Top IoT Viva Questions (26–50) With Deep Explanations

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26. What is a PIR sensor and how does it work?

A PIR (Passive Infrared) sensor detects motion by measuring infrared radiation changes in its surroundings. Humans emit IR radiation. When a person moves across the sensor's detection zone: - IR levels change - The sensor outputs HIGH - Arduino interprets it as motion

Used in security systems, automatic lights, and monitoring.

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27. What is Raspberry Pi?

Raspberry Pi is a credit-card-sized SBC (Single Board Computer). Unlike Arduino, it runs a full Linux OS, has USB ports, HDMI, Wi-Fi, Bluetooth, and can execute multitasking programs. It is used for Python-based IoT automation, cloud connectivity, AI, camera applications, etc.

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28. Steps to set up Raspberry Pi.

1. Download Raspberry Pi OS image.
2. Flash OS into SD card using tools like Balena Etcher.
3. Insert SD card into Pi.
4. Connect monitor, keyboard, mouse.
5. Power ON → Boot into OS.
6. Configure Wi-Fi, regional settings, SSH if needed.

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29. What OS is commonly used in Raspberry Pi?

Raspberry Pi OS (formerly Raspbian), based on Debian Linux. It is lightweight, optimized for Pi hardware, and supports GPIO programming.

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30. Difference between Raspberry Pi and Arduino.

Feature	Arduino	Raspberry Pi
Type	Microcontroller	Mini computer

Feature	Arduino	Raspberry Pi
OS	No OS	Full Linux OS
Execution	Real-time	Multitasking
GPIO	Analog + Digital	Digital only
Use	Control sensors, motors	Cloud, Python, AI, camera

31. What is GPIO in Raspberry Pi?

GPIO stands for **General Purpose Input/Output**. These pins allow Pi to interact with external hardware. They support: - Digital input (switches, sensors) - Digital output (LEDs, relays) - PWM (software-based) - Protocols like I2C, SPI, UART

32. How is RGB LED controlled with Raspberry Pi?

Pi uses **software PWM** (via RPi.GPIO or pigpio library): - Assign separate GPIO pins to R, G, B. - Use PWM to vary duty cycle. - Combine intensities for desired color.

33. What is an ultrasonic sensor?

Ultrasonic sensor measures distance using high-frequency sound waves. HC-SR04 has two pins: - TRIG → sends sonic pulse - ECHO → receives reflected pulse

Time taken for pulse to return determines distance.

34. How does ultrasonic sensor calculate distance?

Formula: **Distance = (Time × Speed of Sound) / 2** Speed of sound ≈ 343 m/s. Dividing by 2 because pulse travels to object and back.

35. How to print distance on Raspberry Pi?

Using Python: - Trigger ultrasonic pulse - Measure ECHO pulse duration - Calculate distance - Print on Python terminal or display

Used for parking sensors, robotics, obstacle detection.

36. Why does Raspberry Pi need an ADC?

Pi has **no analog input pins**. To read analog sensors like temperature or gas sensors, we use external ADC modules such as: - MCP3008 - MCP3208

These convert analog voltages to digital data over SPI communication.

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37. What is SPI protocol?

SPI = Serial Peripheral Interface. A fast, synchronous serial communication protocol. Uses: - MOSI → Master Out Slave In - MISO → Master In Slave Out - SCK → Clock - CS → Chip Select

Used in ADC modules, SD cards, sensors.

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38. What is MQTT?

MQTT (Message Queuing Telemetry Transport) is a lightweight Publish/Subscribe communication protocol ideal for IoT due to: - Low power consumption - Small data packets - Low bandwidth usage

Used for cloud communication.

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39. How does the publish/subscribe model of MQTT work?

- **Publisher** sends messages to a *topic*.
- **Subscriber** listens to that topic.
- **Broker** manages message delivery.

This decouples sender and receiver, increasing scalability.

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40. What is an MQTT broker?

A server that handles message routing between publishers and subscribers. Examples: - Mosquitto - HiveMQ - AWS IoT Core

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41. How does Raspberry Pi send data to cloud using MQTT?

Using **Paho-MQTT Python library**: 1. Connect Pi to internet. 2. Read sensor values. 3. Use Paho client to publish data. 4. Cloud platform subscribes and receives values.

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42. What is QoS in MQTT?

QoS = Quality of Service. It defines message delivery guarantee: - **QoS 0:** At most once - **QoS 1:** At least once - **QoS 2:** Exactly once Higher QoS ensures reliability but increases overhead.

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43. Why MQTT is preferred in IoT?

• Extremely lightweight
• Supports unreliable networks
• Power-efficient
• Works with low-bandwidth systems
• Ideal for remote IoT nodes

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44. What is a topic in MQTT?

A string-based channel to which messages are published or subscribed. Example:

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home/sensor/temperature
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Topics help organize data flow.

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45. What is cloud in IoT?

Cloud refers to remote servers used for: - Data storage - Data analysis - Remote monitoring - Device control

Popular IoT clouds include AWS, Azure, Google IoT Core.

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46. Common IoT cloud platforms.

• AWS IoT Core
• Google Cloud IoT
• Microsoft Azure IoT Hub
• ThingSpeak
• Blynk

These platforms allow dashboards, analytics, automation.

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47. What is ThingSpeak?

ThingSpeak is an IoT analytics cloud platform used for data visualization. Using API keys, IoT devices upload data to channels and view real-time graphs.

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48. How is IoT used in automation?

IoT enables machines to communicate and operate with minimal human intervention. Examples: - Smart homes - Automated street lighting - Industrial automation - Smart agriculture

Sensors + cloud + actuators = autonomous systems.

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49. What is the role of sensors in IoT?

Sensors collect real-world data such as: - Temperature - Humidity - Motion - Light - Gas levels

They convert physical measurements into electrical signals for microcontrollers.

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50. Explain the complete flow of an IoT system.

1. **Sensors** detect data.
2. **Microcontroller** (Arduino/Pi) processes it.
3. **Communication module** sends data to cloud.
4. **Cloud** stores and analyzes.
5. **Dashboard/UI** displays information.
6. **Actuators** perform actions based on decisions.

This creates a full closed-loop IoT architecture.