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Raspberry Pi Technology: A Review

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ABSTRACT:

The Raspberry Pi is a very powerful, small computer having the dimensions of credit card which is invented with the hope of inspiring generation of learners to be creative. This computer uses ARM (Advanced RISC Machines) processor, the processor at the heart of the Raspberry Pi system is a Broadcom BCM2835 system-on-chip (SoC) multimedia processor. This review paper provides a description of the raspberry pi technology which is a very powerful computer. Also it introduces the overall system architecture and the design of hardware components are presented in details.

Keywords: ARM, SoC , NOOBS, SD, GP, RPi.

I. INTRODUCTION

The Raspberry Pi is a small computer, same as the computers with which you're already familiar. It uses a many different kinds of processors, so can't install Microsoft Windows on it. But can install several versions of the Linux operating system that appear and feel very much like Windows. Raspberry Pi is also used to surf the internet, to send an email to write a letter using a word processor, but you can too do so much more. Simple to use but powerful, affordable and in addition difficult to break, Raspberry Pi is the perfect device for aspiring computer scientists [1].

This small computer features amazing HD (high-definition) quality, video playback, also sports high quality audio and has the capability to play 3D games. The device use the ARM processor which does nearly all of the hard work in order to run the Raspberry Pi.

RASPBIAN, PIDORA, OPENELEC, RASPBMC, RISC OS, and ARCH LINUX these are few software's which are used. All this software's can be downloaded easily and these are free from the official forum under the NOOBS (new out of the box software) category. It supports Python as the main programming language for functioning and coding. It also supports BASIC, C, C++, JAVA, and Perl and Ruby languages [2].

II. HISTORY

Eben Upton in UK-based Raspberry Pi Foundation at Cambridge University has begun manufacturing a \$35, credit-card sized computer, designed to make it affordable, bare-bones, tiny to teach basic computer science in schools worldwide. The Linux-based, single-board computer will have a 700-MHz ARM architecture, CPU, 256 Mbytes of RAM, two USB ports and a 10/100 Ethernet controller.

The foundation later plans to propose a \$25 model with 128 Mbytes RAM, one USB port with no Ethernet controller. Both models have RCA and High-Definition Multimedia Interface outputs that enable users to plug the machines into a TV. Mice, keyboards, and other input devices could connect via a USB port. The computers won't include a hard disk or solid-state drive but instead will use an SD memory card to boot up and store data. The 45-gram machines will measure $85.6 \times 53.98 \times 17$ millimeters, not including the SD card and connectors, which will project a bit over the edge. For one computer takes three to four weeks. The foundation expects an initial production runs of 10,000 machines.

Raspberry Pi was founded in 2009 with the stated goal of producing an affordable computer that young people could use to learn computer programming. Various schools have reportedly inquired about using the Raspberry Pi machines. Proponents hope corporations will pay for computers that could be used in schools with fewer financial resources [3].

III. HARDWARE SETUP

Since the board has been designed by considering curious school children in mind, it's easy to use. The Raspberry Pi board encompasses a processor and graphics chip, program memory (RAM) and various interfaces, and connectors for external devices. RPi operates in the same way as a standard PC, demanding a keyboard used for command entry, a display unit, a power supply. RPi use a SD Flash memory card generally used in digital cameras, configured in a same as a hard

drive used in PC. RPi will 'load the Operating System into RAM'(boot)from this card in the same way as a PC 'boots up' into Windows from its hard disk [5]. The basic representation is shown in figure 1. :

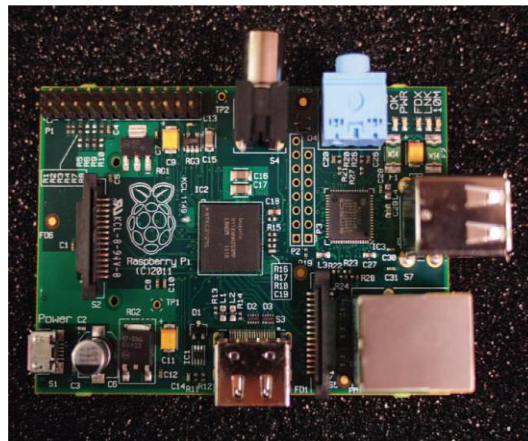


Figure 1: Board representation

Essential components used in RPi hardware are:

- SD card having Linux Operating system
- USB keyboard
- TV or monitor having HDMI, DVI, Composite or SCART input
- Power supply
- Video cable suited with the TV or monitor used

Optional components are:

- USB mouse
- Internet connection, Model A or B: USB Wi-Fi adaptor
- Internet connection, Model B only: LAN (Ethernet) cable
- Powered USB hub
- Case

IV. INTERFACING RASPBERRY PI

Following are the steps of connecting RPi given below [5]:

1. Pay attention to the gold connectors on the SD card. These gold connectors must make contact with the gold connectors on the Raspberry Pi.



Figure 2: Making contact of SD card and RPi

2. Plug in your mouse and keyboard into the USB ports.



Figure 3: Connecting mouse and keyboard

3. If you want to connect your Raspberry Pi to the internet or a network you will need to plug in the Ethernet cable.

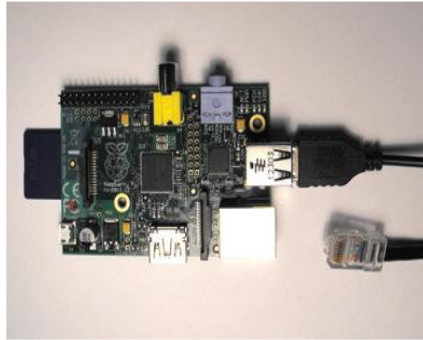


Figure 4: Ethernet cable plugging

4. If you have a HDMI TV or monitor then you can plug in your HDMI cable into the Raspberry Pi and plug the other end into your TV. If you have a combined video connection on your TV and then goes to step 5. (If your TV/monitor does not have a HDMI port you will need to use an adapter - this will either be a HDMI to DVI or a HDMI to VGA.)



Figure 5: HDMI Cable plugging

5. Insert the merged video connection if you are using a TV that does not support HDMI and plug it into your television.
6. Insert your power cable into the Raspberry Pi power connector.



Figure 6: Connecting Power cable

V. ADVANTAGES AND DISADVANTAGES

A. Advantages

Some of the merits are:

- Is an inexpensive device with an easily affordable price, anyone from teenagers to computer enthusiasts can grab a piece of Pi for themselves? Where commercial counterparts of certain applications of Raspberry Pi can costs hundreds of dollars, Pi offers a much cheaper alternative at only a fraction of the price.
- Raspberry Pi has the size of a credit card. As we all know with technology, generally the smaller it is, the better. With a small size, Raspberry Pi can be hidden almost anywhere, behind television sets, inside walls or even in your wallet.

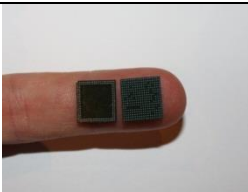
- Raspberry Pi with low price and small size do not necessarily indicate low performance. Even though you won't be capable to play the latest hardcore 3D games on your machine, RPi allows for High Definition (HD) video streaming and other basic computer functions like word processing and web browsing. Pi was initially intended as a programming platform for beginners and hence, it is versatile, powerful, an all-rounder.

B. Disadvantages

Although it has merits but it has some demerits also some of them are:

- Raspberry Pi does not support X86 operating systems means hardware limitations do not allow for Raspberry Pi to run 32 bit operating systems such as Microsoft Windows, Max OS X or some varieties of Linux. This can be a huge loss for not-so computer friendly end users. For professional users; this is not much of a set back as Raspberry Pi supports other popular operating system.
- Some applications which necessitate high demands on CPU processing are off-limits. Such as "Model B took 107 ms to complete one calculation of the entirely synthetic prime number test and a mid-range desktop Core 2 Duo E8400 took only 0.85ms." (By Collins, 2012) shown in Table1. :-

Table 1: Comparison between RPi and Intel

Synthetic Prime Number Test	
Raspberry Pi	Intel
Model B	Core 2 Duo E8400
107ms	0.85ms
	

- Users must not use usual computer standards to judge Raspberry Pi. It can work as a private computer but still cannot replace it.

VI. APPLICATIONS

Raspberry Pi is proposed to get people interested in computing, programming or even to solve their general needs. School children, college kids, adolescents, oldies of the technology sphere have all started working on this board. People are inclined to use this board for interfering, for enhancing ever day experiences like using the FAX machine, innovating Home-robots, media players, video camera streamers. Some of applications which include [3]:-

- Games application- Due to powerful multimedia and 3D graphics capabilities, Raspberry Pi has potential to be used as a games platform.
- Pi in the sky: This board is a GPS receiver, radio transmitter designed for tracking high altitude balloon flights.
- R2D2 powered by Rasp Pi: Xiang's R2D2 tracks faces and motion and is motorized for movement which has the capacity to respond to voice commands.
- Electronics devices: Otto is a camera product which captures pictures with a twist. It converts them into animated GIF's, period lapses; it can also add many effects to a picture or to a GIF.
- Live bots: Live bots is scheme that allows users to control many robots based on Raspberry Pi over the internet.
- Lap pi: The scheme features a laptop assembled from scratch which is based on the Raspberry pi board.

VII. CONCLUSIONS

Raspberry Pi is an innovative technology. The sheer number of users and fan base support the fact that the device can see an abundant future ahead. The device can certainly help anyone who really needs to learn electronics and computers. Raising the processing power can certainly assist the product in the future. Also supply a case and a appropriate instruction manual will get better the product. Also at present Windows operating systems are not compatible because of the ARM processor. If the processor is enhanced or any workaround is found to run Windows directly on the Raspberry Pi then it can be a great step for the Pi. The Raspberry Pi is a wonderful piece of hardware because of the combination of the features of a traditional computer and an embedded device. It supports computer operating systems like Linux and provides easy input/output lines i.e. the GPIO makes it ideal for controlling almost anything. Programming the GPIO is much simple and perceptive then a traditional FPGA or microprocessor. Lastly it can be said that Raspberry Pi can be efficiently used if its processing power is kept in mind. It can work as a individual computer but cannot swap it.

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