# Configuring Cost Effective Netbook using RASPBERRY PI 3

**Prof. Souvik Paul[1], Saumedhik Biswas[2], Atreyo Sengupta[3], Banhishikha Basu[4], Sreya Basu[5]**

Assistant Professor, BCA Department, The Heritage Academy, Kolkata, India[1]

Student, BCA Department, The Heritage Academy, Kolkata, India[2,3,4,5]

souvik.paul@heritageit.edu

**Abstract**: Laptop computers, tablets, and smart phones have dramatically changed the way in which people work, interact with each other, and even how they think. 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. Also, it introduces the overall system architecture and the design of hardware components are presented in details. The mobile devices are those devices together with the applications that run on them and (usually) network connectivity that provide access to additional application functionality and additional data. Mobile applications (mobile apps) bring with them a new set of management challenges, particularly in the realm of security. Bring your own device (BYOD) has simultaneously complicated and simplified the challenge of managing mobile apps. BYOD made managing mobile apps more complicated because of the diversity of devices on which the applications may run. Alternatively, BYOD simplified the management challenge because most of the responsibility for managing the performance and availability of mobile apps is shifted to the user of the device.

**Keywords:** Raspberry PI 3, 7 inch IPS Display and connector, Wireless Keyboard, Power bank, Male USB pin, Memory card etc.

## I. INTRODUCTION

Netbook or mini laptop is a generic name given to a category of small, lightweight, legacy-free, and inexpensive laptop computers that were introduced in 2007. Netbooks compete in the same market segment as mobiles and Chrome books (a variation on the portable network computer).At their inception in late 2007as smaller notebooks optimized for low weight and low cost—netbooks omitted certain features (e.g., the optical drive), featured smaller screens and keyboards, and offered reduced computing power when compared to a full-sized laptop. Over the course of their evolution, netbooks have ranged in size from below 5" screen diagonal to 12". A typical weight is 1 kg (2.2 pounds). Often significantly less expensive than other laptops, by mid-2009, netbooks began to be offered by some wireless data carriers to their users "free of charge", with an extended service contract purchase. A Netbook is a new type of laptop computer, defined by size, price, horsepower, and operating system. They are small, cheap, under-powered, and run either an old or unfamiliar operating system. Netbooks run either Windows XP Home edition or Linux (not only is Linux unfamiliar to many, but the versions of Linux on Netbooks are not the mainstream popular distributions). They do not run XP Professional, Vista, or OS X. Microsoft arbitrarily restricts Netbooks from running the Professional Edition of Windows XP. Likewise, Apple arbitrarily restricts OS X to Apple hardware and it has never played in the low-end realm that Netbooks occupy. Vista requires too much horsepower to run well on a Netbook. HP has been the only company to offer Vista on a Netbook. The price, however, was so high that it's debatable whether such a machine qualifies as a Netbook

## II. RASPBERRY PI 3

The Raspberry Pi (/paɪ/) is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside its target market for uses such as robotics. It now is widely used even in research projects, such as for weather monitoring because of its low cost and portability. It does

not include peripherals (such as keyboards and mice) or cases. However, some accessories have been included in several official and unofficial bundles. Raspberry Pi 3 is tiny single board computer, introduced by Raspberry Pi Foundation that comes with CPU, GPU, USB ports and I/O pins and capable of doing some simple functions like regular computer. This tiny computer was developed with the purpose of making computer learning process easy so an average student can get benefit and anticipate what an advanced computer can do. Raspberry Pi 1(first generation Model B) came into play in 2012, and soon got a renowned reputation in terms of ease of use and availability. Similarly, Raspberry Pi 2 was introduced in Feb, 2015 will little improvement in design with added RAM than its previous version. Introduced in 2016, Raspberry Pi 3 Model B comes with a quad core processor that shows robust performance which is 10 times more than Raspberry Pi 1. And speed exhibits by Raspberry Pi 3 are 80% more than Raspberry PI 2.
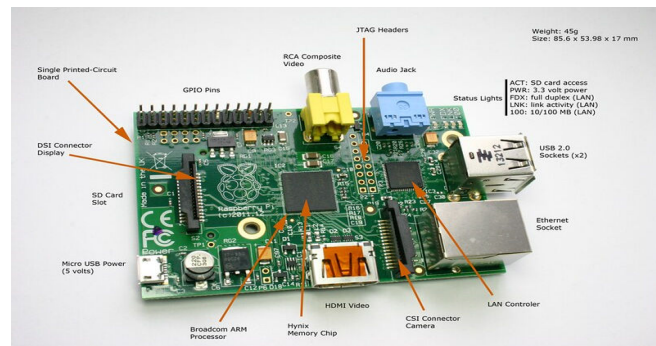


**Figure I (a):** RASPBERRY PI 3



**Figure I (b):** RASPBERRY PI 3 Model B Pictorial Description

**A. Hardware Specification**
- Raspberry Pi 3 Model comes with 64 bit quad core processor, on board WiFi and Bluetooth and USB features.
- It has a processing speed ranging from 700 MHz to 1.4 GHz where RAM memory ranges from 256Mb to 1GB
- The CPU of this device is considered as the brain of the device which is responsible for executing numbers of instructions based on mathematical and logical operation.
- The GPU is another advanced chip incorporated in the board that carries out function of image calculation. The board is equipped with Broadcom video core cable that is mainly used for playing video games through the device.
- The Pi 3 comes with GPIO (General Purpose Input Output) pins that are essential to maintain connection with other electronic devices. These input output pins receive commands and work based on the programming of the device.
- The Ethernet port is incorporated on this device that sets a pathway for communicating with other devices. You can connect Ethernet port to the router to maintain a connection for internet.
- The Board has four USB ports that are used for communication and SD card is added for storing the operating system.
- Power source connector is a basic part of the board that is used to provide 5 V power to the board. You can use any source to set up a power for the board, however, it is preferred you connect power cable through laptop USB port for providing 5 V.
- The Pi 3 supports two connection options including HDMI and composite. The HDMI connector is used to connect LCD or TV that can support 1.3 and 1.4 version cables. Composite video connection is used to connect the older version of TV with the device that uses the 3.5mm jack socket for the audio production.
- The new device comes with a video core multimedia 3D graphics which is capable of playing 1080 MP video. This feature puts this advice ahead of its predecessors where video quality was not that much upgraded.
- The USB hard drive incorporated on the board is used to boot the device, similar to PC hard drive where windows are used to boot the computer hard drive.

### B. Networking Specification

The Raspberry Pi 3b and Pi Zero W (wireless) are equipped with 2.4 GHz WiFi 802.11n (150 Mbit/s) and Bluetooth 4.1 (24 Mbit/s) based on the Broadcom BCM43438 Full MAC chip with no official support for monitor mode but implemented through unofficial firmware patching[61] and the Pi 3 also has a 10/100 Mbit/s Ethernet port. The Raspberry Pi 3B+ features dual-band IEEE 802.11b/g/n/ac WiFi, Bluetooth 4.2, and Gigabit Ethernet (limited to approximately 300 Mbit/s by the USB 2.0 bus between it and the SoC). The Raspberry Pi 4 has full gigabit Ethernet throughput is not limited as it is not funnelled via the USB chip.

### C. Operating System Specification

The official Raspbian Linux operating system runs on Pi 3. Other third party OS that can operate on this device are RISC, Kodi Media Centre, Windows 10 IoT core, Ubuntu Mate and classroom management. There are other non-Linux based systems that can run on this device which you can pick based on your needs and requirements. Windows 10, the latest version of windows, can run remarkably well on the desktop computer, but running windows 10 on the Pi 3 is a whole new experience, not as good as desktop computer, but still you can get a little glimpse of running windows 10 on a tiny device like Pi 3.The windows 10 that run on this device is not a full version of windows 10, but a reduced version that is called windows 10 loT core, capable of running only one single full screen windows app at a time, however, still it supports number of software running on the background. Raspberry Pi 3 is a 64 bit device, which is capable of running official Raspbian operating system. The Raspbian Pi Foundation is also looking to modifying the Raspbian operating system to make it compatible for 32 bit devices that were introduced a while ago.

### D. Browser Specification

Recent addition of Raspberry Pi comes with a Chromium browser which is quick and robust than the browser available in its predecessors, but still it gets stuck when it comes to opening number of heavy duty sites, however, YouTube video buffering is too quick that you don't need to wait too long before video comes into play. Opening number of sites at once can take more time than you anticipate which ultimately hangs the device, causing the device memory to freeze or stuck. Although, experts are in constant struggle to add more advanced features with every new addition, still Pi 3 doesn't support number of advanced applications.

### III. 7 INCH ISP DISPLAY AND CONNECTOR

IPS stands for in-plane switching, a type of LED (a form of LCD) display panel technology. IPS monitors or "In-Plane Switching" monitors, leverage liquid crystals aligned in parallel to produce rich colours. IPS panels are defined by the shifting patterns of their liquid crystals. These monitors were designed to overcome the limitations of TN panels. The liquid crystal's ability to shift horizontally creates better viewing angles.IPS monitors continue to be the display technology of choice for users that want colour accuracy and consistency. IPS monitors are really great when it comes to colour performance and super-wide viewing angles. The expansive viewing angles provided by IPS monitors help to deliver outstanding colour when being viewed from different angles. One major differentiator between IPS monitors and TN monitors is that colours on an IPS monitor won't shift when being viewed at an angle as drastically as they do on a TN monitor. IPS monitor variations include S-IPS, H-IPS, e-IPS and P-IPS and PLS (Plane-to-Line Switching), the latter being the latest iteration. Since these variations are all quite similar, they are all collectively referred to as "IPS-type" panels. They all claim to deliver the major benefits associated with IPS monitors – great colour and ultra-wide viewing angles. When it comes to colour accuracy, IPS monitors surpass the performance of TN and VA monitors with ease. While latest-gen VA technologies offer comparative performance specs, pro users still claim that IPS monitors reign supreme in this regard. Another important characteristic of IPS monitors is that they are able to support professional colour space technologies, such as Adobe RGB. This is due to the fact that IPS monitors are able to offer more displayable colours, which help improve colour accuracy.IPS monitors are 1 of the 4 main panel types; other monitor panel types are TN, VA, and OLED. All of the above panel types are part of the LCD panel technology family**.**
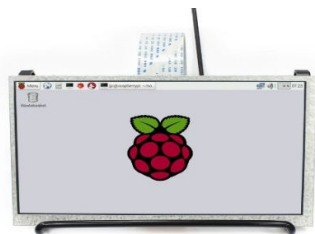
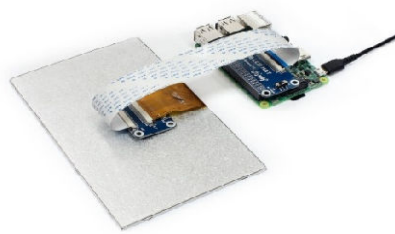**Figure II (a):** 7 Inch Display Screen



**Figure II (b):** 7 Inch Display Screen with Connectors

**A. Key features of 7 Inch Display Screen**

- Compatible with Raspberry Pi 2B/3B/Zero/Zero W.
- The TFT LCD is directly driven by Raspberry Pi DPI interface, refresh rate up to 60Hz.
- Supports Raspbian, Ubuntu, OSMC, etc.
- Backlight can be turned off to lower power consumption.
- Compact size, suit for various projects.

## IV. WIRELESS KEYBOARD

A wireless keyboard is a computer keyboard that allows the user to communicate with computers, tablets, or laptops with the help of radio frequency (RF), infrared (IR) or Bluetooth technology. It is common for wireless keyboards available these days to be accompanied by a wireless mouse. Wireless keyboards based on infrared technology use light waves to transmit signals to other infrared-enabled devices. But, in case of radio frequency technology, a wireless keyboard communicates using signals which range from 27 MHz to up to 2.4 GHz. Most wireless keyboards today work on 2.4 GHz radio frequency. Bluetooth is another technology that is being widely used by wireless keyboards. These devices connect and communicate to their parent device via the bluetooth protocol. A wireless keyboard can be connected using RF technology with the help of two parts, a transmitter and a receiver. The radio transmitter is inside the wireless keyboard. The radio receiver plugs into a keyboard port or USB port. Once the receiver and transmitter are plugged in, the computer recognizes the keyboard and mouse as if they were connected via a cable.

## V. POWER BANK

These rechargeable power banks are simple, portable and are extensively used for charging almost all portable electronic gadgets. The mobile phones require high powered batteries for enhancing the operating duration. Therefore, the power banks with enhanced capacities ranges from 2000mAh to20000mAh or beyond are in a great demand for charging mobile phones.
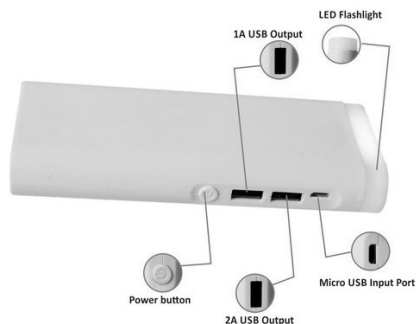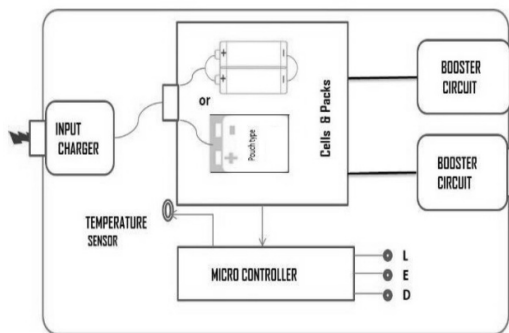


**Figure III (a):** Power Bank



**Figure III (b):** 7 Inch Display Screen with Connectors

Some of the portable electronic gadgets charged by the power bank are shown in Fig.III (a). The power bank consists of three components such as lithium-ion battery, hardware protection circuit, and outer case. Among all, the battery is the heart of the power bank and hardware protection controls the current, voltage and temperature as well. The health of the power bank is estimated by the LED profiles for better operation of the device. The block diagram of the power bank is shown in Fig.III (b).

## VI. MALE USB PIN

A USB cable can have one of two forms of connector in the original system. These are designated the "A" and "B" connectors. The USB Type A plug is the male version of the connector. What might be referred to as the socket, is the female connector or receptacle, although it is often referred to as the port. The female connector or receptacle is the type found on the host, e.g. computer, etc, whereas the male will be seen on items like flash memories, mouse connector, keyboard connector, etc. There is some colour coding on these connectors in terms of their capabilities. USB 3.0 Type A connectors are often, but not always, the coloured blue. USB 2.0 Type A and USB 1.1 Type A connectors are often black, but this is not always the case.



**Figure IV (a):** Male USB Pin **Figure IV (b):** Memory Card

## VII. MEMORY CARD

A memory card is a type of storage device that is used for storing media and data files. It provides a permanent and non-volatile medium to store data and files from the attached device. Memory cards are commonly used in small, portable devices, such as cameras and phones. A memory card is also known as a flash card. A memory card is mainly used as a primary and portable flash memory in mobile phones, cameras and other portable and handheld devices. PC Cards (PCMCIA) was a predecessor of modern memory cards that were introduced for commercial purposes. Besides providing non-volatile media storage, a memory card also uses solid state media technology, which lowers the chances of mechanical problems, such as those found in traditional hard drives.

## VIII. THE MAIN PCB

The PCB has two main ICs visible from the underside, many ground/power planes, and other components such as a USB connector, capacitors, resistors, and various semiconductors. The left side of the PCB shows many horizontal traces with multiple via points as well as various test points. The horizontal traces are most likely for the routing of the keyboard matrix that will be found on the opposite side of the PCB. This PCB appears to be made of two layers which explain the use of traces and planes on the same side. If a four-layer board were used, the PCB would most likely have used either the inner layers as power/ground planes or the output layers for traces or the other way around. The center of the PCB shows a really interesting pattern (located directly under the touchpad) of a hatched ground plane as opposed to being filled. This area of the PCB also houses an IC with the identification eKT2101 QN32 which, thankfully, is an off- the-shelf capacitive touch IC microcontroller. The core of the microcontroller is an ARM968E-S and has 32KB RAM and 256KB of FLASH ROM. It is becoming increasingly common for designers to integrate their entire design into a single wireless controller as doesn't require a separate module, saving money. The controller shown here also has two pads nearby labeled as RX1 and TX1, which will most likely be for debugging (such as viewing AT commands). The IC also has a missing J4 component, which is probably the eminence of the prototyping stage where a small four-way jumper switch used to be which may have changed internal options for testing and programming of the controller.

The USB charging port has various components nearby, including three resistors, two capacitors, and a six-pin surface mount device. The device has the identification of HXN MH which does not return any credible answers as to what the IC actually is. However, considering the use of two capacitors (one on the input and one on the output) and a few resistors, this device may be a lithium-ion charging IC that uses an internal linear regulator whose voltage output depends on the external resistors. Linear regulators, while potentially wasteful, would work well in this circuit considering that the power comes from an external USB host (most likely a phone charger) where power is abundant.



**Figure V:** The horizontal traces, test pads, and various horizontal traces of PCB

### IX. WORKING OF A MINI LAPTOP

The Raspberry Pi board comes equipped with an SD card. This slot permits us to insert an SD card and that can use it as our devices. The SD card is a main storage device for raspberry pi board like a hard disk of a personal computer. The bootable Linux operating system is loaded onto the card, you are planning to use. The raspberry pi supports Linux, Qtonpi, ARM, Mac operating systems. You can select one OS; you will need to write it to an SD card using a Disk manager application. You can also use other storage mechanism, like USB external hard drive or USB drive. There are a numerous brands of SD cards are available in the market in different sizes. The raspberry pi supports max 64 GB SD card. Before you start your raspberry pi, you are going to need to connect a display, keyboard, mouse like as a PC. It supports three different O/Ps like HDMI video, composite video, and DSI video, where the DSI video needs some specific hardware. When you buy a raspberry pi board it may sold with or without an SD card. It is a very important specification in raspberry pi board. Because, it keeps its operating system, documents and programs. If your raspberry pi did not come with an SD card, then the min size you should get is 4GB. Advantages of the raspberry pi are, it is small in size, and it works as a normal computer at low cost server to handle web traffic.

### X. FUTURE USE OF MINI LAPTOP USING RASPBERRY PI 3

- This OS not only provides a fully functional desktop environment with commonly used programs such as chromium and word processing, but it also includes a wide range of programming tools. Since 2015, the Raspberry Pi Foundation has declared Raspbian as the primary operating system for Raspberry Pi and is open source.
- So, whenever you want to do something with your pi, just connect it with Ethernet cable to your laptop and power it. Then open VNCViewer, mention the IP address of your pi. And you can use the display of your laptop as the raspberry pi's monitor.
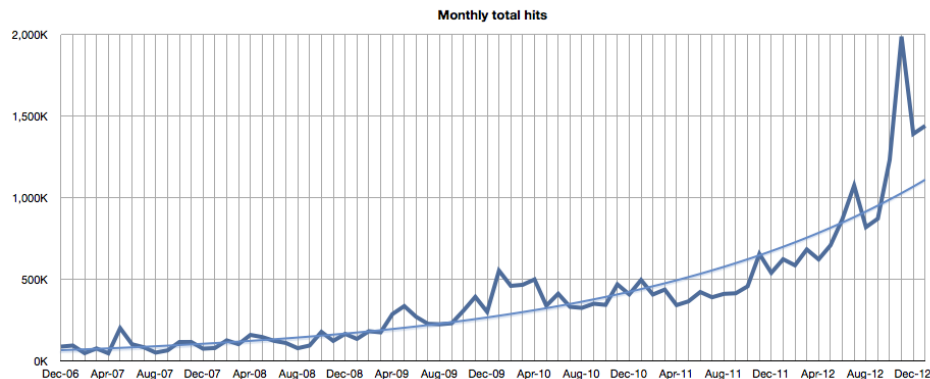
**Figure:** VI Increase of RASPBERY PI 3 use in respect of year 2019

## XI. CONCLUSION

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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