Arduino session

A picture containing electronics, circuit

Description automatically generated

By: Aya Ali Kamal

Table of Contents

[**C++ language & Arduino:** 2](#_Toc126929707)

[**Difference between micro-processors and micro-controllers:** 2](#_Toc126929708)

[**Micro-processor:** 2](#_Toc126929709)

[**Micro-Controller:** 2](#_Toc126929710)

[**Types of Micro-controllers:** 2](#_Toc126929711)

[**What is AVR:** 2](#_Toc126929712)

[**Why use AVR microcontrollers:** 3](#_Toc126929713)

[**What is the difference between AVR and Arduino:** 3](#_Toc126929714)

[**Arduino types:** 3](#_Toc126929715)

[**Arduino Hardware component:** 3](#_Toc126929716)

[**Arduino pins:** 3](#_Toc126929717)

[**Arduino software interface:** 3](#_Toc126929718)

[**Practical examples through the session:** 4](#_Toc126929719)

[**Example1:** 4](#_Toc126929720)

[**Example2:** 4](#_Toc126929721)

[**Example3:** 4](#_Toc126929722)

[**Example4:** 5](#_Toc126929723)

[**Example5:** 5](#_Toc126929724)

[**References:** 5](#_Toc126929725)

# **C++ language & Arduino:**

Arduino is a language that support the syntax of C++ language,

Variables & constants if conditions, Loop, Function, Return, Pointers, Array, operators, struct, #define, #include.

Variables & constants, if conditions, Function, Return will be discussed by using calculator example.

Loop, array, and operators will be explained in auto increment array elements.

Pointers will be explained as a swapping function.

Struct will be explained as a simple code.

# **Difference between micro-processors and micro-controllers:**

## **Micro-processor:**

It consists of only a central processing unit CPU.

A **microprocessor** is a controlling unit of a micro-computer wrapped inside a small chip. It performs Arithmetic Logical Unit (ALU) operations and communicates with the other devices connected with it. It is a single Integrated Circuit in which several functions are combined.

It doesn’t contain memory, or programmable I/O.

## **Micro-Controller:**

A **microcontroller** is a chip optimized to control electronic devices. It is stored in a single integrated circuit which is dedicated to performing a particular task and execute one specific application.

It is specially designed circuits for embedded applications and is widely used in automatically controlled electronic devices. It contains memory, processor, and programmable I/O.

We can say that the micro-processor is one of the components of the micro-controller.

# **Types of Micro-controllers:**

AVR micro-controllers (ATMega32, Atmega16, Atmega8, Atmega326).

## **What is AVR:**

AVR stands for Atmel Virtual microcontroller. It is a microcontroller series developed by Atmel, which is a semiconductor company based in the United States. The company was founded in 1984 and has since grown to be one of the largest manufacturers of microcontrollers, with more than one hundred million products sold per year. Their flagship product is the AVR line of microcontrollers, which are used in everything from household appliances to consumer electronics.

## **Why use AVR microcontrollers:**

The main reason why AVR microcontrollers are used is because they are cheap and easy to use. They can be programmed using the C programming language, which makes them easy to use. Also, they are very small in size, making them very portable and lightweight.

## **What is the difference between AVR and Arduino:**

Arduino is a microcontroller, while AVR is a microcontroller family. However, they are both based on the same ARM architecture and are compatible with each other.

# **Arduino types:**

Arduino uno- Arduino nano- Arduino mega- Arduino Due32-bit- ESP.

# **Arduino Hardware component:**

**Graphical user interface

Description automatically generated**

The hardware component is almost the same, but with different number of analog and digital pins.

A picture containing text, electronics, circuit

Description automatically generated

# **Arduino pins:**

Digital pins values (0,1).

PWM pins (digital pins but with distinctive feature)as:

PWM, is a technique for getting analog results with digital means. Digital control is used to create a square wave, a signal switched between on and off.

analog pins values in range from 0 to 1023.

# **Arduino software interface:**

* A brief about the Arduino IDE (Arduino reference).
* Explanation for the code implementation.
* Arduino functions (digital read (), digital write (), analog read (), analog write (), pin mode (), map (), delay (), servo motor library (servo. attach (), servo. write ()).
* How to implement a code.

# **Practical examples through the session:**

## **Example1:**

An example on how to toggle a led with a switch.

* **Functions to be used:** digital Write (), digital Read (), pin Mode ().
* **Tinker cad circuit:**

<https://www.tinkercad.com/things/ifTCyKKn66Y-incredible-krunk-fulffy/editel?sharecode=NKpJ4AUcbd3whFn2rBRTefzhcZbCpSsn0f5CTt2NMXw>

## **Example2:**

Control a light density of a led using potentiometer.

* **Functions to be used:** analog Read (), map (), analog Write (), pin Mode ().
* **Tinker cad circuit:**

<https://www.tinkercad.com/things/aq2hC01pwNy-terrific-habbi/editel?sharecode=dnZ372c1npgE1fxSkk3sZs2M6i2mpZ9VO4ibcVYn6Js>

## **Example3:**

* **Traffic light:**

There is a traffic lights every where some of them are automatic, but a lot of them need humans to turn the lights from yellow, red, and green.

Programmers’ role is to help make humans life more comfortable, so required to make this traffics simi autonomous as it just wants to be opened using a push button which is humans role and it will turn the lights with itself.

* **Functions to be used:** digital Read(), delay (),digital Write(), pin Mode().
* **Tinker cad circuit:**

<https://www.tinkercad.com/things/7KZWJ8kIbnD-glorious-curcan/editel?sharecode=Dn9UVM96u0V4TLb8MkWmwZyknmrZ6k3GOj5XDuYp9ds>

## **Example4:**

* **Robot movement:**

Robots used motors to move so it can do required tasks.

Try to control the angel of twist for a servo motor using potentiometer as when you turn the potentiometer selector the value of the twisting angle from 0 to 180 degree.

**Hint:** use servo motor library, and its functions to write the code.

* **Functions to be used:** analog Read (), map(), servo library (servo. attach (), servo. write ()).
* **Tinker cad:**

<https://www.tinkercad.com/things/dtfHOXuunSZ-powerful-trug/editel?sharecode=mctLp3nGXoNXWvagMJW7xAk_aTE4bqbKnxNurZvENNE>

## **Example5:**

Obstacles identify:

Obstacles may prevent robot from reaching to its destination, so you must build a robot that can define Obstacles and avoid them, use ultrasonic sensor to help you define obstacles and can determine the space between robot and obstacles.

**Functions to be used:** Use the following functions: pinMode(), delayMicroseconds(), digitalWrite().

**Tinker cad:**

<https://www.tinkercad.com/things/jHfe9GXWTCV-terrific-kasi-blad/editel?sharecode=_qMShbKmeanCZ5eJmGAy1sSVt9HjA7BUgvq11OBsWQ4>

# **References:**

[Document15.docx](https://alexuuni-my.sharepoint.com/:w:/g/personal/es-ayaali2025_alexu_edu_eg/EU5YhGAVrlVCpbjpRdzo4m8Btt1A31okiCbilI7MiTGD1g?e=8tcuYQ)