Arduino Recapping Session

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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 that is dedicated to performing a particular task and executing one specific application.

It is a specially designed circuit 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 microprocessor is one of the components of the microcontroller.

Types of Micro-controllers:

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:

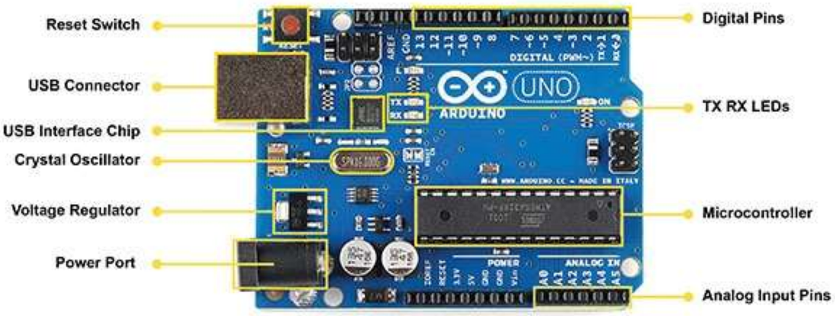
The main reason why AVR microcontrollers are used is because they are cheap and easy to use. They can be programmed using the C programming language, which makes them easy to use. Also, they are very small in size, making them very portable and lightweight.

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 Hardware:

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



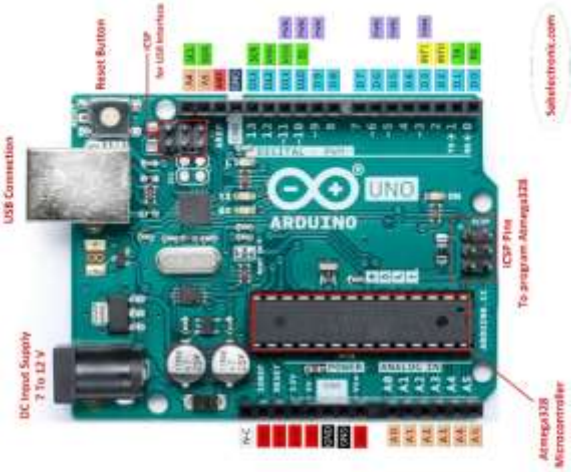
Arduino pins:

Digital pins values (0,1).

s PWM pins (digital pins but with distinctive features) 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 range from 0 to 1023.



Digital VS Analog:

Digital is a type of signal that takes two values 1 or 0 1 refers to high or on, and 0 refers to low or off.
Analog is a type of signal that takes infinite values which can be positive or negative.

PWM:

Is a type of signal that is a combination of a digital and analog signal that takes a certain value for a period.

Arduino software:

Arduino is a language that uses Arduino IDE to write code, so what is the code, and how does it work?

Code is instructions written by the programmer to make the robot understand the variables around him and do some missions.

The code we will write will use Arduino language but before we go into it we are going to understand the main concepts of programming.

Each line in code must end with a ; that mean this line finished.

Variable:

What is a variable?

Humans are not declared, when we say our names and ages we are now declared.

When we say my name is Robot Sofia and my age is 2 years old.

Now I am declared when anyone calls Sofia, I will know that it is me.

But I have to know how many seats he will need.

But the program has its Size and this variable is in the program so I need to know which size this variable will take in the memory, and that can be known when we know its type so we can know how many places this variable will take In the memory.

The famous variables type is:

1- Int 4 bytes.
2- Char 1 byte.
3- Float 4 bytes.
4- Double 8 bytes.

Byte is the size of the memory, and each byte consists of 8 bits.

Imagen the memory is a desk drawer and has rows which are bytes, and each row consists of 8 columns which represent bits.

Declaration VS Definition:

The declaration is to just say the name and type of the variable without setting an initial value for it.

Ex: int Value;

The definition is to set an initial value for this Value.

int Value = 0;

Restrictions in naming Variable:

1- The variable name can’t start with a number EX: 8Value.
2- We can start it with capital Value.
3- We can start with underscore _Value.
4- If we have A name that consists of two parts we can write it as e.g.: Value_Name, ValueName, Valuename.

IF Condition:

If condition we have 2 paths, one is light and the other is dark, and our microcontroller says we have to go in the path that has a Lamb.

So we are going to check which path has lambs, and we will go in.

The first path is light so the condition is true and the robot will go in it.

And the second path is dark, so the condition is false.

Syntax:

```
If (Condition){

What is my robot going to do?

}

else {// if the condition is false go to this line if not skip it.

}
```

Nested if:

If we have more than one condition, we need to check each condition if the first condition is false go and check the second condition if not skip the second condition.

Syntax:

```
If (Condition){

What is my robot going to do?

}

else if (second condition) {

What is my robot going to do?

}

else if (third condition) {

What is my robot going to do?

}

else {// if all previous conditions are false go to this line if not skip it.

}
```

While Loop:

If I want to repeat a line more than one time and want to write it one time only.

We will give our Arduino 3 main things.

1- Initial value for a variable.
2- Final value for a variable.
3- Condition that I must check to repeat the line.

Syntax:

While (condition){

If true do this line if false, skip this line.

}

Other syntax:

For (variable = start value; Variable = final value ; increment way){

Do this line if the variable is out of the range we need.

}

Other syntax:

do{something}

while (this condition is true).

Function:

If we want to write code that does a specific task we can write and we want to make it on our opinions, we can make functions such as int main (){}.

The syntax is: function type Function name (Parameters type parameters name){

Code we want to execute.

}

Function scoop:

The thing written in this {} pracite is shown only in this pracite, it’s as rooms we can if we are in a room number one, I can’t know what is happening in room number two, and so on.

If we are talking about function scoop, we have to talk about local and global variables.

Local VS Global Variables:

If I define myself on a stage so anyone can know who I am, that is the global variable any function, or scoop can see this variable.

But if I define myself in a small room with 5 people in it, no one will know me except these 5 people, that is the local variable it is defined only in one scoop so any other scoops can’t see it.

Famous Functions in Arduino:

Serial.begin():

We have communication between the laptop and Arduino and this communication has a speed so when we call Serial.begin(Speed), We start the communication at a speed we want.

analogRead(pin I want to read):

This function makes the Arduino read the analog pin I want and get the value of the electrical signal on it.

analogwrite(pin I want to read, value I want):

This function makes Arduino write the value I want on the analog pin I want.

pinMode(pin name or number , input/ output):

This function lets Arduino know if the pin connected with it is input so it gets data from it, or output so it prints data on it.

digitalRead(pin I want to read):

This function makes the Arduino read the digital pin I want and get the value of the electrical signal on it, which is High or Low.

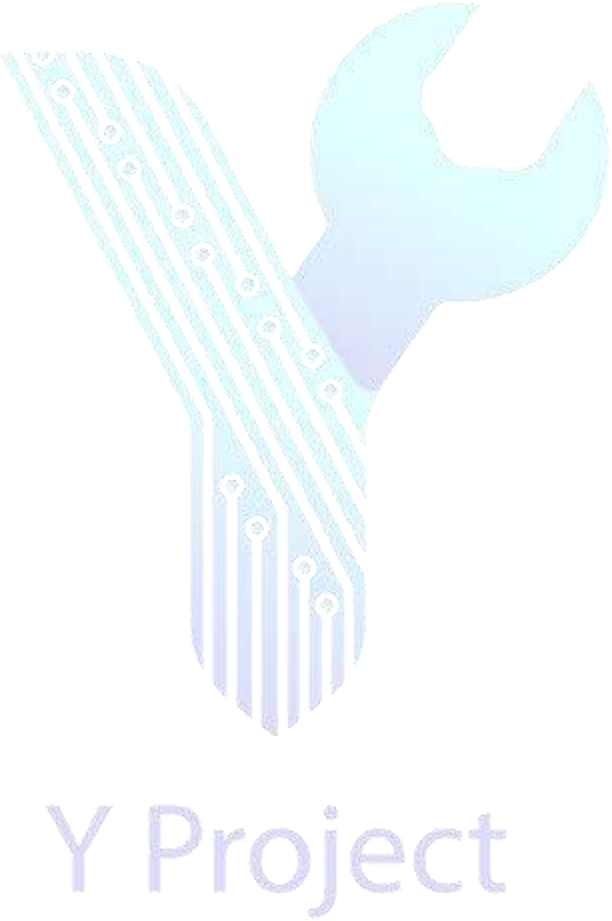
digitalWrite(pin I want to read, value I want):

This function makes Arduino write the value I want on the digital pin I want.

delay(time in milliseconds):

this function make a delay in the code in milliseconds.

If you want to get more functions and know their function, and syntax you can search here: https://www.arduino.cc/reference/en/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