**Experiment No. 1 – KHUSHBOO JAIN (G7 – 2410993045)**

**Aim:** To examine the architectural framework of the Arduino Uno (ATmega328P)

microcontroller and demonstrate fundamental General-Purpose Input/Output (GPIO)

operations through digital signal manipulation.

**Apparatus**: Wokwi Simulator

**Circuit Layout:**

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Figure 1: Arduino Architecture

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Figure 2: Pin description

**Theory:**

***Arduino Architecture:***

Arduino’s processor basically uses the Harvard architecture where the program code and program data have separate memory. It consists of two memories- Program memory and the data memory. The code is stored in the flash program memory, whereas the data is stored in the data memory. The Atmega328 has 32 KB of flash memory for storing code (of which 0.5 KB is used for the bootloader), 2 KB of SRAM and 1 KB of EEPROM and operates with a clock speed of 16MHz.

**Pin Description:**

1. Analog Pins:
   * There are 6 analog input pins (A0 to A5).
   * These are used to read analog sensors like temperature, light, etc.
   * Each pin can read values from 0 to 1023 (10-bit ADC).
2. Digital Pins:
   * There are 14 digital I/O pins (0 to 13).
   * These pins can be configured as either input or output.
   * Pins 3, 5, 6, 9, 10, and 11 support PWM (~) output.
3. Power Pins:
   * 3.3V: Provides 3.3 volts (max 50 mA).
   * 5V: Provides regulated 5 volts.
   * GND: Ground pins (3 in total).
   * VIN: Input voltage to the Arduino when using an external power source (7–12V recommended).
4. AREF Pin:
   * AREF (Analog Reference): Used to provide a reference voltage for analog inputs.
5. Reset Pin:
   * Used to reset the microcontroller.
6. Communication Pins:
   * TX (Pin 1): Transmit data – used for serial communication.
   * RX (Pin 0): Receive data – used for serial communication.
   * These are also connected to the USB-to-serial converter for communication with a computer.
7. Power Indicator LED (ON):
   * The green LED indicates that the board is powered on.
8. Pin 13 LED (L):
   * The built-in LED on pin 13 is useful for testing and debugging basic code.
9. ICSP Header:
   * Used for programming the Arduino using an external programmer.
10. USB Connector:

* Used for uploading code and serial communication with a computer.
* Also supplies power when connected.

**Code used:**

void setup() {

  // initialize digital pin LED\_BUILTIN as an output.

  pinMode(LED\_BUILTIN, OUTPUT);

}

// the loop function runs over and over again forever

void loop() {

  digitalWrite(LED\_BUILTIN, HIGH);  // turn the LED on (HIGH is the voltage level)

  delay(1000);                      // wait for a second

  digitalWrite(LED\_BUILTIN, LOW);   // turn the LED off by making the voltage LOW

  delay(1000);                      // wait for a second

}

**Simulation Outcome:**

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Figure 3: (a) LED ON (b) LED OFF

**Result:**

The Arduino UNO board was successfully studied, and all major pins were identified and understood. The pin functions—such as Analog Inputs, Digital I/O, PWM, Power Supply, Serial Communication, and LED indicators—were clearly examined and documented. This understanding forms the foundation for interfacing sensors, modules, and performing embedded system tasks in future experiments.