Building Palm Computer Using Raspberry Pi

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***Abstract*—The primary objective of this paper is to present the design and implementation of a compact, all-in-one portable computing device developed using the Raspberry Pi 5. The proposed system is approximately 75% smaller than a conventional laptop, while still offering complete and user-friendly computing functionality at a significantly lower cost. The system integrates essential components such as a Raspberry Pi 5 motherboard, a power bank for portable power supply, an external display (mobile or laptop screen), a wired keyboard and mouse, and a compact enclosure that houses all components in a single unit. This design effectively extends the capabilities of a standard personal computer into a highly portable form factor. Additionally, the versatile architecture of the Raspberry Pi enables seamless interfacing with a wide range of external sensors and peripherals, making the system suitable for various computing, educational, and embedded applications.**

***Index Terms*—RASPBERRY PI 5, SD card (16GB minimum), HDMI cable, video capture card, OTG (type C), power bank, USB-C cable, etc.**

I. INTRODUCTION

The Raspberry Pi 5 is a powerful and compact single-board computer that offers a significant performance improvement over its previous generations. It is equipped with a 64-bit quad-core Arm Cortex-A76 processor and an 800 MHz VideoCore VII GPU, enabling smooth desktop performance and efficient multitasking. The board features the in-house designed RP1 I/O controller, a PCIe 2.0 interface, and advanced camera support, making it suitable for both consumer and industrial applications. Due to its enhanced processing power, improved graphics performance, and flexible hardware architecture, the Raspberry Pi 5 is widely used in areas such as desktop computing, robotics, and Internet of Things (IoT) systems. These features make it an ideal choice for developing a portable palm-sized computing device. [2]

II. RASPBERRY PI SPECIFICATION

Key Features and Improvements

- Processor:

A 2.4 GHz quad-core Arm Cortex-A76 processor, offering approximately 2–3 times higher CPU performance compared to earlier Raspberry Pi models.

- Graphics:

An 800 MHz VideoCore VII GPU that delivers significantly improved graphics and multimedia performance.

- RP1 Chip:

The first full-size Raspberry Pi to use in-house designed silicon. The RP1 “southbridge” enhances input/output performance and improves peripheral handling.

- Display Support:

Supports dual 4Kp60 display output through micro-HDMI ports.

- PCIe Interface:

Includes a dedicated PCIe 2.0 interface for connecting high-speed peripherals such as NVMe storage devices.

- Connectivity:

Provides Wi-Fi 5, Bluetooth 5.0, Gigabit Ethernet, and two USB 3.0 ports for high-speed data transfer.

- Power Button:

Features a dedicated power button for the first time in the Raspberry Pi series.

- GPIO:

Retains a 40-pin GPIO header for interfacing with sensors, actuators, and other electronic components.

- LAN:

Supports 10/100 Mbps Ethernet connectivity.

- USB Ports:

Equipped with 2 to 4 USB ports for peripheral connections. [3]

III. ESSENTIAL COMPONENTS OF PALM COMPUTER

A. Raspberry Pi 5 – Diagram:

Fig 1.1. Raspberry Pi 5.

Fig1.2 Raspberry Pi 5 With Case.

B. Power Bank As Power Supply.
C. Wired Keyboard And Mouse.
D. Raspberry Pi Case.
E. Display.

For the display, you can use any regular monitor. Since this is a palm-sized computer, you also have several compact options like a mobile screen, a tablet screen, or a 7-inch display. A 7-inch screen with a resolution of 1024×600 pixels works well, offering a wide viewing angle, quick response time, and accurate colours. It also supports different video input options such as HDMI, VGA, and USB.

F. SD Card:

It is recommended to use an SD card with a minimum of 32GB of storage when installing Raspberry Pi OS.

G. Connecting Wires:

Required connecting wires are HDMI CABLE, OTG, TYPE C MOBILE CHARGER, HDMI TO USB CABLE & MINI HDMI DONGLE, etc. [2]

IV. APPLICATIONS OF RASPBERRY PI

Here are some common ways Raspberry Pi is used:

A. Home Media Center:

You can turn the Raspberry Pi into a media hub using software like Kodi to play movies, music, and other entertainment at a low cost.

B. Smart Home Control:

It can run home automation systems that manage lights, cameras, sensors, and other smart devices, often working together with microcontrollers.

C. Retro Gaming Console:

Using tools like RetroPie or Recalbox, you can build a handheld or desktop retro gaming system to play classic games.

D. Network Ad Blocker:

With Pi-Hole, the Raspberry Pi can block ads for every device connected to your home network.

E. Internet and Networking:

It can be used for various networking tasks and small internet-related projects.

F. VPN Router:

You can set it up as a secure, fast VPN router for safe online browsing.

G. File Server:

The Pi can act as a NAS (Network Attached Storage) for storing, backing up, and sharing files.

H. Home Server:

It can host websites, manage small databases, or run simple web applications.

I. Education and Development:

Widely used in schools and learning environments for programming and electronics.

J. Instructional Tool:

The Raspberry Pi was originally created to help teach basic computer science and coding concepts.

K. Robotics and Automation:

It can serve as the control unit ("brain") for robots or automated systems using sensors and motors.

L. Hardware Programming:

A great platform for learning electronics, coding, and simple circuit design.

V. INSTALL AN OPERATING SYSTEM

To start using a Raspberry Pi, you need to install an operating system. The Raspberry Pi usually looks for the operating system on the SD card you put into it. Some Raspberry Pi models can also start from other devices like USB drives, special add-on boards, or even from a network.

To install an operating system on any storage device, you need a computer that can write the OS onto it, and a way to connect that storage device to the computer. Most people use a microSD card to boot their Raspberry Pi.

The easiest way to install the operating system is by using Raspberry Pi Imager. This program works on Windows, macOS, and Linux, and lets you download and write OS images easily. It includes many popular Raspberry Pi operating systems and also lets you use images from Raspberry Pi's website or other sources like Ubuntu. You can also set up things like username, Wi-Fi, and remote access before writing the image. It supports .img files and compressed files like .zip.

VI. WAYS TO INSTALL THE RASPBERRY PI OS

Install Using Imager

You can install Raspberry Pi Imager in two main ways:

- Download the latest version from raspberrypi.com/software and run the installer.
- Install it through the terminal using a package manager, for example: sudo apt install rpi-imager.

Once it is installed, open Raspberry Pi Imager either by clicking its icon or by typing rpi-imager in the terminal.

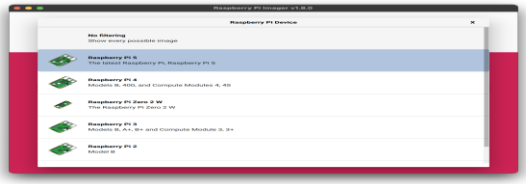

Fig 2.1 Device Selection In Imager Tool.

Click Choose device and pick your Raspberry Pi model from the list.

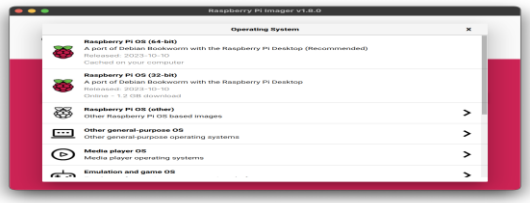

Fig 2.2 OS Selection in Imager Tool.

Then click Choose OS and select the operating system you want to install. The recommended Raspberry Pi OS version for your device will always appear at the top.

Now connect your storage device to the computer—usually a microSD card using a card reader. After that, click Choose storage and select the correct device.

When multiple devices are connected to computer select the proper one depending upon its size.

Next, Imager will ask if you want to customise the OS settings. It is strongly recommended to set up your Raspberry Pi here. To do this, click Edit Settings.

If you skip OS customisation, Raspberry Pi OS will ask for the same details the first time you start your Raspberry Pi. You can choose No if you want to continue without customising.

We can also install the Windows, Linux, macOS, Android-14, etc for the Raspberry Pi via SD card. But for study of Raspberry Pi, we have installed the Raspberry Pi OS.

VII. CONFIGURATION ON FIRST BOOT

Congratulations! If you used the OS customization options in Imager, your Raspberry Pi is already set up and ready to use. You can now move on to the next steps to start using your device effectively.

If your Raspberry Pi does not boot within 5 minutes, first look at the status LED. A blinking LED may indicate an issue—check the LED error codes to understand the problem. If your Pi still won't start, try these troubleshooting steps:

- If you are using a boot device other than an SD card, switch to an SD card and try again.
- Re-image the SD card and make sure the verification step in Imager completes successfully.
- Update your Raspberry Pi's bootloader and then re-image the SD card.

A. Raspberry Pi Connect

This option lets you enable Raspberry Pi Connect, which allows remote access to your Raspberry Pi without needing any manual network setup.

B. Software Updates

Here, you can update the operating system and installed applications once your Pi is connected to the internet. If you removed the non-default browser during setup, it will be uninstalled during this update. Downloading updates may take a few minutes.

When a pop-up appears saying your system is up to date, click OK to move ahead.

At the end of the setup wizard, click Restart. Your Raspberry Pi will reboot, apply all the settings, and then load the desktop.

VIII. RECOMMENDED SOFTWARE

Raspberry Pi OS already includes several built-in apps that you can use immediately. If you want to install more useful applications, click the Raspberry menu icon in the top-left corner of the screen. Then go to Preferences > Recommended Software.

Fig 3. Output with Recommanded Software

For instance, if you are going to use your Raspberry Pi as a home computer, you might find LibreOffice useful for writing and editing documents and spreadsheets. You can also make your Raspberry Pi more accessible with apps like a screen magnifier and Orca screen reader, found under Universal Access. [1]

IX. CONCLUSION AND FEATURES

This computer is designed mainly for educational use. Since I have VS Code opened in the Raspberry Pi window on my display, I can easily write code, edit programs, and work on software projects. It also allows me to browse the internet and access online information whenever needed. The Raspberry Pi works as a general-purpose computing device, capable of handling a wide range of everyday tasks. One of its biggest benefits is that it is inexpensive and easy to carry. Because it costs much less to manufacture compared to regular computers, more people can afford to buy and use it.

A. Output:- 1 on mobile:-

Fig 4.1. Mobile as a display of Raspberry Pi.

To use Mobile as a display of Raspberry Pi we need to install an application called “USB Camera”. After that we will need a Video Capture Card and OTG(type C) A keyboard and mouse is also needed to operate,both could be either be wired or wireless which we can attach it to the Raspberry Pi.

An output device as Mobile we have shown “VS Code” on the screen.

We also can write a code and simulate it which will results its output on the screen!

B. Output: - 2 on laptop: -

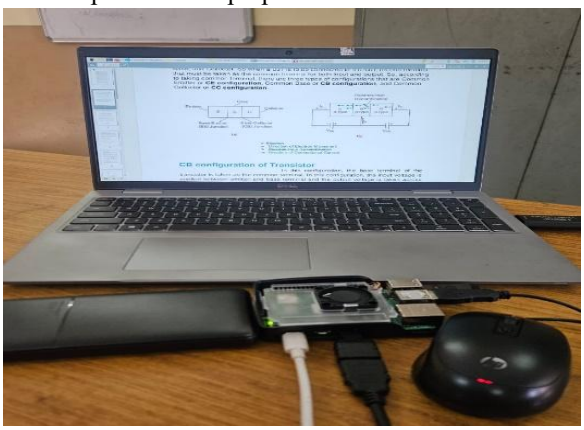

Fig 4.2 Laptop as a display of Raspberry Pi.

To use Laptop as a display of Raspberry Pi we need an application/software called “OBS Studio”. We can use that Video Capture Card directly, we don’t need the OTG any more for this, we can just attach the Video Capture Card to any of USB Ports on the Laptop and

setup up the OBS Studio then you are good to go. As we are using the Laptop as Display we can use even bigger screens like TV or Monitors,etc

As we have use a Laptop as an Display of Raspberry Pi, we have displayed a PDF as a result.

When comparing the Raspberry Pi with other popular boards and development platforms in terms of processing power, size, and overall cost, the UDOO(Single board computer) shows the highest performance among the options studied. However, it is also more expensive. Detailed evaluation shows that the Raspberry Pi is an excellent choice for projects involving sensor networks. Its ability to work with many external devices makes it highly suitable for a wide variety of applications.

X. ADVANTAGES AND LIMITATIONS OF RASPBERRY PI

Advantages

A. The Raspberry Pi is a small, powerful, and energy-efficient computer that comes at a very low cost. Because of its compact size and affordability, many small and medium enterprises (SMEs) use it for tasks like running a web server, database server, or media server, helping them save money on expensive hardware [4], [5].

B. Raspberry Pi is also great for programming. It supports many programming languages, and users can easily install compilers. Python the main language used on the Pi is simple, beginner-friendly, and supports automatic memory management, making coding easier and faster [13] – [28].

C. Since the Raspberry Pi supports open-source operating systems, users can choose from many Linux-based OS options and install thousands of open-source applications freely. This flexibility makes the Pi suitable for a wide range of projects [13] - [28].

D. The Raspberry Pi also supports various hardware add-ons like the Camera Module, Gertboard, and HAT boards. These allow users to connect LEDs, buttons, sensors, and other electronics, enabling hands-on experiments and hardware projects [29], [30], [34].

E. It is highly energy-efficient and environmentally friendly. Its small size makes it easy to recycle, and its low power consumption helps reduce electricity costs making it a greener choice for small businesses [4], [5].

Limitations

A. Although useful, the Raspberry Pi cannot fully replace a complete desktop computer. Its processor and Ethernet port are not powerful enough to handle heavy multitasking or high-speed computing [6] - [12].

B. It does not support the full Windows operating system. Only Windows IoT Core works on the Raspberry Pi, which is very limited compared to standard Windows [22].

C. Raspberry Pi is not suitable for large enterprises because it is mainly designed for small to medium-level applications and does not provide high-end computing features [4], [5].

D. The Pi does not have a built-in Real-Time Clock (RTC) with battery backup. It can only maintain accurate time through an internet-based NTP server, which most Linux OSes do automatically [31].

E. Older Raspberry Pi models do not come with built-in Wi-Fi or Bluetooth, and many USB dongles may not work properly for wireless connectivity [6] - [12].

F. The Raspberry Pi does not include an inbuilt Analog-to-Digital Converter (ADC). External hardware is needed to read analog signals [32].

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