

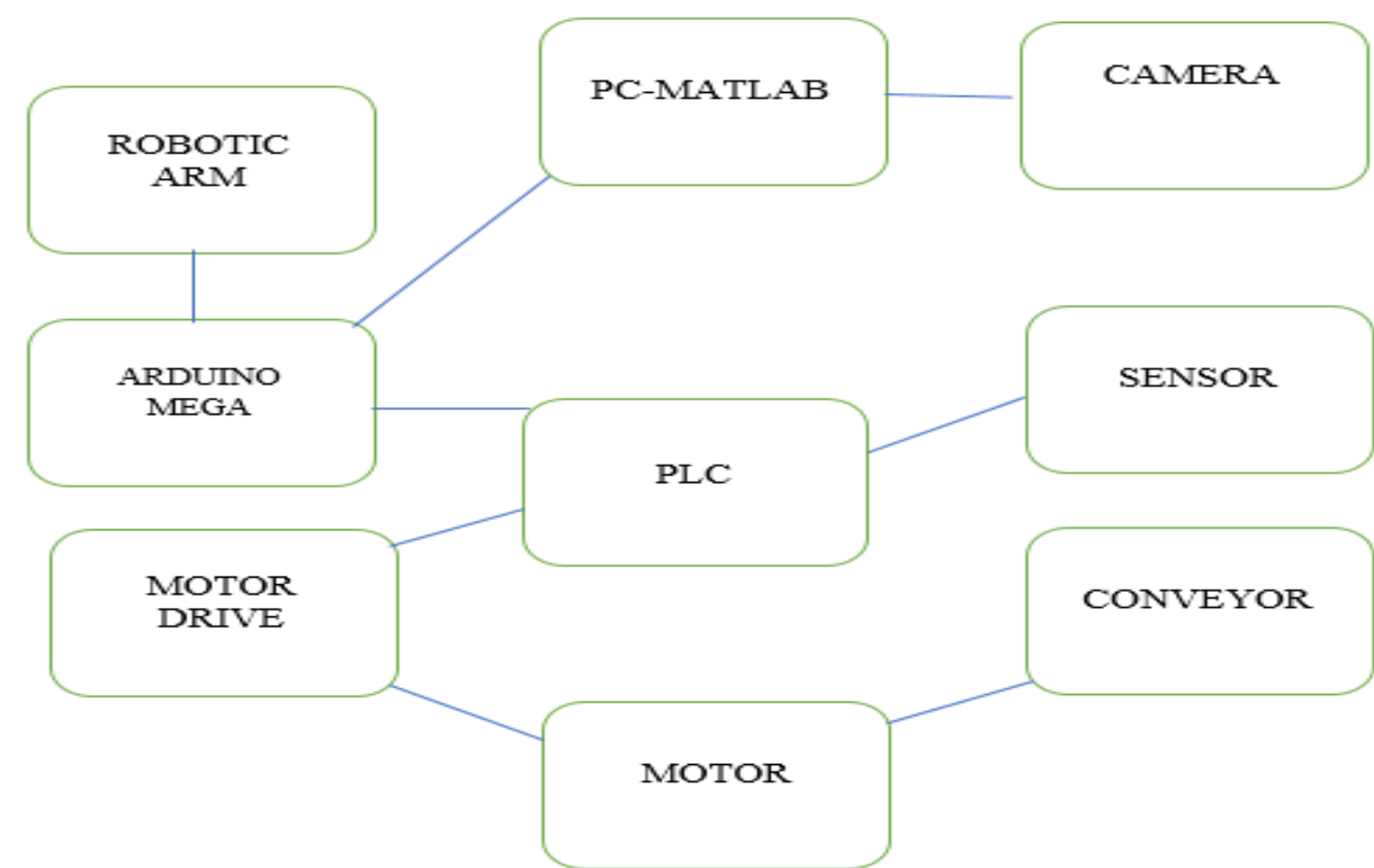
# Products Separation Line

Names: | Mohammed Al-kharouf , Ibrahim Saidi , Mohammed Moqadi , Yousef Salah | Supervision: Dr .Raed Jaber | An-Najah National University

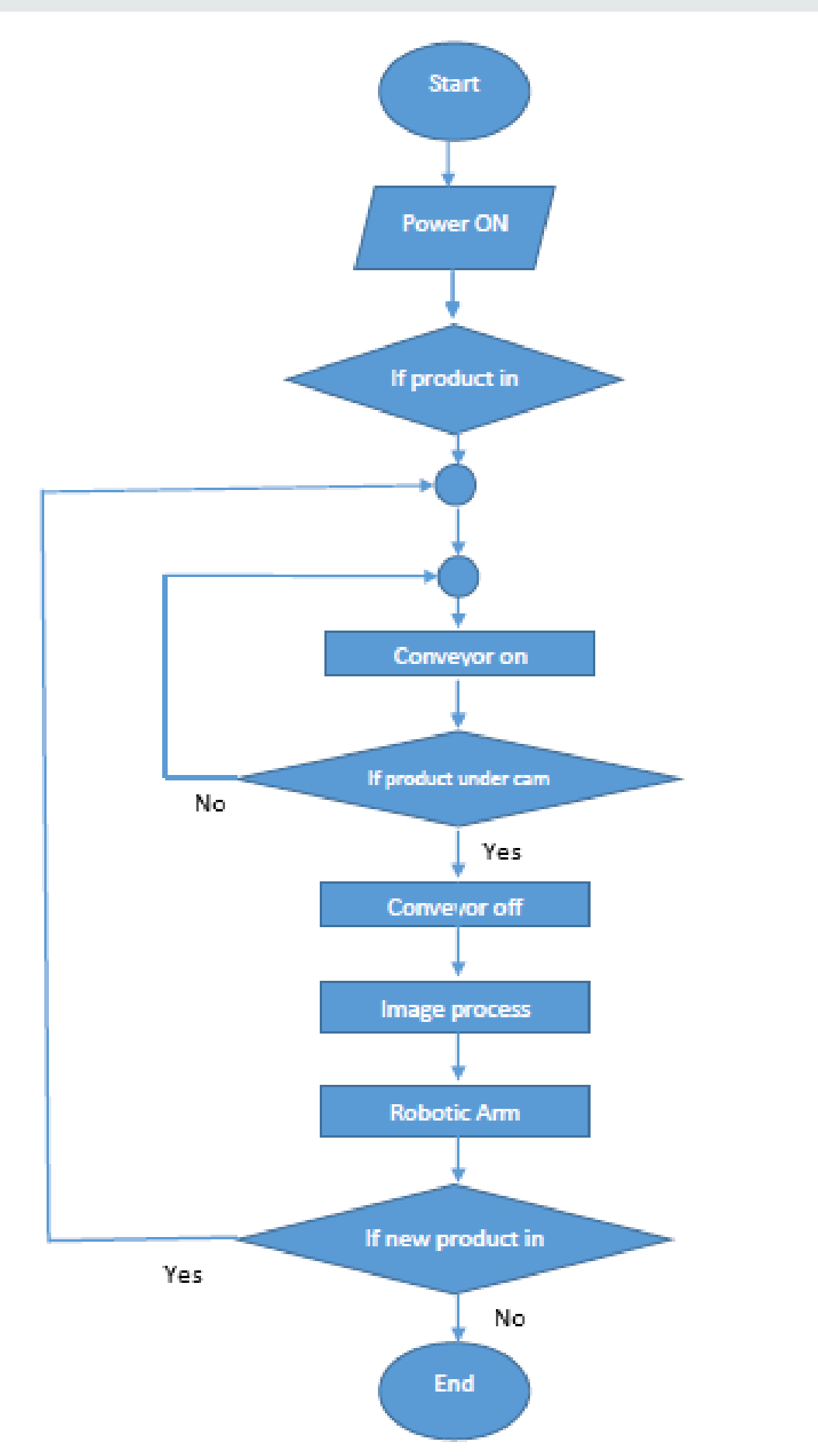
## Abstract

Our **graduation project** is a line for **separating products** of any **type and shape** so that it **consists** of a **conveyor** to transfer products and is controlled by the **PLC** and the **VFD driver** and also a **robotic arm** to hold the pieces and is controlled by **Arduino mega** and placed in the appropriate place, product analysis It is done by take a picture for it and analyzing it through **MATLAB**, and all of these controllers and systems must be working with each other simultaneously and harmoniously.

## Block Diagram

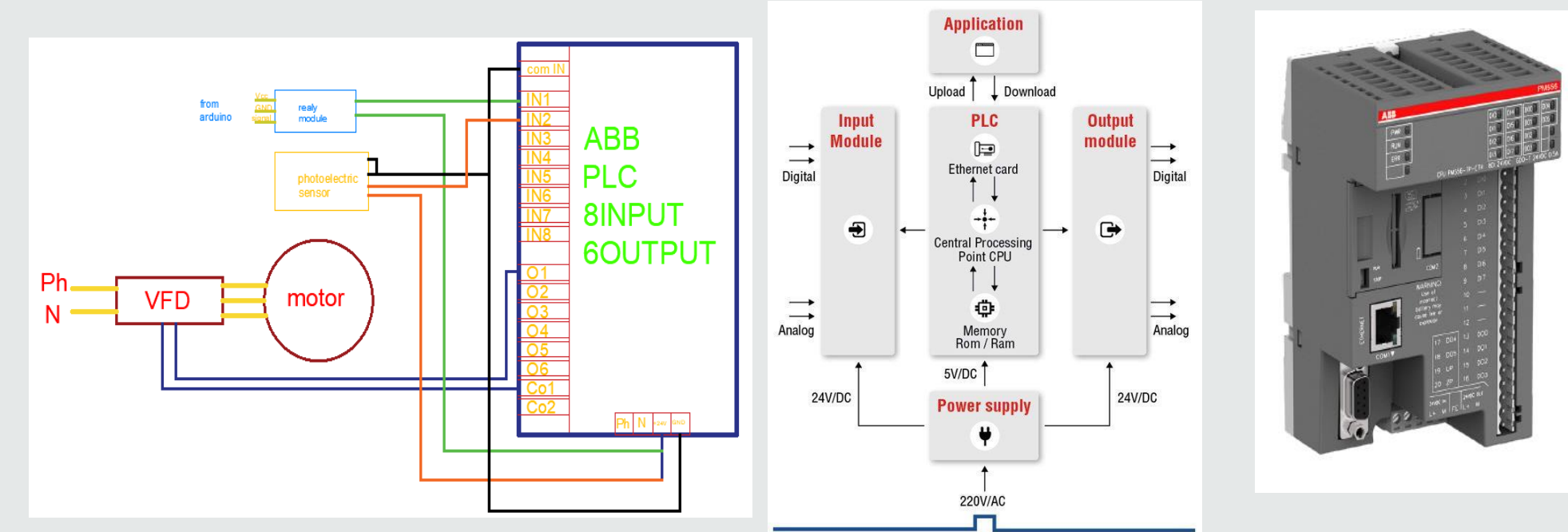


## Flow Chart



## Conveyer

A **Programmable Logic Controller, or PLC**, is a ruggedized computer used for industrial automation. These controllers can automate a specific process, machine function, or even an entire production line.



A **Variable Frequency Drive (VFD)** is a type of motor controller that drives an electric motor by varying the frequency and voltage supplied to the electric motor. Other names for a VFD are variable speed drive, adjustable speed drive, adjustable frequency drive, AC drive, Microdrive, and inverter.

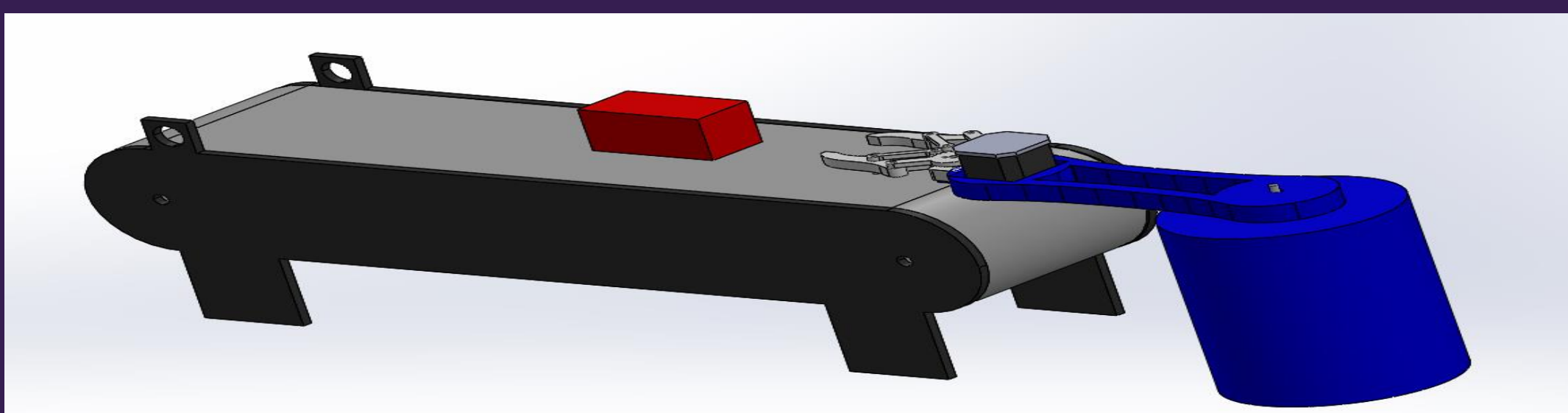
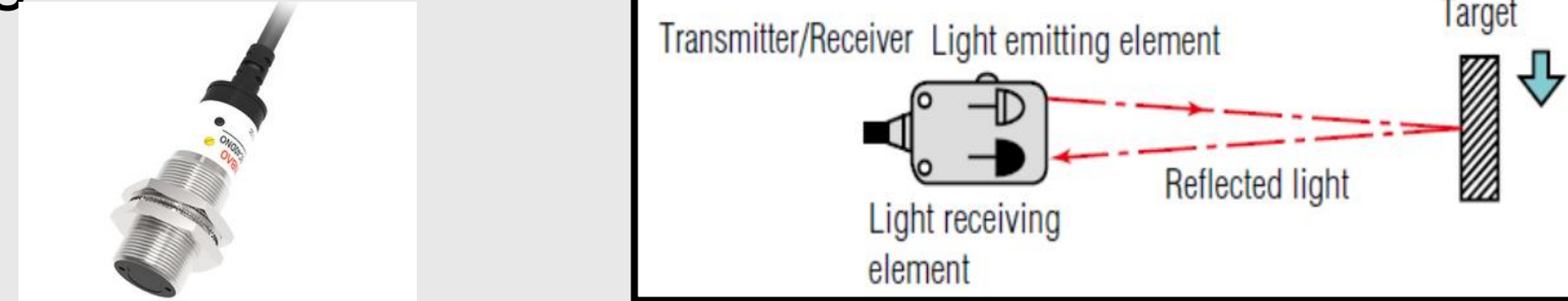


## Three Phase Induction Motor - Squirrel Cage

Motor with steel plate frame, for general use, developed to meet different applications with maximum performance and economy.



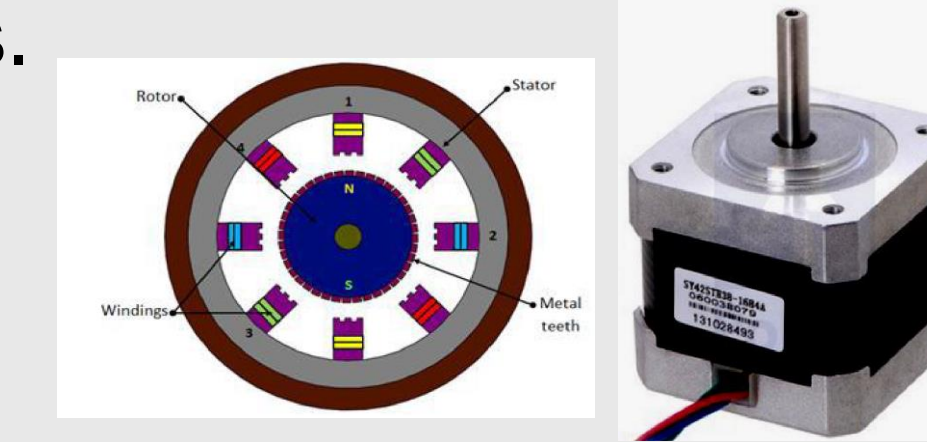
**Photoelectric Sensor** :A beam of light is emitted from the light emitting element and is received by the light receiving element.



## Robotic Arm

The **Robotic Arm** is designed using the Microcontroller i.e. ATMEGA1280 Micro-controller using Arduino programming. This process works on the principle of interfacing stepper and potentiometers. This task is achieved by using Arduino board. The board processes the signals received from the PLC and finally, converts them into requisite digital pulses that are then sent to the stepper motors. This stepper motor will respond with regards to the pulses which results in the moment of the arm.

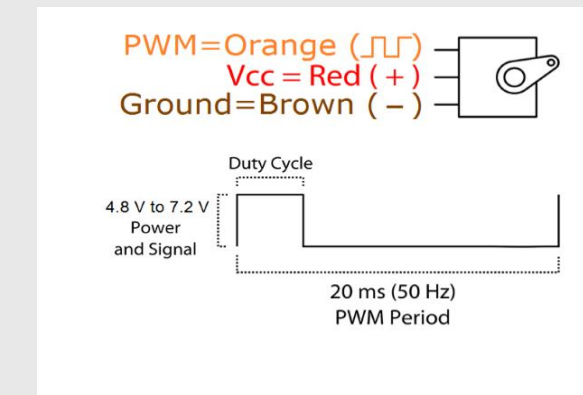
The **stepper motor** is one kind of electric motor used in the robotics industry which converts electrical pulses that are provided by a stepper motor driver into discrete mechanical movements. Stepper motors are an important part of 3D printers.



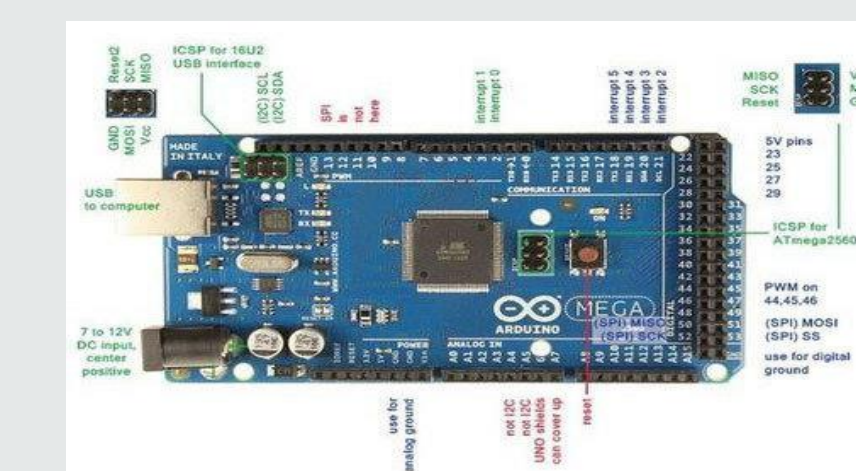
A **stepper drive** is the driver circuit that controls how the stepper motor operates. Stepper drives work by sending current through various phases in pulses to the stepper motor.



A **servo motor** is a rotary actuator that allows for precise control of angular position. It consists of a motor coupled to a sensor for position feedback.



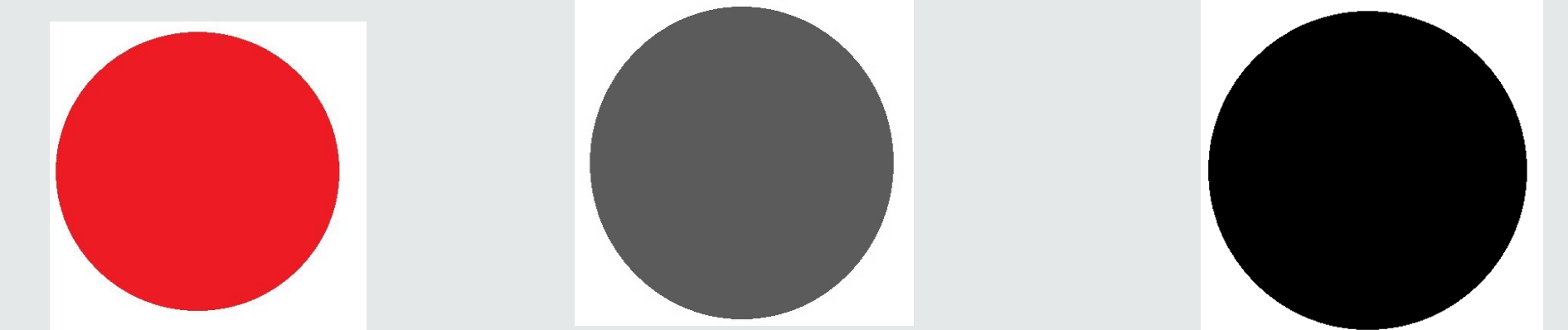
The **Arduino Mega** is a microcontroller board based on the ATmega1280. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs.



## Image Processing by MATLAB

**Image processing** is one of the most important area of multimedia and industrial applications and it is known, these applications can be found almost everywhere in the modern world. Because of that, the number of people working with images is rapidly increasing which means, that demand for image processing tools also grows.

original image Gray scale image white and black image



## Image processing algorithms:

- 1- camera declaration and configuration
- 2- Send data from Arduino to matlab by serial port.
- 3-Get a snapshot
- 4- Save the image
- 5-Read the image
- 6- Grayscale for edge detection
- 7-Show the image
- 8- detects edges in the grayscale image (only in gray scale)
- 9- find the vertical and horizontal length of pixels in Black white image
- 10- plots the sparsity pattern of the matrix S matrix and length calculation
- 11- find the area and the length of the shape and based it determined the result
- 12- by using Arduino library between matlab and Arduino then send the data again to the Arduino by serial port by fprintf(serial COM, the required value) then the Arduino response and run the robotic arm

## Conclusion

Through the graduation project, a robotic arm which controlled by Arduino has been designed to separate the products based on their shape and area by using image processing technology using the Matlab program and also select the appropriate electrical and mechanical components and how to connect all controllers each other in order to operate simultaneously.