Assignment-2

Q-1 = Define the Following

- 1) Sensors :-

Sensor that are devices that detect and respond to changes in an environment. They convert physical Parameters into signals that can be measured and interpreted.

2) Actuators :-

Actuators is a devices that turns electrical energy into mechanical energy is known as an actuators.

3) Micro Controller :-

A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system.

4) Microprocessor :-

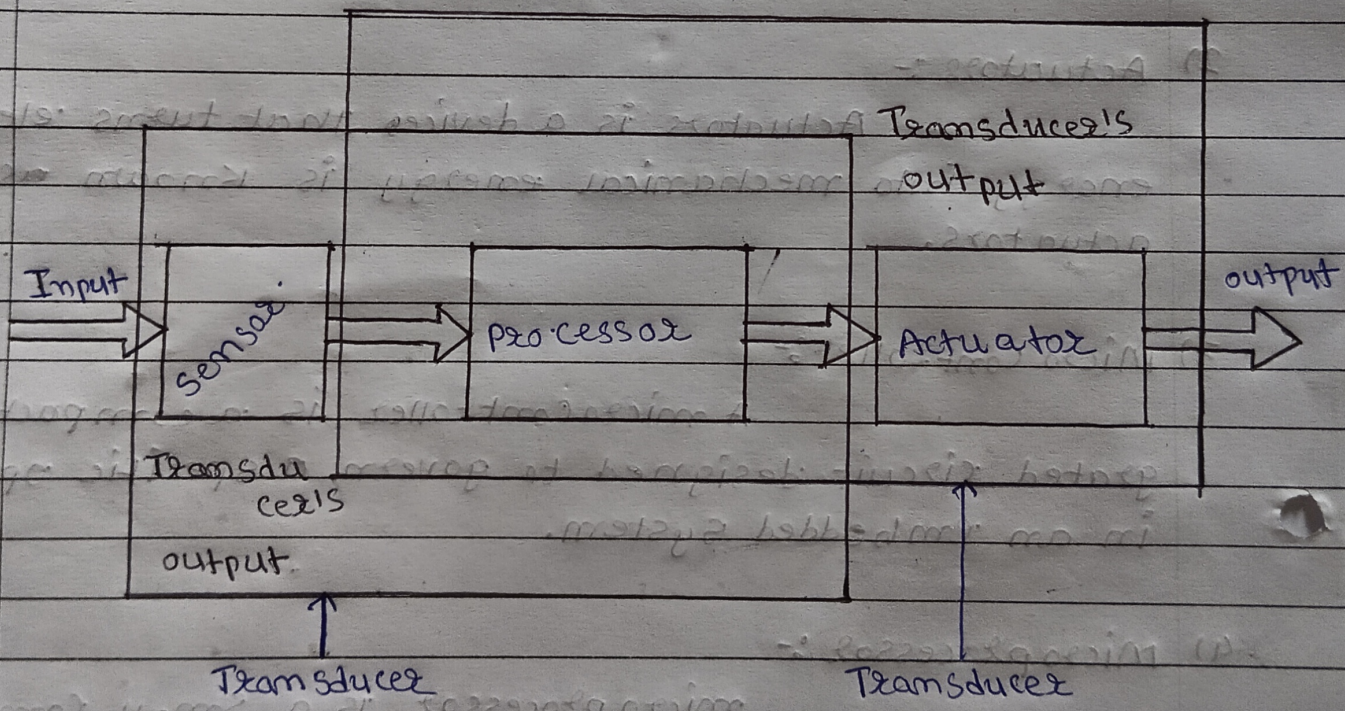
microprocessor is a small computer contained on an integrated circuit, also called a semiconductor chip or microchip.

Q-2 = write a brief note on Sensor in IoT and explain any 4 sensors in details.

A devices that provides a usable output in response to a specified measurement.

- The Sensor attain a physical parameter and converts it into a signal suitable for processing the characteristics of any device or material to detect the presence of a particular physical quantity.

- The output of the Sensor is a signal which is converted to a human-readable form like changes in characteristics, changes in resistance, capacitance, impedance, etc.



→ Transducer :-

A transducer converts a signal from one physical structure to another.

- It converts one type of energy into another type
- It might be used as actuator in various system.

- Example of Sensor :-

1) Smoke Sensor :-

Smoke Sensor is a device that senses smoke typically as an indicator of fire. Smoke detectors / Alarm are usually housed.

- Sensing Range :- 60 ~~sq~~ sq. m
- Voltage :- 120 V AC

2) Proximity Sensor :-

A proximity sensor is a device that can detect or sense the approch or presence of nearby object and for this it does not need physical contact.

- Sensing Range :- between 3 and 60 mm
- Voltage :- 10 V DC to 30 V DC

3) Air quality Sensor :-

A device used to detect the concentration of Pollutants in the air. It can usually measure two or more air quality indicators such as temperature

- Sensing Range :- 1 to 1000 ppm
- Voltage :- 10 - 30 V DC

4) Chemical Sensor :-

A device or instrument that determins the detectable. Presence, concentration, quality of an analytic.

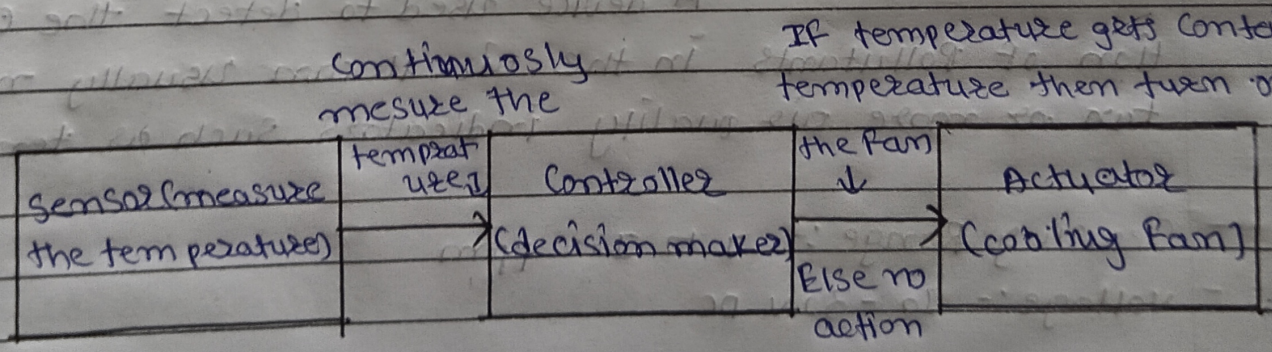
- Sensing Range :- PPm to PPb
- Voltage :- 5V to 12V.

Q-3 ⇒ Write a brief note on actuators in IoT and explain any 2 actuators in detail.

- actuator :-

A device that turns electric energy into mechanical energy is known as an actuator.

- An Actuator in other terms, is a Componant that can move or control a mechanism or System
- Actuator are commonly employed in industrial automation, robotics, and other applications requiring precise mechanical System control
- Actuator Come in a variety of configuring, including electric, hydraulic and pneumatic actuator.



* Example of actuators :-

1) DC Motors :-

DC Motors are simple actuators that convert electrical energy into rotational motion. In IoT they are used for task like rotating wheels, fans, or small robotic arms.

- They are controlled by varying the voltage or using Pulse width Modulation to adjust speed and direction.

2) ~~Pie~~ Piezoelectric Actuator :-

Piezoelectric actuators create precise mechanical movements by applying voltage to piezo-electric materials, causing them to expand or contract.

- In IoT they are often used in precision positioning system such as in medical devices or micro-manufacturing, where tiny, accurate movements are needed.

2-4 Classify the sensors based on output and datatype in brief.

→ Sensor Based on output :- 1) Analog Sensor
2) Digital Sensor

→ Sensor Based on Datatype :- 1) Scalar Sensor
2) Vector Sensor

* Sensor based on output :-

1) Analog Sensor :-

it produce a continuous output signal or voltage which is generally proportional to the quantity being measured.

- Physical quantites such as Temperature, Speed, pressure, Displacement, strain etc. are all analog quantites as they tend to be continuous in nature.

- For, example the temperature of a liqued can be measured using a thermometer or thermocouple which continuously responds to temperature changes as the liqued is heated up or cooled down.

2) Digital Sensor :-

it produce discreate digital output signals or voltage that are a digital representation of the quantity being measured.

- Digital Sensor produce a binary output signal in the form of a logic "1" or a logic "0" ; ("on" or "on" "or" "off")

- Digital signal only produces discreate values, which may be output as a single "bit" or by combining the bits to produces a single "byte" output.

* Sensor based on Datatype :-

1) Scalar Sensors :-

Scalar Sensors produces output signal or voltage which is generally proporitional to the magnitude of the quantity being measured.

- Physical quantites such as temperature, Color, pressures Strain, etc, are all Scaler quantites as only their magnitude is sufficient to convey an information.

- For example, the temperature of a room can be measured using a thermometer or thermo couple, which responds to temperature changes irrespective of the orientation of the sensor or its direction.

2) Vector Sensor :-

It produce output signal or voltage which is generally proporitional to the magnitudes, direction, as well as the orientation of the quantity being measured

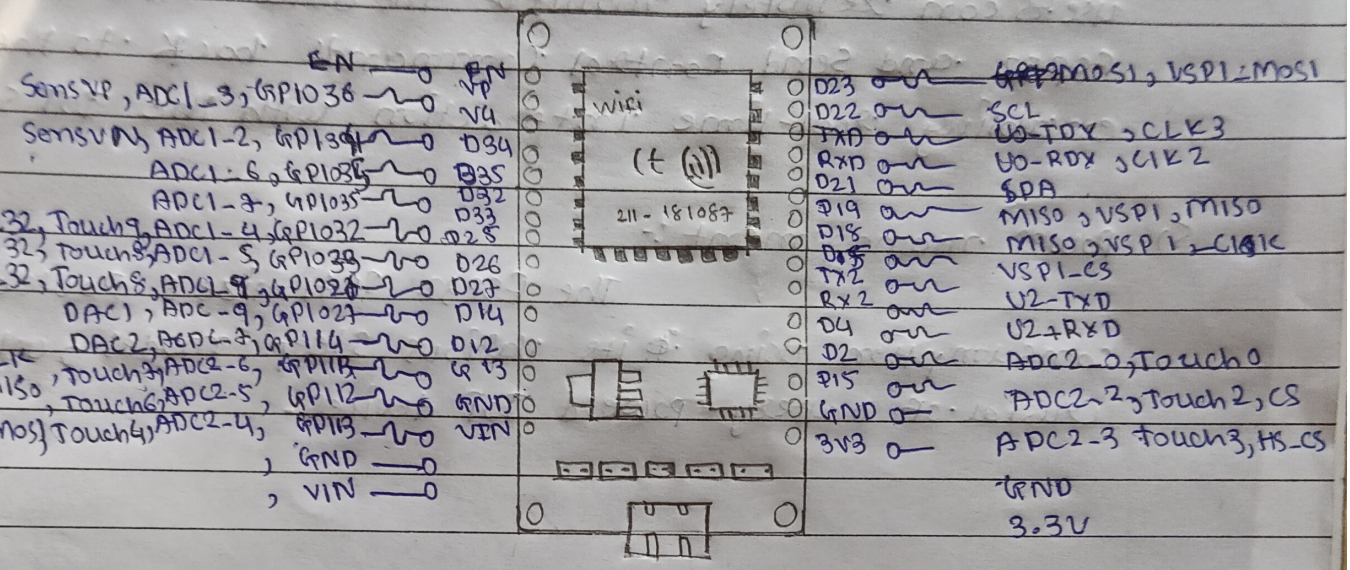
- Physical quantities such as Sound, Image, velocity, acceleration etc, are all vector quantities, as only their magnitude is not sufficent to convey the information.

- For example, the acceleration of a body can be measured using an accelerometer which gives the components of acceleration of the body with respect to the x, y, z coordinate axes.

Q-5 Write the difference between Arduino & ESP32.

ESP32	Arduino
- ESP32 is a low-power and low-cost serial with dual-none Bluetooth & Wi-Fi capabilitgies.	- The Arduino board is an open-source develop-ment board.
- ESP32 includes Tensilica xtensa 1x6 CPU.	- It includes an 8-bit ATmega 328p microcontroller.
- It operating voltage is 3.3v	- Arduino's operating voltages is 5v.
- ESP32 has 520KB-RAM.	- It has 2KB-RAM.
- This Board has an in-built wi-fi and Ethernet Port.	- Arduino has Ethernet shield internet connectivity
- Bluetooth connectivity is present	- Bluetooth connectivity is not present.
- Software used is Python micro Python ;c&ctt	- The software used in this board is c/ctt language.
- It needed operating system like Raspbian and ubuntu.	- It doesn't use any operating system
- Its operating frequency is up to 240 MHz	- Its operating frequency is 16 MHz.

Q-6 Draw only the pin diagram of ESP32 board.



Q-7 Explain the working of ESP32 in brief.

→ 1) Data Collection :-

The ESP32 collects data from connected sensor through its GPIO pins and various communication interfaces like SPI, I2C or ADC

→ 2) Processing :-

The dual-core processor of the ESP32 processes the collected data, allowing for real-time decision-making or pre processing before transmission. It can also run algorithm to filter, analysis or compress the data.

→ 3) Wireless Communication :- The ESP32 uses its integrated WiFi or Bluetooth modules to connects to the Internet or other devices, transmitting data to cloud server, networked devices.

4) Remote control and Monitoring :-

Through the internet, users can remotely monitor the data collected by the ESP32 and send control commands back to the device enabling real-time interaction with the IoT system

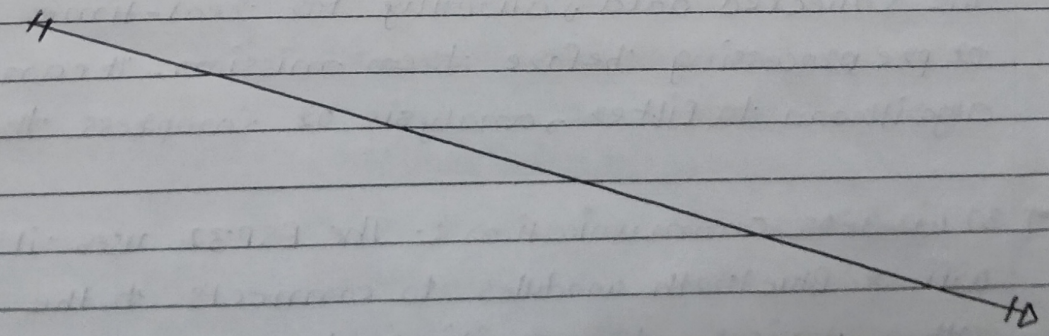
5) Power management :-

The ESP32 optimizes power consumption using its various sleep modes, which is crusial of battery-powered IoT devices.

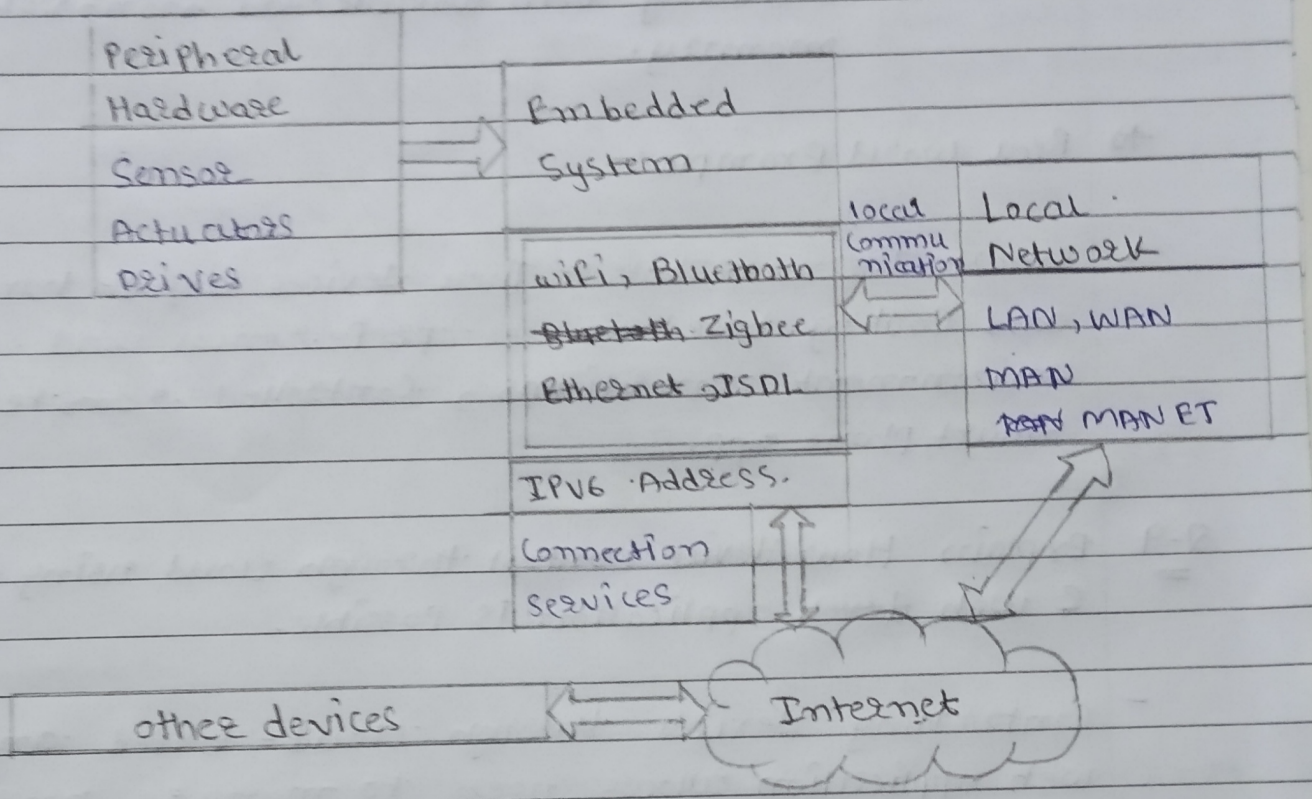
Q-8 Explain in detail Embedded IoT system with neat and clean diagram.

- The embedded devices are the objects that build the unique computing system These system may or may not connect to the Internet

- An embedded devices system generally runs as a single application. However, these devices can connect through the internet connection, and able to communication through other network devices.



→ diagram :-



→ Key components :-

1) Microcontroller :- Acts as the brain, processing data and controlling other components.

2) Sensor :- Gathers data from the environment, such as temperature, humidity or motion.

3) Actuators :- Perform actions in responds such as temperature, humidity or motion

4) Embedded software :- specialized code that runs on the microcontroller, managing tasks and operations.

5) Memory :- Stores data and instruction for the system including both volatile and non-volatile memory.

* Real world Example :-

→ Smart Thermostats :- These devices adjust home heating and cooling based on user preferences and environment conditions, controlled remotely via a smart phone app.

Q-9 Explain How device control through cloud using mobile & web ~~teteth~~ application is possible.

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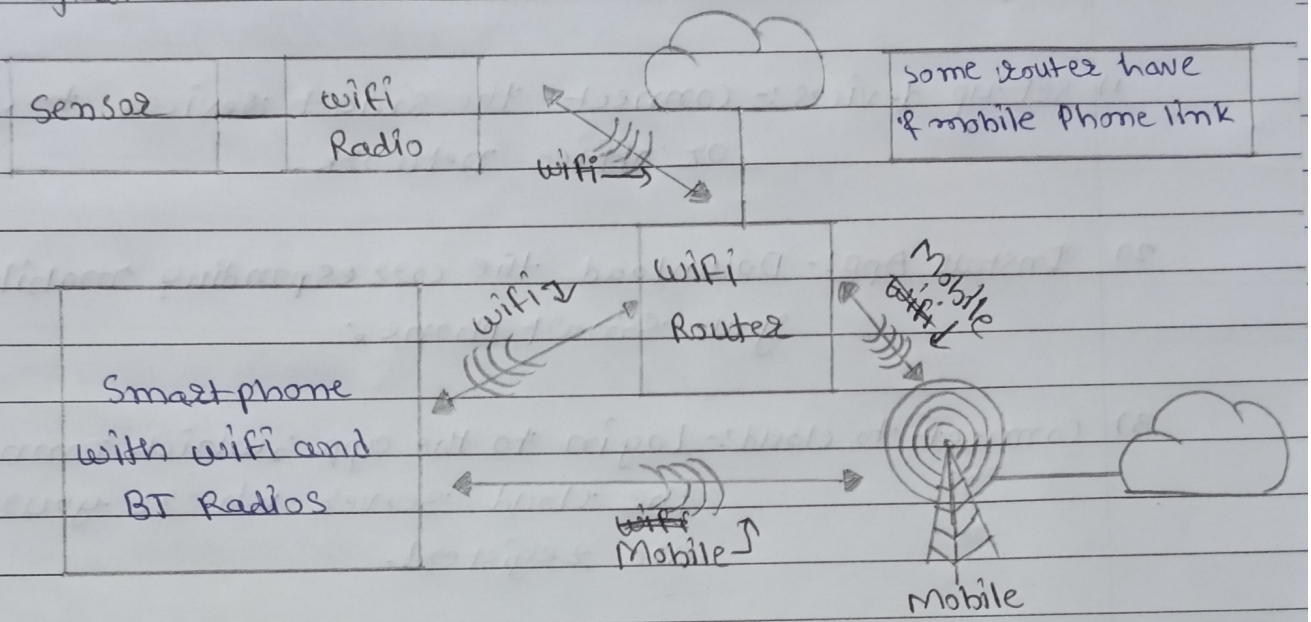
- Controlling devices through cloud-based and web application allows users to manage and operate various devices remotely using the internet

- This technology is commonly used in smart homes, industrial automations and various IOT applications.

- diagram :-



→ working :-

1) Devices :- Smart Phone are connected to the internet through wifi or other networks.

2) Cloud :- These Devices send and recives data to and from a cloud server which stores and process the information

3) Mobile / web App :- Users Interact with the cloud server through a Mobile app or web browser sending commands and Reciving feedback from devices.

→ Steps to control devices:-

1) Set up devices:- Connect the smart devices to your home or office network.

2) Install App:- Download the corresponding mobile app on your smart phone.

3) Connect to cloud:- Login to the app which connects to the cloud server where your devices are registered.

4) Control Devices:- Use the app to turn devices on/off. Adjust setting, monitor status and recives alerts.

Programs

1) Write a program to control two leds using two push buttons.

```
Const int Push1 = 18;
Const int Push2 = 19;
Const int led1 = 22;
Const int led2 = 23;
Const int btns1 = 0;
Const int btns2 = 0;

Void Setup () {
```

```
    PinMode (Push1, INPUT);
    PinMode (Push2, INPUT);
    PinMode (led1, OUTPUT);
    PinMode (led2, OUTPUT);
}
void loop () {

btnS1 = digitalRead (Push1);
if (btnS1 == HIGH)
{
    digitalWrite (led1, HIGH);
}
else
{
    digitalWrite (led1, low);
}

btnS2 = digitalRead (Push2);
if (btnS2 == HIGH)
{
    digitalWrite (led2, HIGH);
}
else
{
    digitalWrite (led2, LOW);
}
}
```

ii) write a program to read the digital sensor data and display on serial monitor of Arduino IDE

```
- const int sensorI = 2;

void setup () {

   Serial.begin (9600);

   pinMode (sensorI ; INPUT);
}
void loop () {
   int sensorI = digitalRead (sensorI);

   Serial.print ("IR Sensor Value:");
   IF (sensorI == HIGH)
   {
      Serial.println ("Detected");
   }
   else
   {
      Serial.println ("Not Detected");
   }
   delay (500);
}
```

iii) write a program to read the analog sensor data and display on serial monitor of Arduino IDE.

```
#include <DHT.h>

#define DHTPIN 2
#define DHTTYPE DHT11

DHT dht(DHTPIN, DHTTYPE);

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

void loop(){

    delay(2000);

    float humidity = dht.readHumidity();
    float Temperature( = dht.readTemperature();

    if (isnan(humidity) || isnan(temperature())){
    Serial.println("Failed to read from DHT Sensor!");
    return;
    }

    Serial.print("Humidity: ");
    Serial.print(humidity);
    Serial.print("%\t temperature: ");
    Serial.print(temperature());
    serial.println("°C");
}
```

Activity

i) Find the cost of at least five Sensor generally used for Projects.

1) Temperature & Humidity Sensor :- ₹100 to ₹200

2) Ultrasonic Sensor :- ₹80 to ₹150

3) ~~IR~~ PIR Motion Sensor :- ₹90 to ₹150.

4) LDR (Light Dependent ~~Sensor~~ Resistor) :- ₹20 to ₹50.

5) Smoke Sensor :- ₹150 to ₹250.

ii) Find the cost of ESP32 board with USB cable.

→ ESP32 Development Board (30 Pin) with USB Cable :-

- ₹450 to ₹650

Puzzle

→ Identify the correct actuator that could be paired with each Sensor to form a complete system. Each Sensor may have one or more suitable actuators.

1. Sensor : Infrared Sensor (IR sensor)
Potential Actuators :- Relay module, Servo Motor, Buzzer

2 Sensor :- Temperature & ~~Thermometer~~ Sensor
Potential Actuators :- Heater Element, cooling fan, Thermostatic valve

3) Sensor :- pressure Sensor
Potential Actuators :- Solid valve, Air compressor, Hydraulic Pump

4) Sensor :- Smoke Sensor
Potential Actuators :- Exhaust Fan, Alarm System, Sprinkler Sys.

5) Sensor :- Light Sensor
Potential Actuators :- Dimmer Switch, Automatic Blinds, Street Light Control System, LED Lights