**CDH-Intro Task-Research section**

**Part 1:**

Pulse Width Modulation, or 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. This on-off pattern can simulate voltages in between the full Vcc of the board (e.g., 5 V on UNO, 3.3 V on a MKR board) and off (0 Volts) by changing the portion of the time the signal spends on versus the time that the signal spends off.

In general, PWM is not a protocol however it can be used as a protocol for servos. A servo needs regular square wave frames with very specific duty cycles, so PWM is sometimes used to generate this without processor overhead.

Signal Shape:

A diagram of a positive and negative

Description automatically generated

Since we are using UNO Board the Amplitude is 5V. the pin that is used for Servo component is 9. The frequency of pin 9 in UNO Board is set by “TCCR1B” Timer. By default, it is set to “500MHZ”.

Shape of Signal in:

a.75%:

A blue line with a white background

Description automatically generated

b.25%:

A blue line with a white background

Description automatically generated

c.100%:

A green line with black text

Description automatically generated

All the periods are the same because the pin frequency does not change.

**Part 2:**

IC2 is a protocol that uses two wires for communication. It uses a single wire plus a clock wire and includes addressing so that each message gets routed to a specific device. It is used when there is a need for better addressing and it enables communication with many devices only using two wires because it includes address for targeted device.

IC2 vs PWM:

I2c is a kind of serial data. it can send any kind of information over it, commands, sensor data, and so on. On the other hand, PWM can only send just one number. PWM is very much like an analog voltage in a wire.

Advantages of I2C:

As it is mentioned before, it has better addressing which enables communication between many devices with only two wires. I2C also supports multiple masters, which can increase the robustness and versatility of the system.

Disadvantages of I2C:

I2C lower data rates, typically up to a few megahertz. It also requires pull-up resistors on the lines, which can increase the power consumption and reduce the signal quality.