Report on Arduinos

# Microprocessors

A microprocessor is the central unit of the computer system that performs arithmetic, logical and control operations. It consists of a single or multiple integrated circuits.

# Microcontrollers

Microcontrollers are compact integrated circuits designed to govern a specific operation in an embedded system. It is a small computer on a single VLSI integrated circuit (IC) chip.

The main difference between **microprocessors** and **microcontrollers** is that microprocessors consist of only a Central Processing Unit, whereas microcontrollers contain a CPU, Memory, I/O all integrated into one chip. Microprocessor is used in Personal Computers whereas microcontroller is used in an embedded system.

# Arduinos

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

## Types of Arduino

### Arduino R3

Arduino Uno is the most popular and widely used development board. It is powered by an ATMega328P microcontroller.It consists of 14 Digital I/O out of which 6 pins are 8 bit PWM pins, 6 pins are10-bit Analog inputs, and basic communication ports like SPI, I2C, and UART.

### Arduino Nano

Arduino Nano is a small breadboard-friendly version of Arduino UNO. It has more or less functionality of the Arduino UNO but in a small form factor. The only major differences from UNO are the lack of a DC power jack, the usage of a Mini USB port instead of a USB B port, and the USB-TTL converter chip.

### Arduino Leonardo

Arduino Leonardo is powered by an ATmega32U4 chip. It has a built-in USB communication eliminating the need for a second processor.

### Arduino Due

This Arduino board depends on the ARM Cortex-M3 and it is the first Arduino microcontroller board. It includes 54 digital i/o pins and 14 analog pins(12 input and 2 output)

### Lilypad Arduino

The LilyPad Arduino is a microcontroller board designed for wearables and e-textiles. It can be sewn to fabric and similarly mounted power supplies, sensors and actuators with conductive thread.The board is based on the ATmega168V or the ATmega328V.The LilyPad Arduino was designed and developed by Leah Buechley and SparkFun Electronics.

### Redboard Arduino

The Arduino Red board is another type of Arduino board that uses the mini USB cable for getting programmed and the Arduino IDE is used for this purpose. The Red board uses the FTDI chip and USB chip for the connection to other devices. As the design of the red board is very simple it can be easily integrated with other projects. The only requirement is to plug the red board and select the appropriate option and can upload the program in no time. The barrel jack can be used to control the USB cable of the Arduino Red board.

# Pulse Width Modulation

Pulse width modulation or PWM is a commonly used control technique that generates analog signals from digital devices such as microcontrollers. The signal thus produced will have a train of pulses, and these pulses will be in the form of square waves. Thus, at any given time, the wave will either be high or low.

Most of the microcontrollers have built-in PWM modules which help them generate analog signals from a digital system.

# Digital Pins

Digital pins are used for input or output of digital signals in the microcontroller. We use pinmode() to configure these pins as output or input.

Pins configured as INPUT are said to be in a high-impedance state. Input pins make extremely small demands on the circuit that they are sampling, equivalent to a series resistor of 100 megohm in front of the pin. This means that it takes very little current to move the input pin from one state to another, and can make the pins useful for such tasks as implementing a capacitive touch sensor, reading an LED as a photodiode, or reading an analog sensor with a scheme such as RCTime.

digitalRead(pin) is used to read the input value from a specific pin.

Pins configured as OUTPUT are said to be in a low-impedance state.This means that they can provide a substantial amount of current to other circuits. These pins can source (provide positive current) or sink (provide negative current) up to 40 mA (milliamps) of current to other devices/circuits. This is enough current to brightly light up an LED or run many sensors but not enough current to run most relays, solenoids, or motors.

digitalWrite(pin,value) is used to produce a voltage according to the corresponding value, HIGH produces a voltage of 5V while LOW produces a voltage 0V.

# Analog Pins

Analog input pins allow an application to examine the voltage levels present on a pin as an analog signal.

analogRead(pin) function reads the value from the specific analog pin. analogWrite() works on all analog pins and all digital PWM pins.

# Analog and Digital Signals

Analog signals were used in many systems to produce signals to carry information. These signals are continuous in both values and time.

Unlike analog signals, digital signals are not continuous, but signals are discrete in value and time. These signals are represented by binary numbers and consist of different voltage values.

The major difference between both signals is that the analog signals have continuous electrical signals, while digital signals have non-continuous electrical signals.