Experiment No._02

Title: Sensor and actuator interfacing with Arduino

Batch: B2 **Roll No.: 16010421059** **Experiment No.:02**

Aim: Sensor and actuator interfacing with Arduino

Resources needed: Internet, Arduino Board, Sensors and Actuators

Theory:

Pre Lab/ Prior Concepts:

The Internet of Things (IoT) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and connectivity which enable these objects to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure.

Role of Sensor in IoT:

Sensors are now found in a wide variety of applications, such as smart mobile devices, automotive systems, industrial control, healthcare, oil exploration and climate monitoring. Sensors are used almost everywhere, and now sensor technology is beginning to closely mimic the ultimate sensing machine the human being. The technology that allows this to happen is sensor fusion, which leverages a microcontroller to fuse the individual data collected from multiple sensors to get a more accurate and reliable view of the data than one would get by using the data from each discrete sensor on its own. Sensor fusion creates a situation in which the whole is much greater than the sum of its parts.

Role of Actuator in IoT:

An actuator is a component of a machine that is responsible for moving and controlling a mechanism or system, for example by opening a valve. In simple terms, it is a "mover".

An actuator requires a control device (controlled by control signal) and a source of energy. The control signal is relatively low energy and may be electric voltage or current, pneumatic, or hydraulic fluid pressure, or even human power. Its main energy source may be an electric current, hydraulic pressure, or pneumatic pressure. The control device is usually a valve. When it receives a control signal, an actuator responds by converting the source's energy into mechanical motion. In the electric, hydraulic, and pneumatic sense, it is a form of automation or automatic control.

The displacement achieved is commonly linear or rotational, as exemplified by linear motors and rotary motors, respectively. Rotary motion is more natural for small machines making large displacements. By means of a leadscrew, rotary motion can be adapted to function as a linear actuator (a linear motion, but not a linear motor).

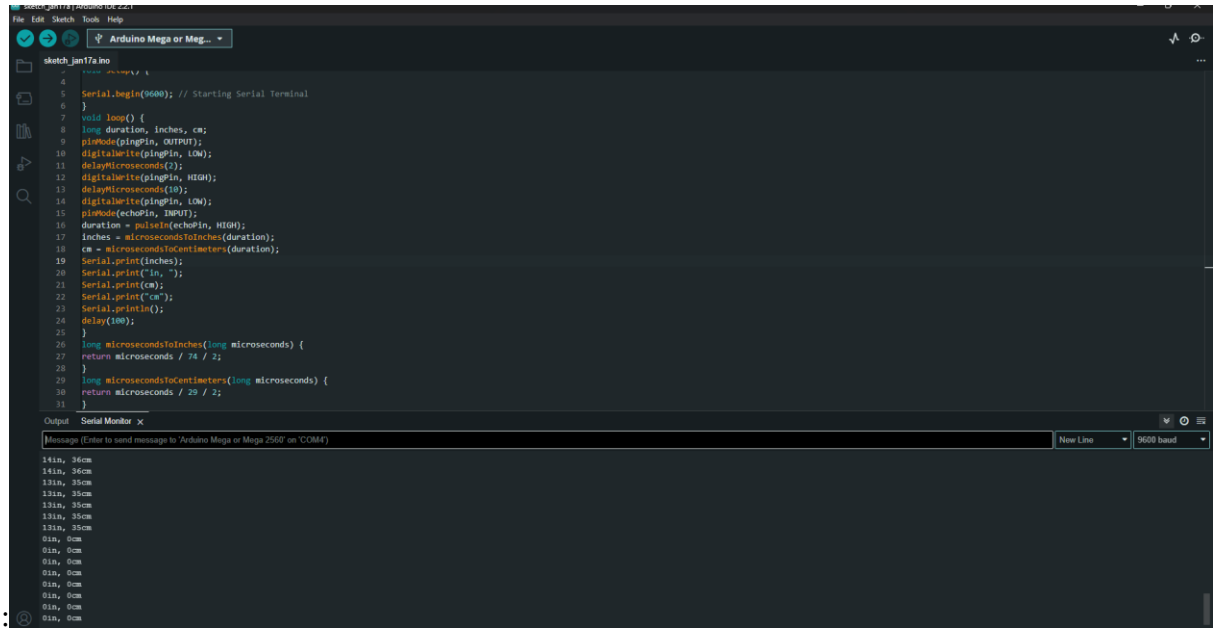
Activity:

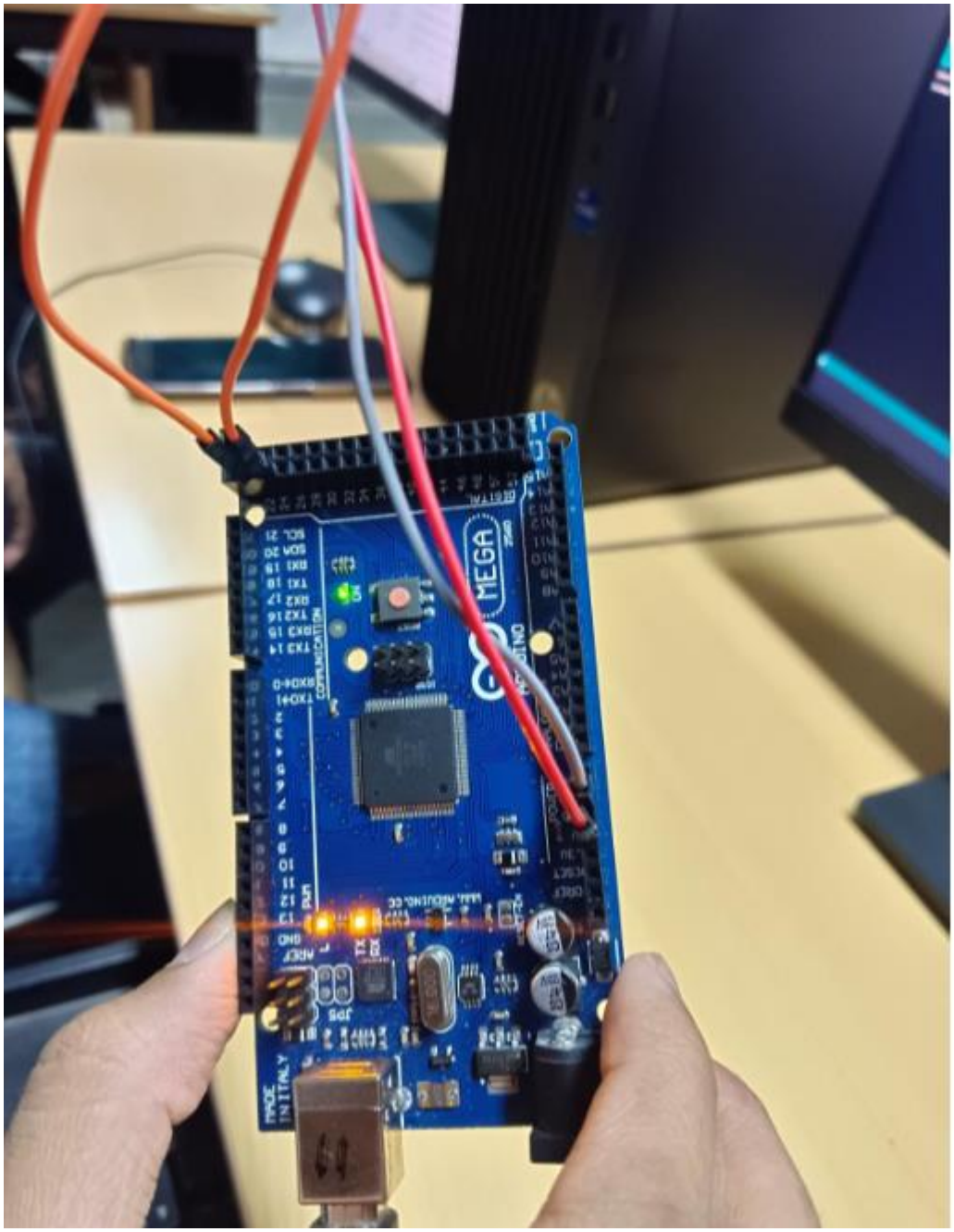
1. List out sensors which can be use with Arduino.
2. Integrate verity of available sensor in lab with Arduino, list out step performed, circuit, code, output and components used.

Results: (Program printout with output / Document printout as per the format)

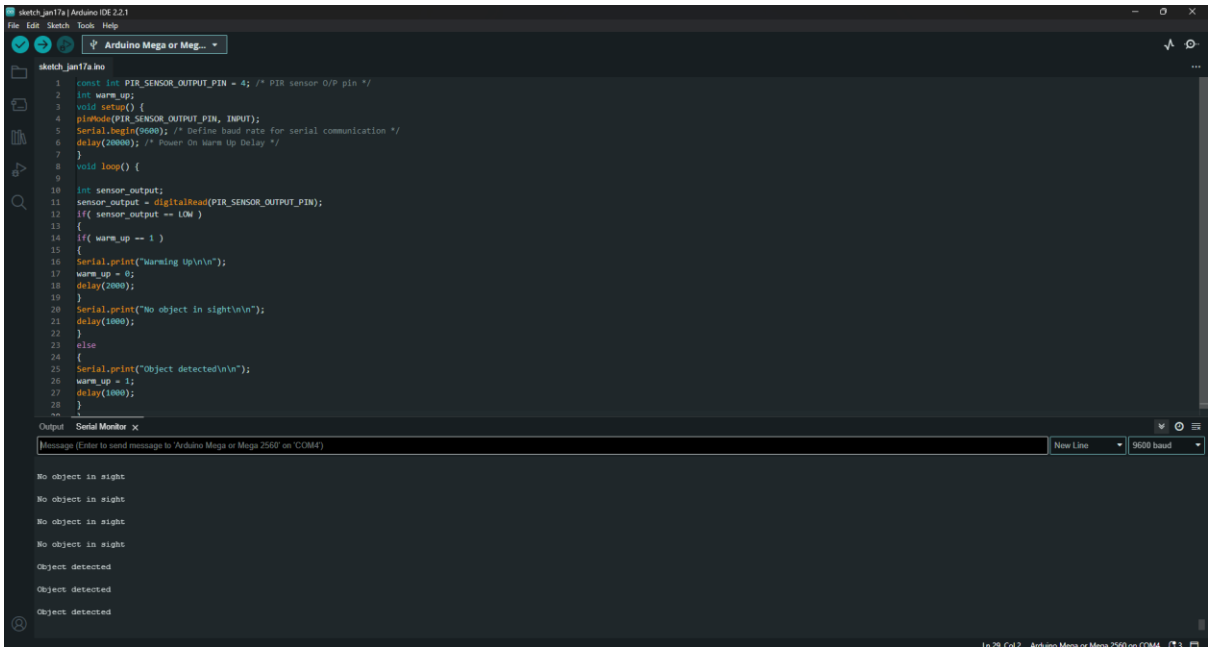
Ultrasound Sensor:

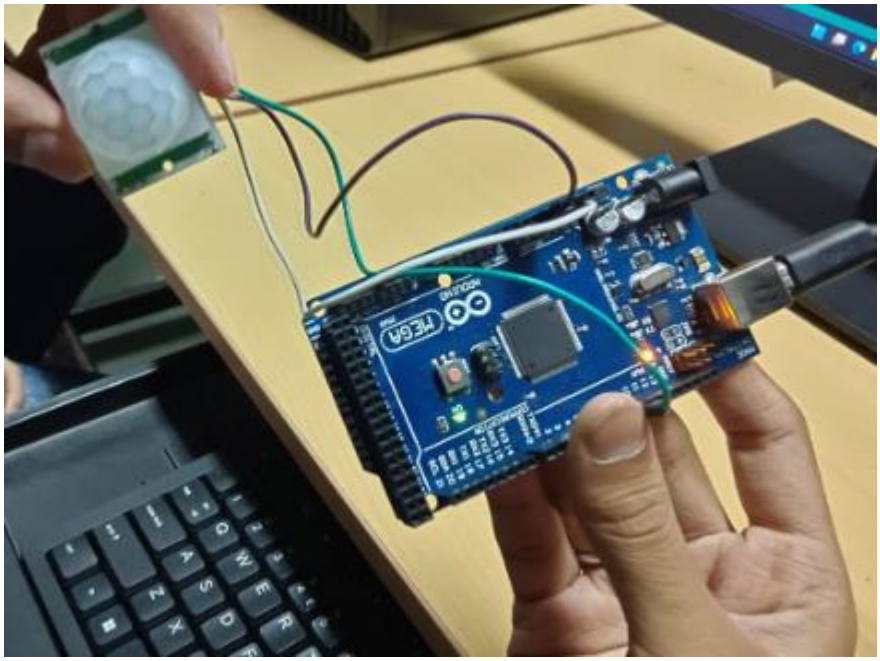
:




MEGA

PIR Sensor:

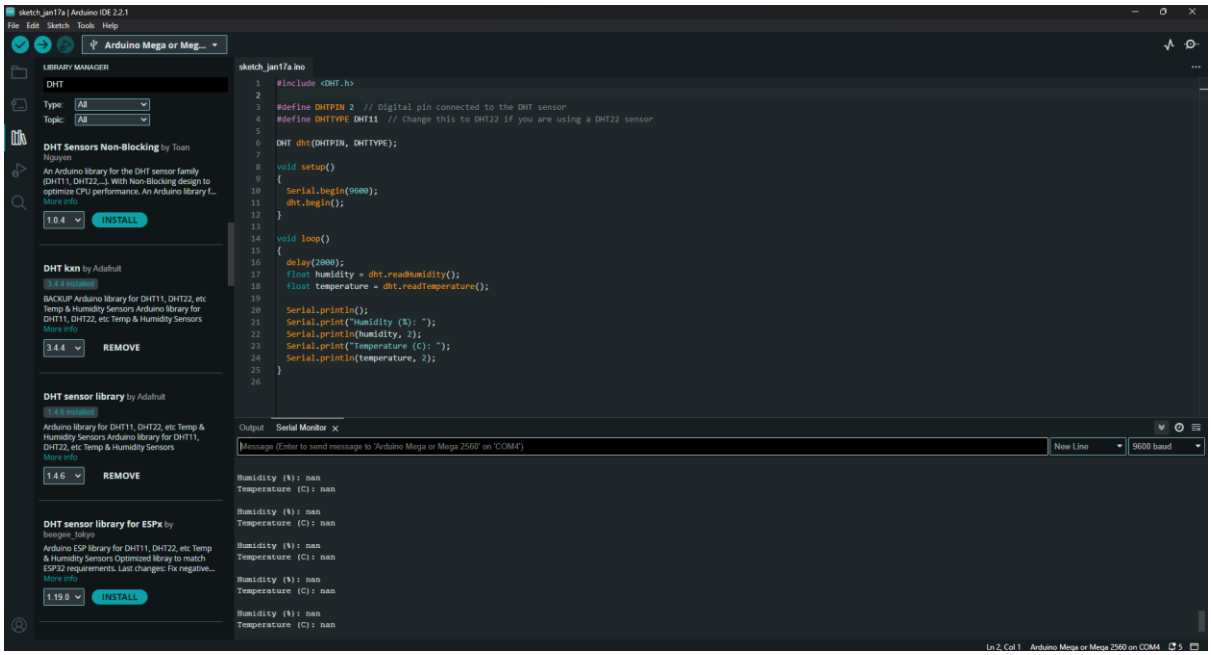


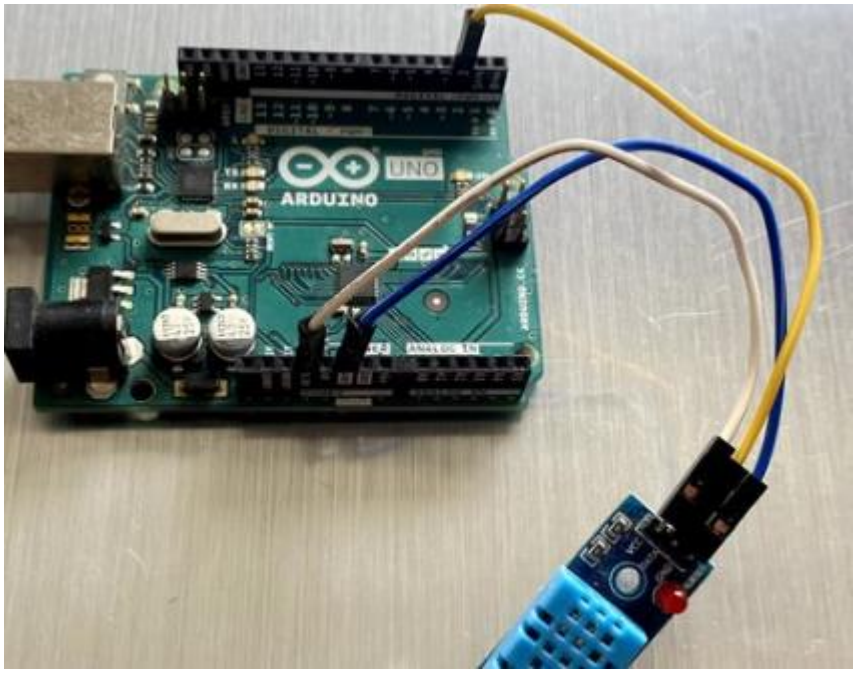


Temperature & Humidity sensor:

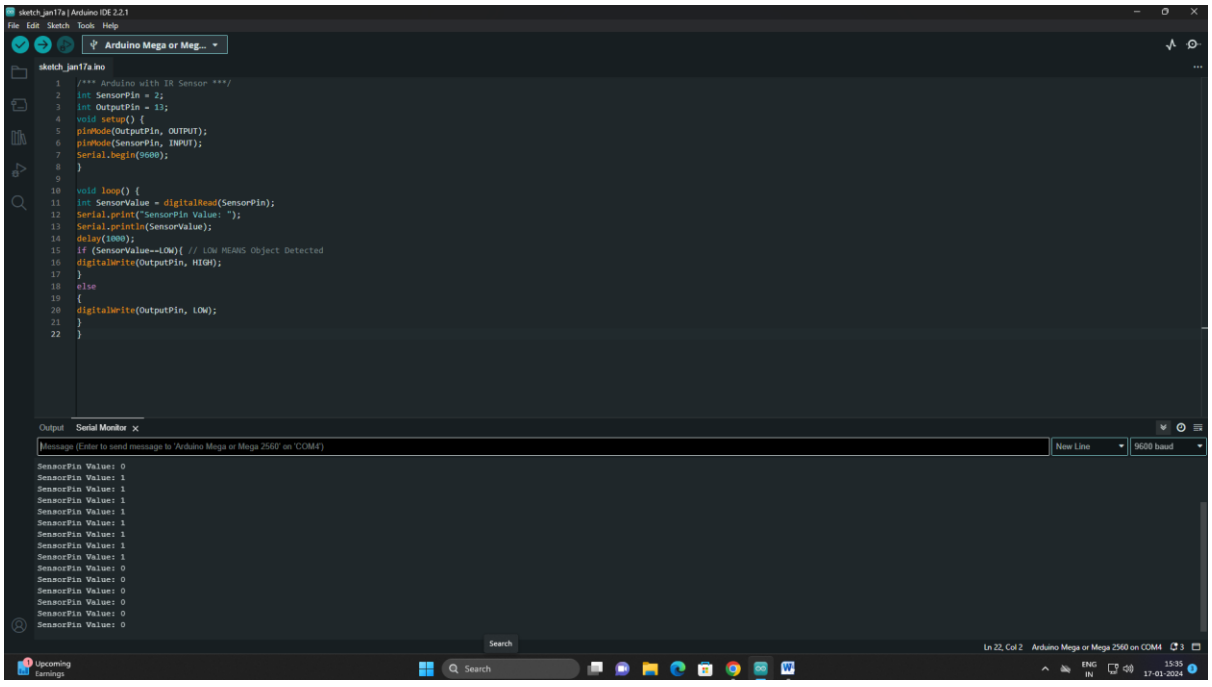
```
#include <DHT.h>

#define DHTPIN 2  // Digital pin connected to the DHT sensor
#define DHTTYPE DHT11  // Change this to DHT22 if you are using a DHT22 sensor
```

```
DHT dht(DHTPIN, DHTTYPE);

void setup()
{
  Serial.begin(9600);
  dht.begin();
}

void loop()
{
  delay(2000);
  float humidity = dht.readHumidity();
  float temperature = dht.readTemperature();

  Serial.println();
  Serial.print("Humidity (%): ");
  Serial.println(humidity, 2);
  Serial.print("Temperature (C): ");
  Serial.println(temperature, 2);
}
```




UNO
ARDUINO

IR Sensor:


sketch_jan17a | Arduino IDE 2.2.1
File Edit Sketch Tools Help
Arduino Mega or Meg...
sketch_jan17a.ino
/*** Arduino with IR Sensor ***/
int SensorPin = 2;
int OutputPin = 13;
void setup() {
pinMode(OutputPin, OUTPUT);
pinMode(SensorPin, INPUT);
Serial.begin(9600);
}
void loop() {
int SensorValue = digitalRead(SensorPin);
Serial.print("SensorPin Value: ");
Serial.println(SensorValue);
delay(1000);
if (SensorValue==LOW){ // LOW MEANS Object Detected
digitalWrite(OutputPin, HIGH);
}
else
{
digitalWrite(OutputPin, LOW);
}
}
Output Serial Monitor
Message (Enter to send message to 'Arduino Mega or Mega 2560' on 'COM4')
New Line
9600 baud
SensorPin Value: 0
SensorPin Value: 1
SensorPin Value: 1
SensorPin Value: 1
SensorPin Value: 1
SensorPin Value: 1
SensorPin Value: 1
SensorPin Value: 1
SensorPin Value: 1
SensorPin Value: 0
SensorPin Value: 0
SensorPin Value: 0
SensorPin Value: 0
SensorPin Value: 0
SensorPin Value: 0
Search
Ln 22, Col 2 Arduino Mega or Mega 2560 on COM4

Questions:

1. **How IoT Works?**

   The Internet of Things (IoT) refers to the network of interconnected physical devices that communicate and exchange data with each other through the internet. These devices can range from everyday objects such as home appliances and wearables to industrial machinery and smart city infrastructure. The primary goal of IoT is to enable these devices to collect and share data, leading to improved efficiency, automation, and decision-making.

   Here's a general overview of how IoT works:

   1. Sensors and Actuators:
   - Sensors: IoT devices are equipped with various sensors that can measure and collect data from the surrounding environment. These sensors can include temperature sensors, humidity sensors, motion sensors, GPS modules, and more.
   - Actuators: Some IoT devices also have actuators that allow them to perform actions based on the data they receive. For example, a smart thermostat can adjust the temperature based on sensor readings.

   2. Connectivity:
   - IoT devices use various communication protocols to connect to the internet and other devices. Common connectivity options include Wi-Fi, Bluetooth, Zigbee, cellular networks, and Low-Power Wide-Area Networks (LPWAN).

   3. Data Processing:
   - Once the data is collected by sensors, it is processed locally on the device or sent to a centralized cloud server for analysis. Local processing is often preferred for real-time applications, while cloud

processing allows for more extensive data analysis and storage.

4. Cloud Computing:
- Cloud platforms play a crucial role in IoT by providing storage, computing power, and analytics services. Large volumes of data from multiple devices can be processed in the cloud, and valuable insights can be extracted.

5. Data Storage:
- Data generated by IoT devices is stored in databases, either on the device itself or in the cloud. This data can be historical, real-time, or a combination of both.

6. Data Analysis and Decision Making:
- Analyzing the collected data helps in gaining valuable insights, identifying patterns, and making informed decisions. Machine learning and artificial intelligence algorithms are often employed to extract meaningful information from the vast amount of IoT data.

7. Communication and Control:
- IoT devices can communicate with each other, with centralized systems, or with user interfaces (such as mobile apps). This communication allows for remote monitoring, control, and automation of connected devices.

8. Security and Privacy:
- Ensuring the security of IoT systems is crucial to protect sensitive data and prevent unauthorized access. This includes secure communication protocols, encryption, and authentication mechanisms.

9. User Interface:
- Users can interact with IoT devices through dedicated interfaces like mobile apps or web dashboards. This interaction allows users to monitor device status, set preferences, and control the connected devices.

In summary, IoT involves a network of interconnected devices that collect, process, and share data to enable automation, improve efficiency, and enhance decision-making in various domains.

Outcomes:

CO3: Demonstrate requirements, modeling and design of a system

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Conclusion:

Used Sensors and actuator interfacing with Arduino successfully in the lab.

Grade: AA / AB / BB / BC / CC / CD /DD

Signature of faculty in-charge with date

References:

https://en.wikipedia.org/wiki/Internet_of_things

Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1stEdition, VPT, 2014.

3. Dr. Ovidiu Vermesan, Dr. Peter Friess, "Internet of Things - From Research and Innovation to Market Deployment", River Publisher, 2014