

STUDY ON RASPBERRY PI-ARCHITECTURE

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Abstract: In this paper we are presenting the architecture and overview and hardware of Raspberry Pi (a credit card sized). This is all about the economy of the device and how the device performs and with what technology and process it works. The device was mainly used in operating systems especially Linux and several operating systems. Raspberry Pi has the best place in the study purpose use and this paper briefly defines about the process of Raspberry Pi

Keywords: Operating System, Process, Raspberry Pi

I.INTRODUCTION

The raspberry pi is a series of small single board computers developed in the united kingdom by the raspberry pi foundation to promote the teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated. Its target is hot selling for robotics in the market and also it does not include “keyboard, mouse etc.. is also called peripheral devices.

II.MARKETING INFORMATION

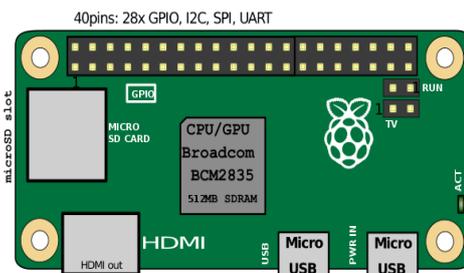
Over a 5 million raspberry pi were sold by February 2015, making it the best selling in the market. And also it is the third best-selling “ general purpose computer”.

Overview:

Several generations of raspberry pi have been released. Its processor speed ranges from 700MHZ to 1.2 GHZ for the pi. On board memory ranges from 256 MB to 1GB RAM. Secure digital (SD) cards are used to store the operating system and program memory in either SDHC or micro SDHC sizes. The raspberry pi board have one to four USB ports. HDMI and composite video are supported with a standard 3.5mm phono jack for audio output. Lower-level output is provided by a number of GPIO pins which support common protocols like IC.

The first generation was released in February 2012. These boards are approximately credit card sized and represent the standard mainline form-factor. The raspberry pi2 which added more RAM was released in February 2015. There many models in raspberry pi

- ✓ Raspberry pi zero
- ✓ Raspberry pi zero w
- ✓ Raspberry pi model B
- ✓ Raspberry pi 2
- ✓ Raspberry pi



The raspberry pi zero is smaller size and reduced (input and output) and general purpose capabilities was released in November 2015. Raspberry pi model was released in February 2016 and has on-board and USB boot capacities. The organization behind the raspberry pi consist of two arms. The first two models were developed by the raspberry pii foundation. After the pi model B was released, the foundation set up raspberry pi trading with to develop the third model, and also is responsible for developing the technology while the foundation is an educational charity to promote the teaching of basic computer science in schools and in developing countries.The foundation provides raspbian a debian based linux distribution for download, as well as third-party UBUNTU,WINDOWS 10, IOT CARE,RISC OS and specialised media centre. It promotes python and scratch as the main programming language with support for many other languages

III.HARDWARE

The raspberry pi hardware has evolved through several versions that features variations in memory capacity and peripheral-device support. The block diagram of Ethernet adapter is internally connected to an additional USB port. The USB port is connect directly to the system on a chip (SOC). Raspberry pi 1 model B+ and later models the USB/Ethernet chip contains a five-point USB hub, of which four ports are available, on the pi zero, the USB port is also

connected directly to the soc, but it uses a micro USB (OTG) port.

IV.PROCESSOR

The first generation raspberry pi is equivalent to the chip used in the first modern generation processor. This includes 700 MHz processor videocore IV graphics processing unit and RAM. It has many level, level 1 cache the data up to 16kb and level 2 cache catches the data up to 128kb. The level 2 cache is used primarily by the GPU. The soc is stacked underneath the RAM chip. So only its visible.

The earlier model of the raspberry pi 2 used a board with a 900 MHz 32-bit quad core processor, with 256 KB shared cache. The raspberry pi 2 was upgraded to a boardcom BCM2837 with a 1.2 GHZ 64-bit quad-core processor the raspberry pi 3 uses a boardcom BCM2837 with a 1.2 GHZ 64-bit quad-core processor with 512KB shared L2 cache.

V.PERFORMANCE

The raspberry pi 3 with a quad-core processor, is described as 10times the performance of a raspberry pi 1. This was suggested to be highly dependent upon task threading and instruction set use. Raspberry pi 3 to be approximately 80% faster than the raspberry pi 2 in parallelized tasks. Raspberry pi 2 include a quad core cortex-A7 cpu running at 900MHz and 1GB RAM. It was described as 4-6 times more powerful than its predecessor. The GPU was identical to the original in parallelized benchmarks, the raspberry pi 2 could be up to 14 times faster than a raspberry pi 1 model. While operating at 700MHz by default, the first generation raspberry pi provided a real world performance roughly equivalent to 0.041. On the CPU level the performance is similar to a 300 MHz Pentium II of 1997-99. The graphics capabilities of the raspberry pi are roughly equivalent to the performance of the 2001. The LINPACK single node compute benchmark results in a mean single precision performance of 0.065. A cluster of 64 raspberry pi model computers.

VI.OVERCLOCKING

Most raspberry pi chips could be over clocked to 800MHz and some to 1000mhz. There are reports the raspberry pi 2 can be similar overclocked,1500 mhz(discarding all safely features and over-voltage limitation). In the raspberry linux distro the overclocking options on boot can be done by a software command running without voiding the warranty. In those cases the pi automatically shuts the overclocking down if the chips reaches. But it is possible to override automatic over-voltage and over clocking settings sized heat sink is needed to protect the chip from serious overheating. This is done by monitoring the core temperature of the chip, the CPU load, and dynamically adjusting clock speeds and the core voltage. When the demand is low on the CPU or it is running too hot the performance is throttled, but if the CPU has much to do and the chip temperature is acceptable performance is temporarily increased with clock speeds of up to 1 GHZ depending on the individual board and on which of the turbo setting is used.

The seven over clock presets are:

None; 700 MHz RAM, 250 MHz core, 400 MHz SDRAM
Modest; 800 MHz RAM, 250 MHz core, 400 MHz SDRAM

Medium; 900 MHz RAM, 250 MHz core, 450 MHz SDRAM

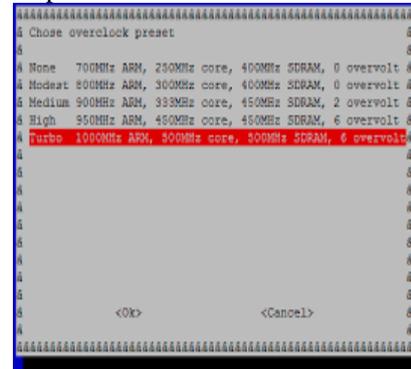
High; 950 MHz RAM, 250 MHz core, 450 MHz SDRAM

Turbo; 1000 MHz RAM, 500 MHz core, 600 MHz SDRAM

Pi 2; 1000MHz RAM, 500 MHz core, 500 MHz SDRAM

Pi 3; 1100 MHz RAM, 500 MHz core, 500 MHz SDRAM
in system information CPU speed will appear as 1200 MHz.

When in idle speed lowers to 600 MHz.



VII.RAM

On the older beta model boards, 128 MB was allocated by default to the GPU leaving 128MB for the CPU. On the first 256MB release model B (and model A), three different splits were possible. The default split was 192MB (RAM for CPU), which should be sufficient for standalone 1080p video decoding, or for simple 3D, but probably not for both together. 224 MB was for Linux only, with only a 1080p and was likely to fail for any video or 3D. 128 MB was for heavy 3D, possibly also with video decoding.

For the later model B with 512 MB RAM initially there were new standard memory split files released, for 256 MB, 384 MB and 496 MB CPU RAM. But a week or so later the RPF released a new version of start, that could read a new entry in dynamically assign an amount of RAM (from 16 to 256 MB in 8 MB steps) to the CPU. The raspberry pi 2 and the raspberry pi 3 have 1GB of RAM. The raspberry pi zero and zero W have 512 MB of RAM.

VIII.NETWORKING

The model of raspberry pi A,A+, and pi zero have no Ethernet circuitry connected to a network using an external user-supplied Ethernet or WI-FI adapter. On the model B and B+ the Ethernet port is provided by a built- in USB Ethernet adapter using the LAN9514 chip. The raspberry pi 3 and pi zero W (wireless) are equipped through unofficial firmware patching and the pi 3 and the pi 3 also has a 10/100 Ethernet port.

PERIPHERALS:

The raspberry pi may be operated with any generic USB computer, keyboard and mouse. It may also be used with USB storage, USB to MIDI converters, and virtually any other devices/component with USB capabilities.

Other peripheral devices can be attached through the various pins and connectors on the surface of the raspberry pi.

VIDEO:

The video controller can emit standard modern TV resolutions, such as HD and full HD, and higher or lower monitor resolutions and older standard CRT TV resolutions. As shipped it can emit the pixels 640*350 EGA 800*600

SVGA 1024*768 XGA 1280*720p HDTV.... 1920*1200 WUXGA.

Higher resolutions such as up to 2048*1152 may work or even 3840*2160 at 15HZ.

That allowing the highest resolutions does not imply that the GPU can decode video formats at those work are not reliably for H.265. commonly used for very high resolutions (most formats, commonly used, up to full HD, do work).

Although the raspberry pi 3 does not have decoding hardware, the CPU is more powerful than its predecessors, potentially fast enough to allow the decoding videos in software. The GPU in the raspberry pi 3 runs at higher clock frequencies of 300 MHZ or 400 MHZ, compared to previous versions which ran at 250 MHZ.

The raspberry pi's can also generate 576i and 480i composite videos signals, as used on old- style (CRT TV) screens and less expensive monitors through standard connectors. The television signals standards supported to the network.

REAL-TIME CLOCK:

None of the currently raspberry pi models have a built-in real-time clock, so they are unable to keep track of the time of day independently. As a workaround, a program running on the pi can retrieve the time from a network time server or from user input at boot time, thus the time while powered on. To provide consistency of time for the file system, the pi does automatically save the time it has on shutdown, and re-install that time at boot.

A real time hardware clock with battery backup such as the DS1307, may be added.



ACCESSORIES:

A raspberry pi foundation device designed for educational purposes, that expand the raspberry pi pins to allow interface with and controls of LEDs, switch, analog signals, sensors and other devices. It also includes an optional Arduino compatible controller to interface with the pi.

Camera - on 14th may 2013 the foundation and the distributors RS components premier farnell/element 14 launched the raspberry pi camera board alongside a firmware update to accommodate it. The camera board is shipped with a flexible flat cable that plugs into the CSI connector which is located between the Ethernet and HDMI ports. In raspbian, the user must enable the use of the camera board by running raspi-config and selecting the camera options. The cost of the camera module it is can produce 1080p, 720p and 640*480p video. The dimension are 25mm * 20mm* 9mm. V2 of the camera came out, and is an 8 mega pixel camera.

HAT - (hardware attached on top) expansion boards – together with the model B+ inspired by the shield boards, the interface for hat boards was devised by the raspberry pi foundation. Each HAT board carries a small EEPROM

containing the relevant details of the board, so that the raspberry pi's OS is informed of the HAT, and the technical details of it, relevant to the OS using the HAT. Mechanical details of a HAT board, that use the four mounting holes in their rectangular formation, are available online.



IX.SOFTWARE

OPERATING SYSTEM:

The raspberry pi foundation recommends the use of raspbian, a debian-based Linux operating system. Other third party operating system available via the official website include UBUNTU MATE, WINDOWS 10 IOT CORE, RISC OS and specialised distribution for the kodi media center and classroom management.

OTHER OPERATING SYSTEM (NOT LINUX-BASED):

RISC-OS pi (as special cut down version RISC OS pico, for 16 MB cards and larger for all models of pi 1&2, has also been made available.

WINDOW 10 IOT CORE – a no-cost edition of window 10 offered by Microsoft that runs natively on the raspberry pi 2

OTHER OPERATING SYSTEM (LINUX-BASED)

Android things - an embedded version of the android operating system designed for IOT devices development.

Kali Linux- is a debian-derived distro designed for digital forensics and penetration testing.

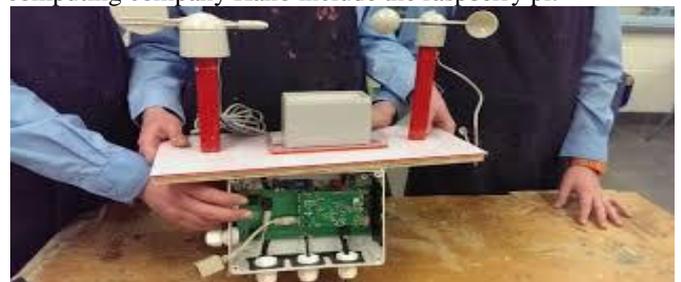
Sailfish OS-with raspberry pi 2 (due to use ARM cortex-A7 CPU; raspberry pi 1 uses different architecture and sailfish requires.)

Raspberry Digital signage- an operating system designed for digital signage deployments.

USE IN EDUCATION:

As of January 2012, enquiries about the board in the united kingdom have been received from schools in both the state and private sectors, with around five times as much interest from the letter. It is hoped that businesses will sponsor purchases for less advantaged schools. The CEO of premier farnell said that the government of a country in the middle east has expressed interest in providing a board to every schools, in order to enhance her employment prospects.

The educational computers kits made by London-based computing company Kano include the raspberry pi.



X.CONCLUSION

Raspberry pi is an innovative product. The sheer number of users and fan base support the fact that the device can see a great future ahead. The device can surely help anyone who really wants to learn and electronics and computer. Increasing the processing power can surely help the product in future. Also supplying a case and a proper instruction manual will improve the product. Also currently windows operating system are compatible because of the ARM processor. If the processor is improve 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 an amazing piece of hardware because of the combination of the features of a traditional computer and an embedded device. Supporting computer operating systems like linux and providing simple input/output lines i.e the GPIO makes it perfect for controlling almost anything. Programming the GPIO is much easy and intuitive then an traditional FPGA or microprocessor. Finally it can be said that Rapsberry Pi can be effectively used if its processing power is kept in mind. It can work as a personal computer but cannot replace it.

XI.REFERENCES

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