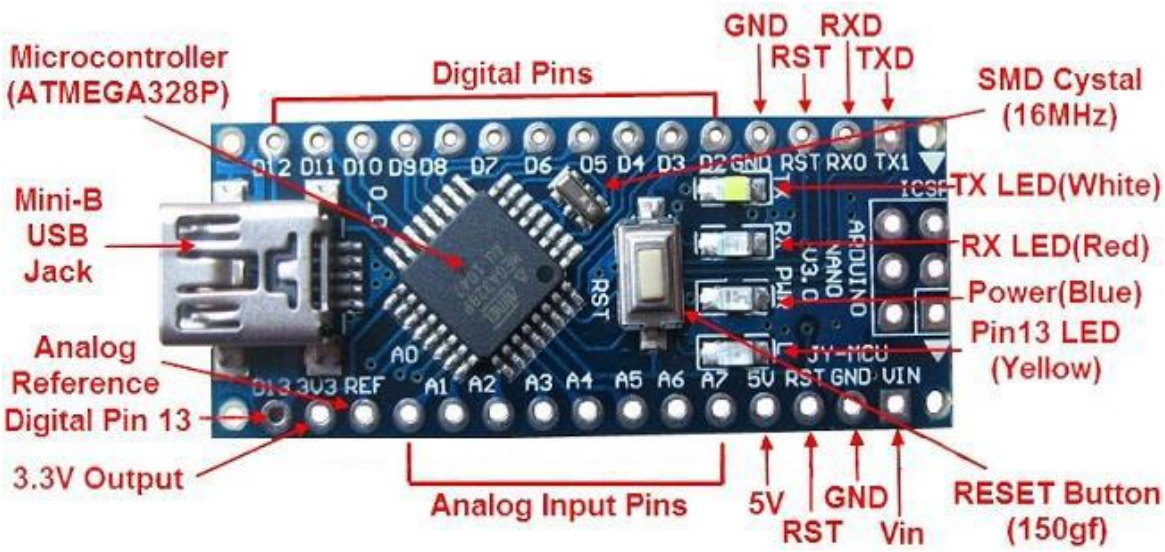


Figure 3.6: How Arduino Nano looks like

Specifications:

- Micro-controller: Atmel ATmega328
- Operating Voltage (logic level): 5 V
- Input Voltage (recommended): 7-12 V
- Input Voltage (limits): 6-20 V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 8
- DC Current per I/O Pin: 40 mA
- Flash Memory: 32 KB (of which 2KB used by boot loader)
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Dimensions: 0.70” x 1.70”

Features:

- Automatic reset during program download
- Power OK blue LED
- Green (TX), red (RX) and orange (L) LED
- Auto sensing/switching power input
- Small Mini-B USB for programming and serial monitor
- ICSP header for direct program download
- Manual reset switch

Micro-controller IC ATmega328p

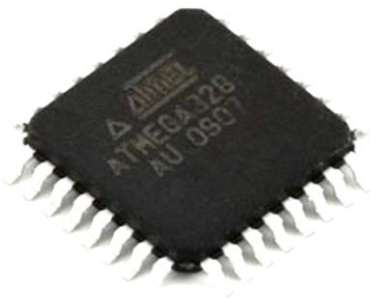


Figure 3.7: Micro-controller IC AT mega 328p

The high-performance Microchip Pico Power 8-bit AVR RISC-based micro-controller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughput's approaching 1 MIPS per MHz, balancing power consumption and processing speed.

3.6.2 Switch Mode Power Supply (SMPS):

A switched-mode power supply (switching-mode power supply, switch-mode power supply, switched power supply, SMPS, or switcher) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a DC or AC source (often mains power) to DC loads, such as a personal computer, while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. A hypothetical ideal switched-mode power supply dissipates no power. Voltage regulation is achieved by varying the ratio of on-to-off time (also known as duty cycles).

In contrast, a linear power supply regulates the output voltage by continually dissipating power in the pass transistor. This higher power conversion efficiency is an important advantage of a switched-mode power supply. Switched-mode power supplies may also be substantially smaller and lighter than a linear supply due to the smaller transformer size and weight.



Fig 3.8: SMPS

Switching regulators are used as replacements for linear regulators when higher efficiency, smaller size or lighter weight are required. They are, however, more complicated; their switching currents can cause electrical noise problems if not carefully suppressed, and simple designs may have a poor power factor.

12V 5A Industrial SMPS Power Supply – 60W – DC Metal Power Supply – Good Quality – Non-Waterproof with Aluminum casing.

- Input Voltage: AC 100 – 264V 50 / 60Hz
- Output Voltage: 12V DC, 0-5A
- Output voltage: Adjustment Range: ±20%
- Protections: Overload / Over Voltage / Short Circuit
- Auto-Recovery After Protection
- Universal AC input / Full range
- 100% Full Load Burn-in Test
- Cooling by Free Air Convection
- High Quality and High Performance
- LED power supply with a metal body for hidden installation for LED lighting
- Design with Built-in EMI Filter, improve signal precision.
- Certifications: CE &RoHs
- No Minimum Load.
- Compact Size Light Weight.
- High Efficiency, Reliability& low energy consumption
- Category – Switch Mode Power Adaptor (SMPS)

Switched-mode power supplies are classified according to the type of input and output voltages. The four major categories are:

- AC to DC
- DC to DC
- DC to AC
- AC to AC

A basic isolated AC to DC switched-mode power supply consists of:

- Input rectifier and filter
- Inverter consisting of switching devices such as MOSFETs
- Transformer
- Output rectifier and filter
- Feedback and control circuit

The input DC supply from a rectifier or battery is fed to the inverter where it is turned on and off at high frequencies of between 20 KHz and 200 KHz by the switching MOSFET or power transistors. The high-frequency voltage pulses from the inverter are fed to the transformer primary winding, and the secondary AC output is rectified and smoothed to produce the required DC voltages. A feedback circuit monitors the output voltage and instructs the control circuit to adjust the duty cycle to maintain the output at the desired level.

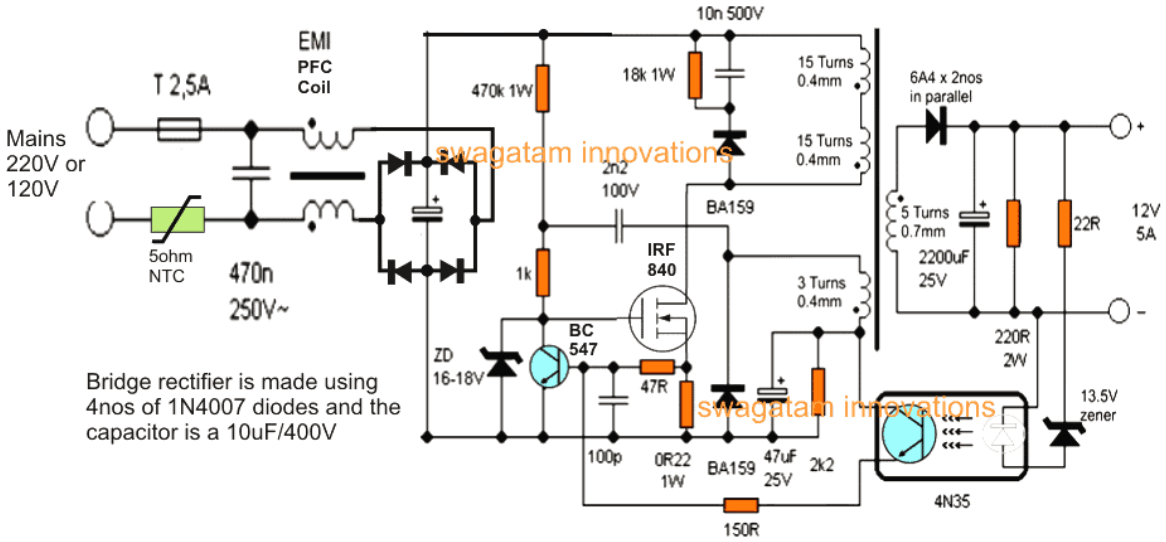


Fig 3.9: SMPS Circuit Design

Basic working concept of an SMPS

A switching regulator does the regulation in the SMPS. A series switching element turns the current supply to a smoothing capacitor on and off. The voltage on the capacitor controls the time the series element is turned. The continuous switching of the capacitor maintains the voltage at the required level.

Design basics

AC power first passes through fuses and a line filter. Then it is rectified by a full-wave bridge rectifier. The rectified voltage is next applied to the power factor correction (PFC) pre-regulator followed by the downstream DC-DC converter(s). Most computers and small appliances use the International Electro technical Commission (IEC) style input connector. As for output connectors and pin outs, except for some industries, such as PC and compact PCI, in general, they are not standardized and are left up to the manufacturer.

There are different circuit configurations known as topologies, each having unique characteristics, advantages and modes of operation, which determines how the input power is transferred to the output. Most of the commonly used topologies such as fly back, push-pull, half bridge and full bridge, consist of a transformer to provide isolation, voltage scaling, and multiple output voltages. The non-isolated configurations do not have a transformer and the power conversion is provided by the inductive energy transfer.

Advantages of switched-mode power supplies:

- Higher efficiency of 68% to 90%
- Regulated and reliable outputs regardless of variations in input supply voltage
- Small size and lighter
- Flexible technology
- High power density

Disadvantages:

- Generates electromagnetic interference
- Complex circuit design
- Expensive compared to linear supplies

Switched-mode power supplies are used to power a wide variety of equipment such as computers, sensitive electronics, battery-operated devices and other equipment requiring high efficiency.

Switch Mode Power Supply

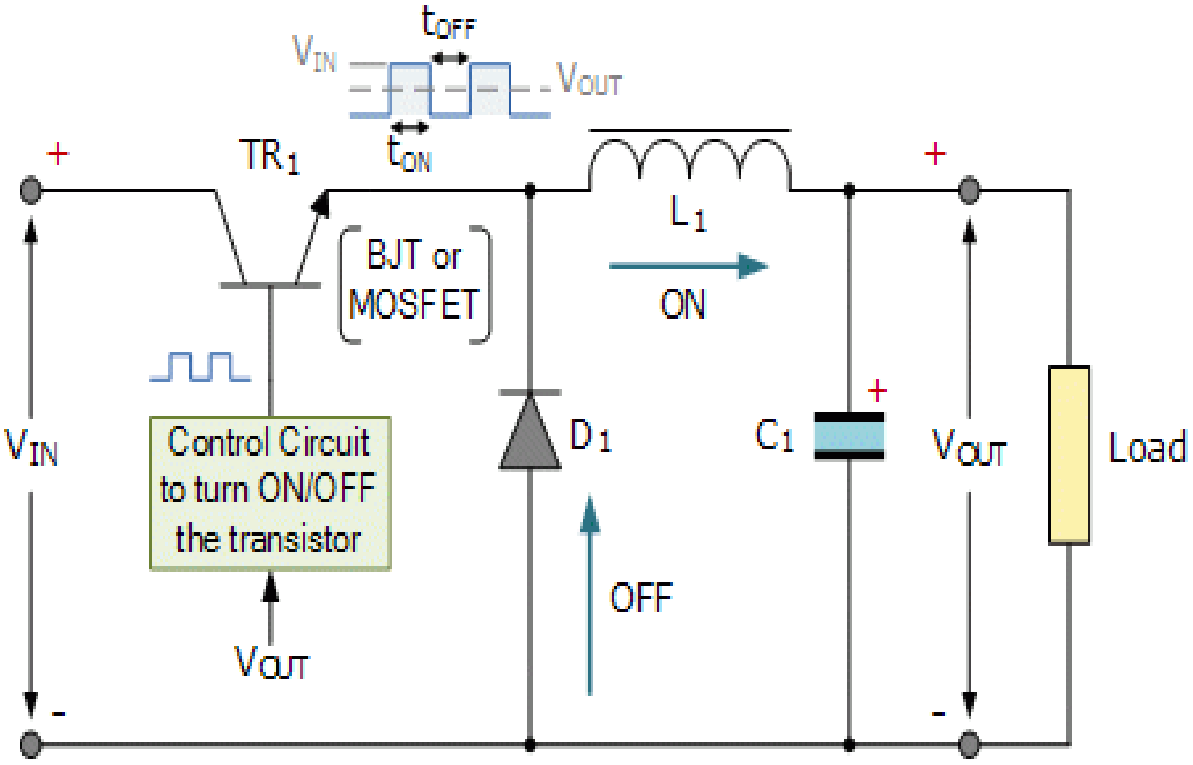


Fig 3.10: Power Supply Connection

Linear voltage IC regulators have been the basis of power supply designs for many years as they are very good at supplying a continuous fixed voltage output.

Linear voltage regulators are generally much more efficient and easier to use than equivalent voltage regulator circuits made from discrete components such a zenerdiode and a resistor, or transistors and even op-amps. The most popular linear and fixed output voltage regulator types are by far the 78… positive output voltage series, and the 79… negative output voltage series. These two types of complementary voltage regulators produce a precise and stable voltage output ranging from about 5 volts up to about 24 volts for use in many electronic circuits.

There is a wide range of these three-terminal fixed voltage regulators available each with its own built-in voltage regulation and current limiting circuits. This allows us to create a whole host of different power

supply rails and outputs, either single or dual supply, suitable for most electronic circuits and applications. There are even variable voltage linear regulators available as well providing an output voltage which is continually variable from just above zero to a few volts below its maximum voltage output.

Most DC power supplies comprise of a large and heavy step-down mains transformer, diode rectification, either full-wave or half-wave, a filter circuit to remove any ripple content from the rectified dc. producing a suitably smooth dc. voltage, and some form of voltage regulator or stabilizer circuit, either linear or switching to ensure the correct regulation of the power supplies

output voltage under varying load conditions. Then a typical DC. power supply would look something like this:

Typical DC Power Supply

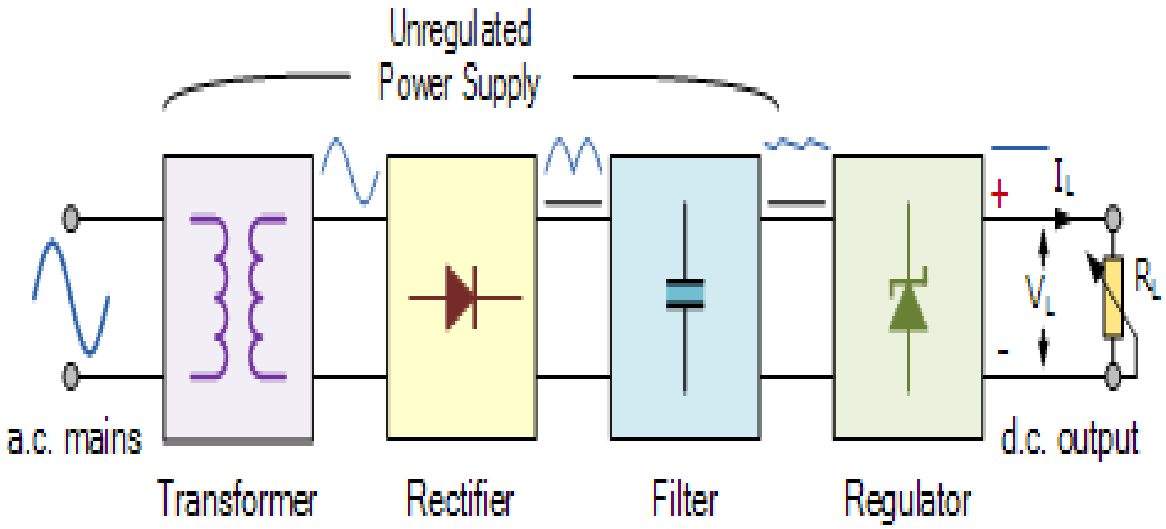


Fig 3.11: DC Power Supply Step

These typical power supply designs contain a large mains transformer (which also provides isolation between the input and output) and a dissipative series regulator circuit. The regulator circuit could consist of a single zener diode or a three-terminal linear series regulator to produce the required output voltage. The advantage of a linear regulator is that the power supply circuit only needs an input capacitor, output capacitor and some feedback resistors to set the output voltage.

3.6.3 IR Sensor:

An infrared sensor is an electronics device that emits certain features around it and / or detects infrared radiation. Infrared sensors are capable of measuring the heat emitted by an object and detecting motion. In this project we will control the fan and light automatically through the closed loop system so the IR sensor for the system is definitely needed as a response. Here the fan will turn on and the light will turn on when the IR sensor detects an object and the fan and light will switch off automatically when an object leaves the house.



Figure 3.12: IR Sensor

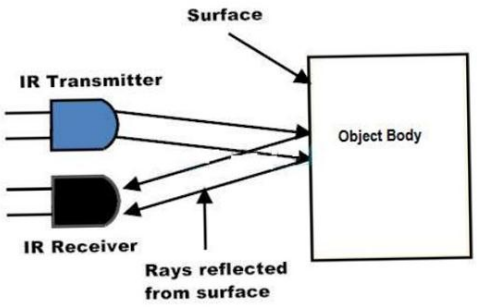


Figure 3.13: IR sensor reflection System.

Principles of operation:

Sensor works with sense. When an object intersects the sensor light then the sensor detects something. Some infrared ray is deflected from the object and scene the length of this distance. In this sensor we can make a fixed length light and detect our exact object. If some object comes in front of this sensor, then the sensor detects it and sends a signal in LED.

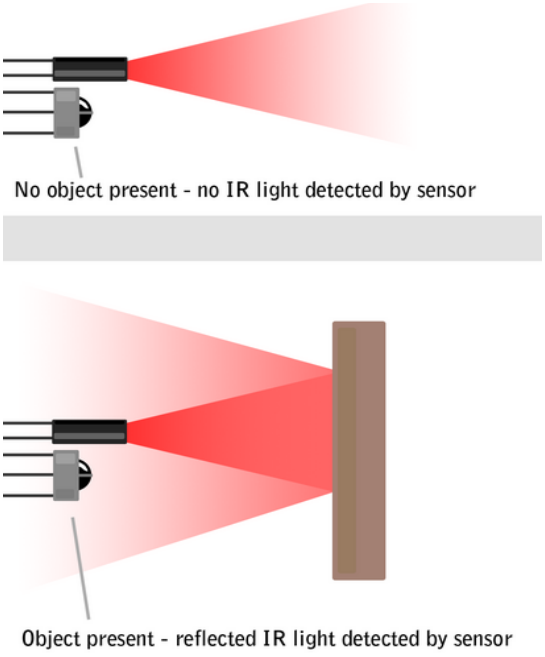


Figure 3.14: IR sensor Detection System.

3.6.4 Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.



Figure 3.15: Relay

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. 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".

Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back. Repeated pulses from the same input have no effect. Magnetic latching relays are useful in applications where interrupted power should not be able to transition the contacts.

Magnetic latching relays can have either single or dual coils. On a single coil device, the relay will operate in one direction when power is applied with one polarity, and will reset when the polarity is reversed. On a dual coil device, when polarized voltage is applied to the reset coil the contacts will transition. AC controlled magnetic latch relays have single coils that employ steering diodes to differentiate between operate and reset commands.

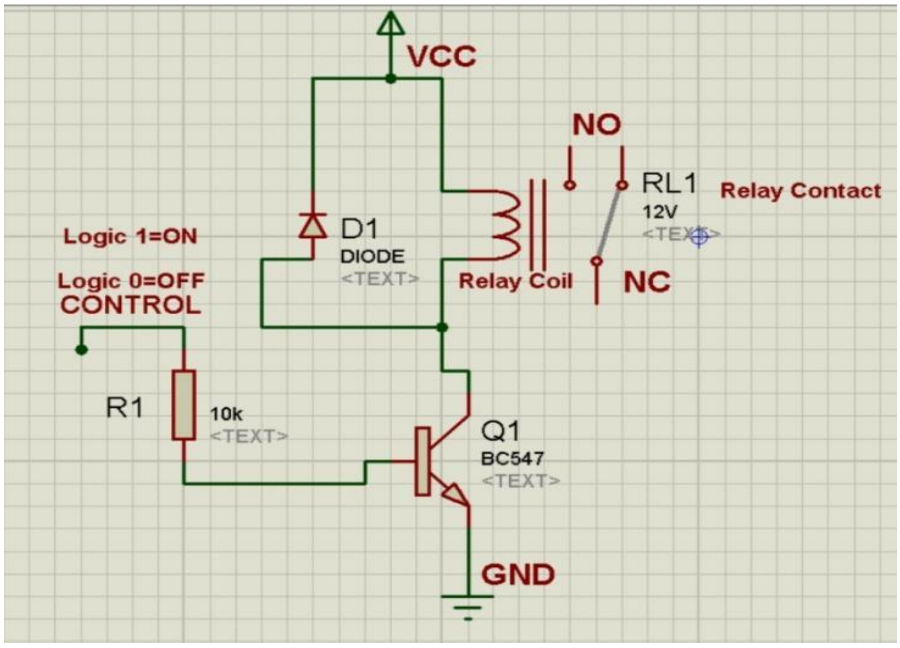


Figure 3.16: Transistor Switching Circuit.

The circuit above is called a low-side switch, because the switch – our transistor – is on the low (ground) side of the circuit. Alternatively, we can use a PNP transistor to create a high-side switch: Similar to the NPN circuit, the base is our input, and the emitter is tied to a constant voltage.
A relay is an electrically operated switch of mains voltage. It means that it can be turned on or off, letting the current go through or not. Controlling a relay with the Arduino is as simple as controlling an output such as an LED. The relay module is the one in the figure below.

This module has two channels (those blue cubes). There are other varieties with one, four and eight channels.

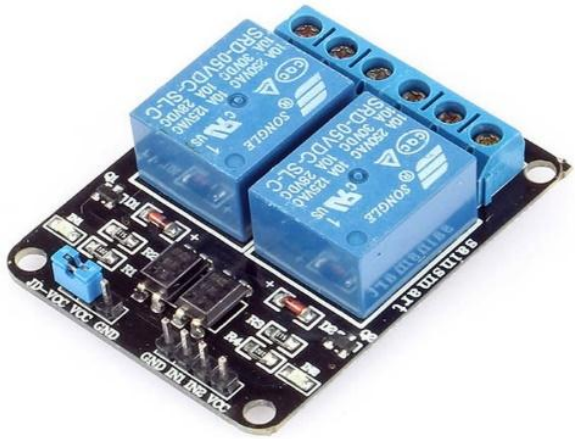


Figure 3.17: Relay Module.

Mains voltage connections: In relation to mains voltage, relays have 3 possible connections:

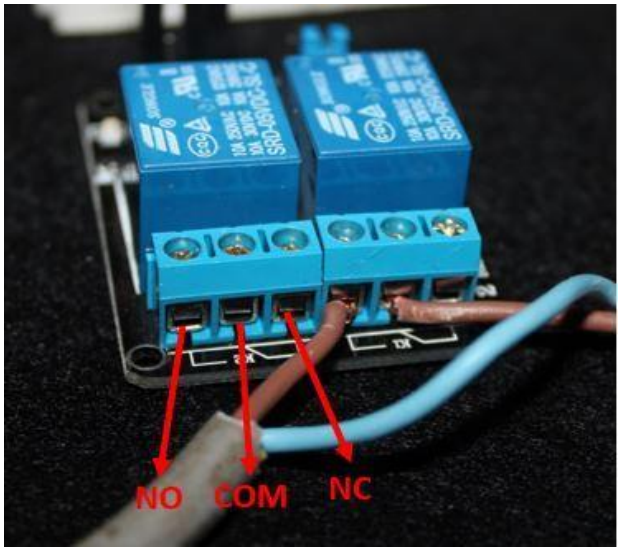


Figure 3.18: Pin diagram of Relay Module

COM: common pin

NO (Normally Open): there is no contact between the common pin and the normally open pin. So, when you trigger the relay, it connects to the COM pin and supply is provided to a load

NC (Normally Closed): there is contact between the common pin and the normally closed pin. There is always connection between the COM and NC pins, even when the relay is turned off. When you trigger the relay, the circuit is opened and there is no supply provided to a load.

If you want to control a lamp for example, it is better to use a normally-open circuit, because we just want to light up the lamp occasionally.

3.6.5 DC Gear Motor

Description:

A DC motor is any motor within a class of electrical machines whereby direct current electrical power is converted into mechanical power. ... A 12v DC motor is small and inexpensive, yet powerful enough to be used for many applications.

Specification:

- Voltage: 12V DC
- Gear ratio: 1/31
- No-load speed: 200RPM
- Rated Speed: 140RPM
- Rated torque: 10kg.cm
- Rated current: 2.5Amp
- Length of Motor (including spindle): 106mm/4.17″
- Diameter: 37mm/1.45″
- Shaft length: 21mm/0.82″
- Shaft diameter: 6mm/0.24″



Fig: 3.19: DC Gear Motor

3.6.6 Proximity Sensor:

A **proximity sensor** is a sensor able to detect the presence of nearby objects without any physical contact.

A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors. For example, a capacitive proximity sensor or photoelectric sensor might be suitable for a plastic target; an inductive proximity sensor always requires a metal target.

Proximity sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between the sensor and the sensed object.

Proximity sensors are also used in machine vibration monitoring to measure the variation in distance between a shaft and its support bearing. This is common in large steam turbines, compressors, and motors that use sleeve-type bearings.

Types of Proximity Sensor

- Inductive Proximity Sensor.
- Optical Proximity Sensor.
- Capacitive Proximity Sensor.
- Magnetic Proximity Sensor.
- Ultrasonic proximity Sensor.

Proximity sensors are suitable for damp conditions and wide temperature range usage, unlike your traditional optical detection. Proximity sensors are also applicable in phones as well, be it your Android or IOS devices. It consists of simple IR technology that switches on and off display accordingly to your usage. Proximity sensors are used in phones, recycling plants, self-driving cars, anti-aircraft systems, and assembly lines. There are many types of proximity sensors, and they each sense targets in distinct ways.

- Model: LJ12A3-4-Z/BY
- Wire Type - Cylindrical DC 3 Wire Type
- Switch Appearance Type - Cylinder Type
- Theory - Inductive Sensor
- Output Type - PNP NO (Normal Open)
- Diameter of Head - 12mm
- Detecting Distance - 4mm
- Supply Voltage - DC 6-36V
- Current Output - 300mA
- Response Frequency - 0.5KHz
- Detect Object - Iron
- Operating Temperature -25°C to +55°C (Non-freezing Condition)
- Size 6.2 x 2cm/2.4" x 0.8" (L*Max. Dia)
- Cable Length 110cm/43.3"
- External Material Plastic, Alloy
- Net Weight 46g

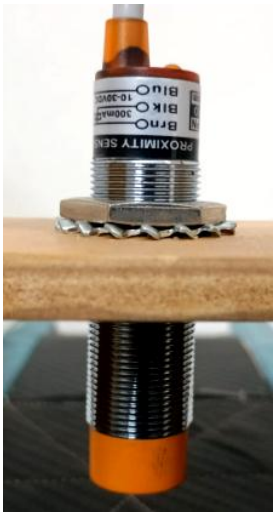


Fig 3.20: Proximity Sensor

3.6.7 Servo Motor

A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft. The motor is paired with some type of position encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops.



Figure 3.21: Servo Motor

The very simplest servomotors use position-only sensing via a potentiometer and bang-bang control of their motor; the motor always rotates at full speed (or is stopped). This type of servomotor is not widely used in industrial motion control, but it forms the basis of the simple and cheap servos used for radio-controlled models. More sophisticated servomotors use optical rotary encoders to measure the speed of the output shaft and a variable-speed drive to control the motor speed. Both of these enhancements, usually in combination with a PID control algorithm, allow the servomotor to be brought to its commanded position more quickly and more precisely, with less overshooting.

3.6.8 Arduino IDE

The digital micro-controller unit named as Arduino Nano can be programmed with the Arduino software IDE. There is no any requirement for installing other software rather than Arduino. Firstly, Select "Arduino Nano from the Tools, Board menu (according to the micro-controller on our board). The IC used named as ATmega328 on the Arduino Nano comes pre burned with a boot loader that allows us to upload new code to it without the use of an external hardware programmer.

Communication is using the original STK500 protocol (reference, C header files). We can also bypass the boot loader and programs the micro-controller through the ICSP (In Circuit Serial Programming) header. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available. The ATmega16U2/8U2 is loaded with a DFU boot loader, which can be activated by:

On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

The Arduino Nano is one of the latest digital micro-controller units and has a number of facilities for communicating with a computer, another Arduino, or other micro-controllers. The ATmega328 provides UART TTL at (5V) with serial communication, which is available on digital pins 0 -(RX) for receive the data and pin no.1 (TX) for transmit the data. An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an .in file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board.

The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial Communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Nano's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus. Arduino programs are written in C or C++ and the program code written for Arduino is called sketch. The Arduino IDE uses the GNU tool chain and AVR Lab to compile programs, and for uploading the programs it uses argued. As the Arduino platform uses Atmel micro-controllers, Atmel's development environment, AVR Studio or the newer Atmel Studio, may also be used to develop software for the Arduino.

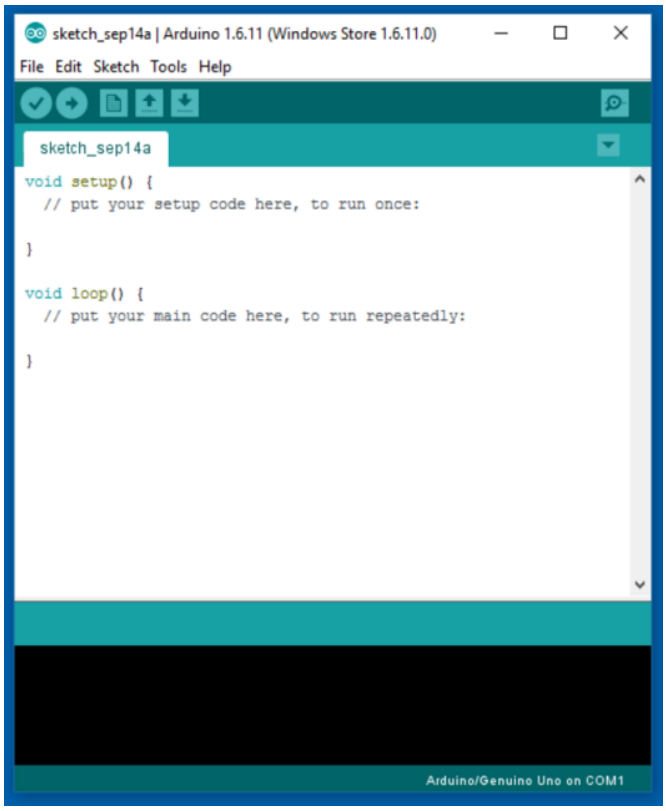


Figure 3.22: Arduino IDE Interface

Figure 3.28: Arduino Software Interface IDE the Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

Writing Sketches

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension. ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right-hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

Sketchbook

The Arduino Software (IDE) uses the concept of a sketchbook: a standard place to store your programs (or sketches). The sketches in your sketchbook can be opened from the File > Sketchbook menu or from the Open button on the toolbar. The first time you run the Arduino software, it will automatically create a directory for your sketchbook. You can view or change the location of the sketchbook location from with the Preferences dialog. Beginning with version 1.0, files are saved with a .ino file extension. Previous versions use the. pde extension. You may still open. pde named files in version 1.0 and later, the software will automatically rename the extension to. ino.

Tabs, Multiple Files, and Compilation

Allows you to manage sketches with more than one file (each of which appears in its own tab). These can be normal Arduino code files (no visible extension), C files (.c extension), C++ files (.cpp), or header files (.h).

Uploading

Before uploading your sketch, you need to select the correct items from the Tools > Board and Tools > Port menus. The boards are described below. On the Mac, the serial port is probably something like /dev/tty. usbmodem241 (for an Uno or Mega2560 or Leonardo) or /dev/tty.usbserial-1B1 (for a Duemilanove or earlier USB board), or /dev/tty.USA19QW1b1P1.1 (for a serial board connected with a Keyspan USB-to-Serial adapter). On Windows, it's probably COM1 or COM2 (for a serial board) or COM4, COM5, COM7, or higher (for a USB board) - to find out, you look for USB serial device in the ports section of the Windows Device Manager. On Linux, it should be /dev/ttyACMx , /dev/ttyUSBx or similar. Once you've selected the correct serial port and board, press the upload button in the toolbar or select the Upload item from the Sketch menu. Current Arduino boards will reset automatically and

begin the upload. With older boards (pre-Diecimila) that lack auto-reset, you'll need to press the reset button on the board just before starting the upload. On most boards, you'll see the RX and TX LEDs blink as the sketch is uploaded. The Arduino Software (IDE) will display a message when the upload is complete, or show an error.

When you upload a sketch, you're using the Arduino boot-loader, a small program that has been loaded on to the micro-controller on your board. It allows you to upload code without using any additional hardware. The boot-loader is active for a few seconds when the board resets; then it starts whichever sketch was most recently uploaded to the micro-controller. The boot-loader will blink the on-board (pin 13) LED when it starts (i.e. when the board resets).

Libraries

Libraries provide extra functionality for use in sketches, e.g. working with hardware or manipulating data. To use a library in a sketch, select it from the Sketch > Import Library menu. This will insert one or more #include statements at the top of the sketch and compile the library with your sketch. Because libraries are uploaded to the board with your sketch, they increase the amount of space it takes up. If a sketch no longer needs a library, simply delete its #include statements from the top of your code.

There is a list of libraries in the reference. Some libraries are included with the Arduino software. Others can be downloaded from a variety of sources or through the Library Manager. Starting with version 1.0.5 of the IDE, you do can import a library from a zip file and use it in an open sketch. See these instructions for installing a third-party library.

Third-Party Hardware

Support for third-party hardware can be added to the hardware directory of your sketchbook directory. Platforms installed there may include board definitions (which appear in the board menu), core libraries, bootloaders, and programmer definitions. To install, create the hardware directory, then unzip the third-party platform into its own sub-directory. (Don't use "Arduino" as the sub-directory name or you'll override the built-in Arduino platform.) To uninstall, simply delete its directory.

For details on creating packages for third-party hardware, see the Arduino IDE 1.5 3rd party Hardware specification.

Serial Monitor

This displays serial sent from the Arduino or Genuino board over USB or serial connector. To send data to the board, enter text and click on the "send" button or press enter. Choose the baud rate from the drop-down menu that matches the rate passed to Serial. Begin in your sketch. Note that on Windows, Mac or Linux the board will reset (it will rerun your sketch) when you connect with the serial monitor. Please note that the Serial Monitor does not process control characters; if your sketch needs a complete management of the serial communication with control characters, you can use an external terminal program and connect it to the COM port assigned to your Arduino board.

3.6.9 EasyEDA Software

EasyEDA is a web-based EDA tool suite that enables hardware engineers to design, simulate, share - publicly and privately - and discuss schematics, simulations and printed circuit boards. Other features include the creation of a bill of materials, Gerber files and pick and place files and documentary outputs in PDF, PNG and SVG formats.EasyEDA allows the creation and editing of schematic diagrams, SPICE simulation of mixed analogue and digital circuits and the creation and editing of printed circuit board layouts and, optionally, the manufacture of printed circuit boards.

Subscription-free membership is offered for public plus a limited number of private projects. The number of private projects can be increased by contributing high quality public projects, schematic symbols, and PCB footprints and/or by paying a monthly subscription. Registered users can download Gerber files from the tool free of charge; but for a fee, EasyEDA offers a PCB fabrication service. This service is also able to accept Gerber file inputs from third party tools.

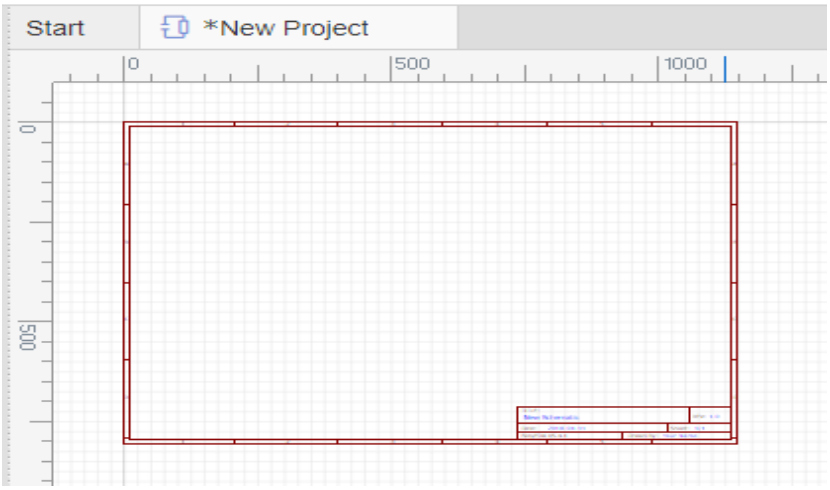


Figure 3.23: EasyEDA Software Interface

Chapter 4

Result & Discussion

4.1 Result

We have been able to build our system by following all the objects and methodologies. At first we have set up the all components well for our system. Here the proximity sensor and IR sensor are used to detect metal and non-metal objects. The efficiency of this project is very good. It is capable of working for a long time. We are satisfied its performance.

4.2 Discussion

This kind of project already many of student study before, but they control it PLC system. We control with a gear motor. When we made this project then we face some of problem. We did not run it smoothly. After hard work and team work we did it.

Chapter 5

Conclusion

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5.1 Advantage

- Good accuracy to find metal and non-metal object.
- Time saving machine for industrial work.
- Very effectively work for product peak and place.
- Reduce energy waste.
- No Oil consumption.
- Less skill technicians are sufficient to operate.
- Installation is simplified very much.
- Less time and more profit.
- Simple construction
- Reduced weight of the system.
- Ease of operation.

5.2 Application

The project has a major application in the

- It can be used for Industrial work.
- It can be used in factories for peak and place.
- It can be used in pharmacy.
- It can be used for metal no-metal separator.

5.3 Limitation

It is a demo project so we found some limitation. In future we will work for reduce this kind of limitation. These limitations are –

- It is a demo project so its accuracy is 85%.
- This compressor has no extra air chamber.
- Our project may delay in work.

5.4 Future Scope

The model can be improved by making some changes in the program and components. Some suggestions are given below-

- We can add a monitoring-based control to automate control.
- We will increase its working accuracy level.
- We will add an air reserve tank.

5.5 Conclusion:

The main objective of this project was to develop an object sorting system based on certain specifications. This was successfully implemented. We consider this project as a journey where we acquired knowledge and also gained some insights into the subject which we have shared in this report. Arduino was used to control the various operations. More features can be added to this system as follows: depending on the size, shape and weight of the objects, sorting operations can be implemented. Sorting operation can be improvised using a piston arrangement.

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Appendix

Microcontroller Code:

```
#include <Servo.h>
Servo myservo;
Servo myservo1;

constint Pin = A0;
int relay = 3;
intirsen=4;
intir;
void setup() {
pinMode(Pin, INPUT);
pinMode(irsen, INPUT);
pinMode(relay, OUTPUT);
myservo.attach(9);
  myservo1.attach(8);
myservo.write(50);
   myservo1.write(50);
Serial.begin(9600);
}

void loop() {
digitalWrite(relay,HIGH);
intir = digitalRead(irsen);
intsensorValue = digitalRead(Pin);
Serial.println(sensorValue);
```

```
delay(1000);
if(sensorValue==LOW &&ir==LOW){
Serial.println("metal Detected");



myservo.write(90);
delay(5000);
myservo.write(50);
delay(500);

   }
if(sensorValue==HIGH &&ir==LOW ){
Serial.println("no metal Detected");



       myservo1.write(10);
delay(5000);
      myservo1.write(60);
delay(500);
    }
}
```