**PRACTICAL –7**

**Aim: - Raspbian Operating Installation**

This practical session delves into the Raspberry Pi, a credit card-sized computer, and equips participants with the knowledge to install the Raspbian operating system. The session covers the Raspberry Pi's architecture, installation procedures for Raspbian and NOOBS (New Out Of The Box Software), a list of essential components, and clarifies the distinction between BCM and BOARD pin numbering modes.

**1. Raspberry Pi Architecture**

The Raspberry Pi is a single-board computer (SBC) featuring a System on Chip (SoC) design. This SoC integrates several critical components onto a single chip, including:

* **Processor (CPU):** The Raspberry Pi utilizes an ARM processor, known for its energy efficiency. Different models come equipped with varying CPU core counts and clock speeds.
* **Memory (RAM):** The Raspberry Pi provides Random Access Memory (RAM) for temporary data storage during program execution. The amount of RAM varies depending on the specific Raspberry Pi model.
* **Graphics Processing Unit (GPU):** The GPU handles graphics processing tasks and can be used for multimedia applications or accelerated computing.
* **Input/Output (I/O):** The Raspberry Pi offers various I/O ports for connecting peripherals like displays, keyboards, and sensors. These ports include HDMI, USB, and GPIO (General Purpose Input/Output) pins.
* **Storage:** The Raspberry Pi does not typically include built-in storage. Instead, it relies on an external MicroSD card to store the operating system, applications, and user data.

**2. Installation of Raspbian and NOOBS Operating Systems**

There are two primary methods for installing an operating system on the Raspberry Pi:

* **Raspbian Installation:** Raspbian is a popular Debian-based operating system specifically optimized for the Raspberry Pi. To install Raspbian, you'll need:
  + A microSD card with sufficient capacity (minimum 8GB recommended)
  + A computer with an SD card reader
  + The Raspberry Pi Imager tool downloaded from the official Raspberry Pi website (<https://projects.raspberrypi.org/en/projects/imager-install>)
  + Follow the instructions provided by the Raspberry Pi Imager to flash the Raspbian image onto the microSD card.
* **NOOBS Installation:** NOOBS (New Out Of The Box Software) is a multi-boot installer that allows you to choose from various operating systems during the installation process. The steps for using NOOBS are similar to those for Raspbian installation, but you'll download the NOOBS image instead.

**3. List of Components (Other Devices and Connectors)**

In addition to the Raspberry Pi itself and the microSD card, you'll need several other components to set up a functional system:

* **Power Supply:** A micro USB power supply with sufficient amperage (amps) to provide adequate power for the Raspberry Pi model you're using.
* **HDMI Cable:** Connects the Raspberry Pi to an HDMI display (monitor or TV).
* **USB Keyboard and Mouse:** Essential for interacting with the operating system.
* **MicroSD Card Reader:** If your computer doesn't have a built-in microSD card reader, you'll need an external reader to prepare the microSD card.
* **Optional Components:** Depending on your project goals, you might also need additional components like:
  + Camera module
  + Sensors (temperature, light, etc.)
  + Network cables for internet connectivity

**4. Difference Between BCM and BOARD Mode**

The Raspberry Pi's GPIO pins can be referenced using two numbering schemes:

* **BCM (Broadcom SOC Channel):** This numbering scheme corresponds to the physical pin location on the Broadcom SoC chip.
* **BOARD:** This numbering scheme reflects the physical pin number on the Raspberry Pi's GPIO header.

While both schemes ultimately refer to the same GPIO pins, the BCM scheme is more commonly used in libraries and documentation. Here's a table summarizing the key points:

|  |  |
| --- | --- |
| Feature | Description |
| Raspberry Pi Architecture | Single-board computer with integrated CPU, RAM, GPU |
| Operating Systems | Raspbian (popular choice), NOOBS (multi-boot) |
| Essential Components | MicroSD card, power supply, HDMI cable, USB peripherals |
| Pin Numbering Modes | BCM (Broadcom chip), BOARD (physical header) |

By understanding these concepts and completing the practical installation steps, participants will be well-equipped to set up their Raspberry Pi and explore the exciting world of Raspbian OS.