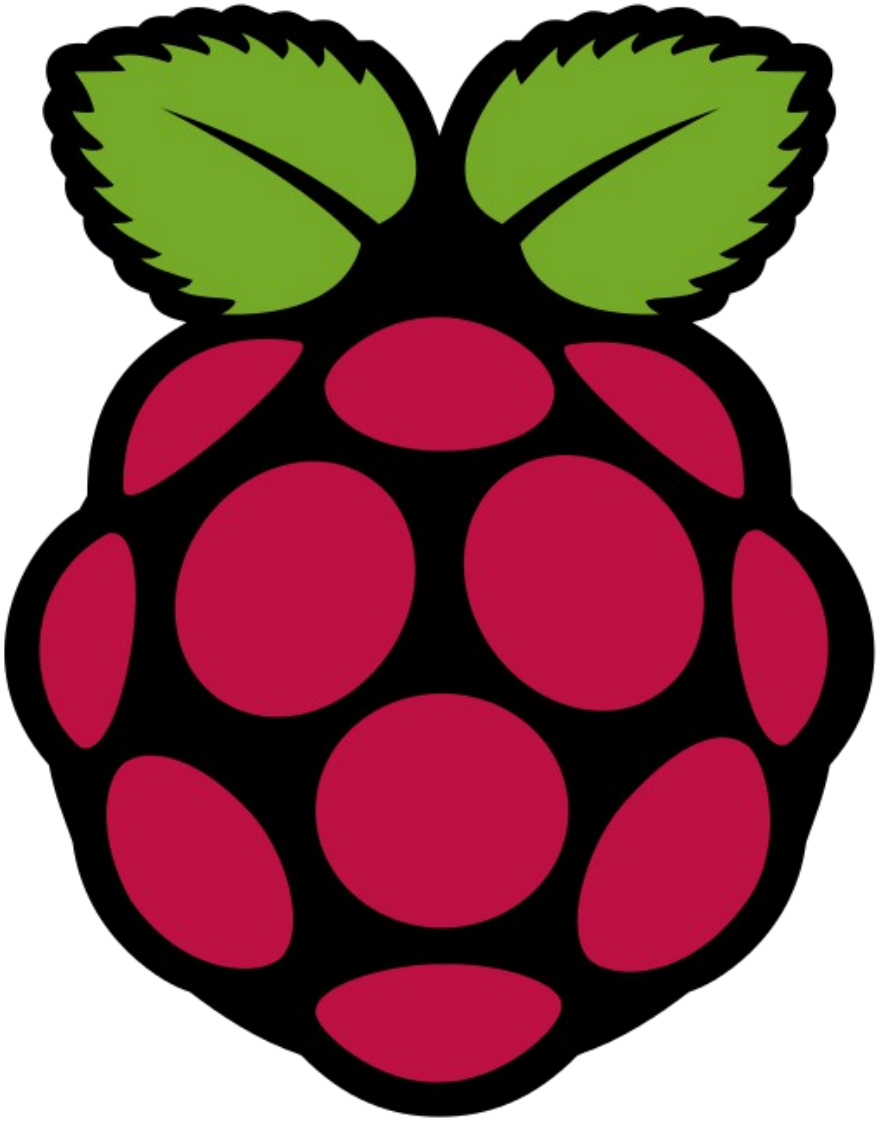
Pi...!
Raspberry Pi...!



Workshop on

Raspberry Pi

A hands on approach

@ PCCE, Goa

11th & 12th May 2016

By,

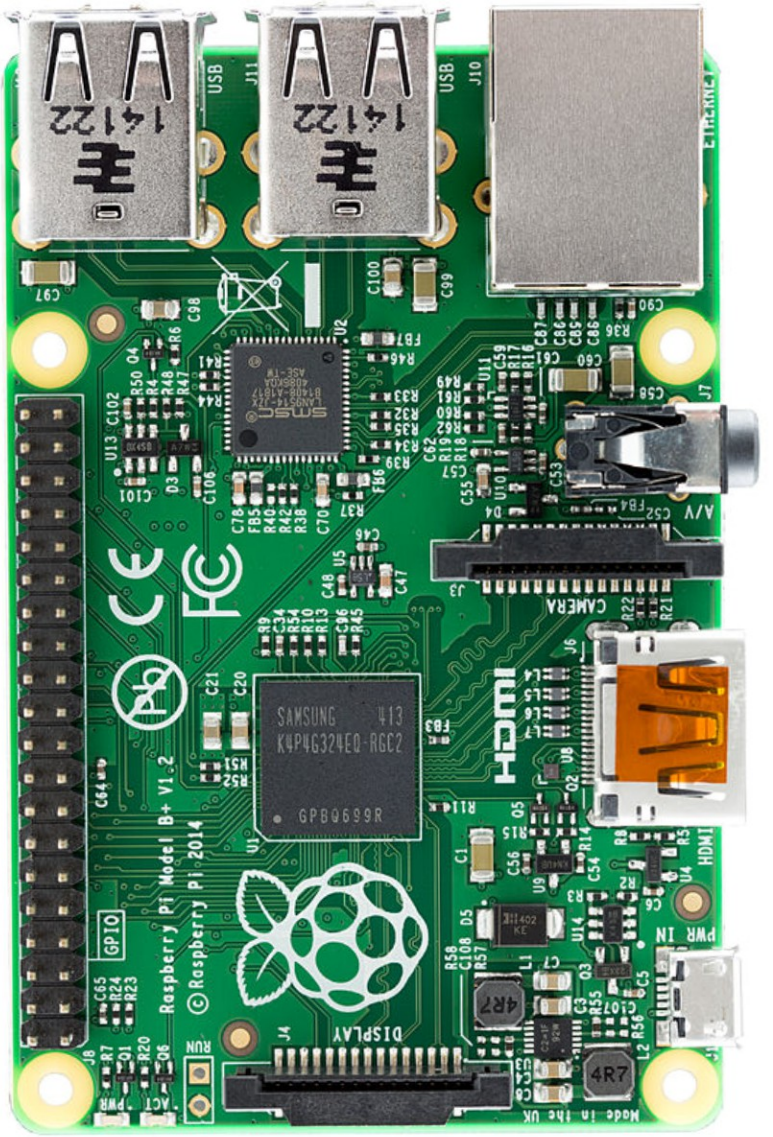
Vadiraja Acharya & Adithya B

Jyothy Institute of Technology

What is it..?

The Raspberry Pi is a series of **credit card–sized** single-board computers developed in England, United Kingdom by the **Raspberry Pi Foundation**

To promote the teaching of basic computer science in schools and **developing countries.**



People Behind Pi...!

Jack Lang
Pete Lomas
Robert Mullins

David Braben, is a British game developer, game designer and CEO of Frontier Developments plc,

Alan Mycroft, is a Professor at the Computer Laboratory, University of Cambridge and a Fellow of Robinson College, Cambridge, where he is also director of studies for Computer science

EbenUpton, is a Technical Director and ASIC architect for Broadcom. He is also a founder and former trustee of the Raspberry Pi Foundation, and now CEO of Raspberry Pi (Trading) Ltd.

Need...?

- **Declining numbers and skills of students applying for Computer Science** at the University of Cambridge's Computer Laboratory in 2006.
- A need for a **tiny and affordable computer** came to minds of a team that includes Eben Upton, Rob Mullins, Jack Lang and Alan Mycroft at the University of Cambridge's Computer Laboratory
- Several versions of the early Raspberry Pi prototypes were designed but were very limited by the **high cost and low power processors** for mobile devices at that time.
- In 2012 the Raspberry Pi Model B was born and it had **sold over two million units** within in two years of mass production.

Back into History...

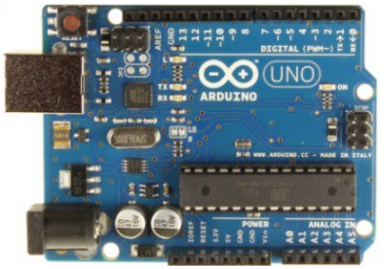
In 2006, early concepts of the Raspberry Pi were based on the Atmel ATmega644 microcontroller.
Foundation trustee Eben Upton assembled a group of teachers, academics and computer enthusiasts to devise a computer to inspire children.
The computer is inspired by Acorn's BBC Micro of 1981.
Pi's model A, model B and model B+ are references to the original models of the British educational BBC Micro computer, developed by Acorn Computers.
The first ARM prototype version of the computer was mounted in a package the same size as a USB memory stick.
It had a USB port on one end and an HDMI port on the other.
On November 26, the cheapest Raspberry PI yet, the Raspberry PI Zero was launched at US$5.

Single-Board Computers

- Properties
  - Processor Speed (Ghz, Multiple core)
  - RAM (speed of RAM)
  - Video Card (Home entertainment)
  - On-board storage (FLASH)
  - Hard-drive storage
  - GPIO pins
  - Features
    - Audio jack
    - IR remote
    - Blue tooth
    - Other connectors

Single-Board Computer vs. Microcontroller

Rough Specifications

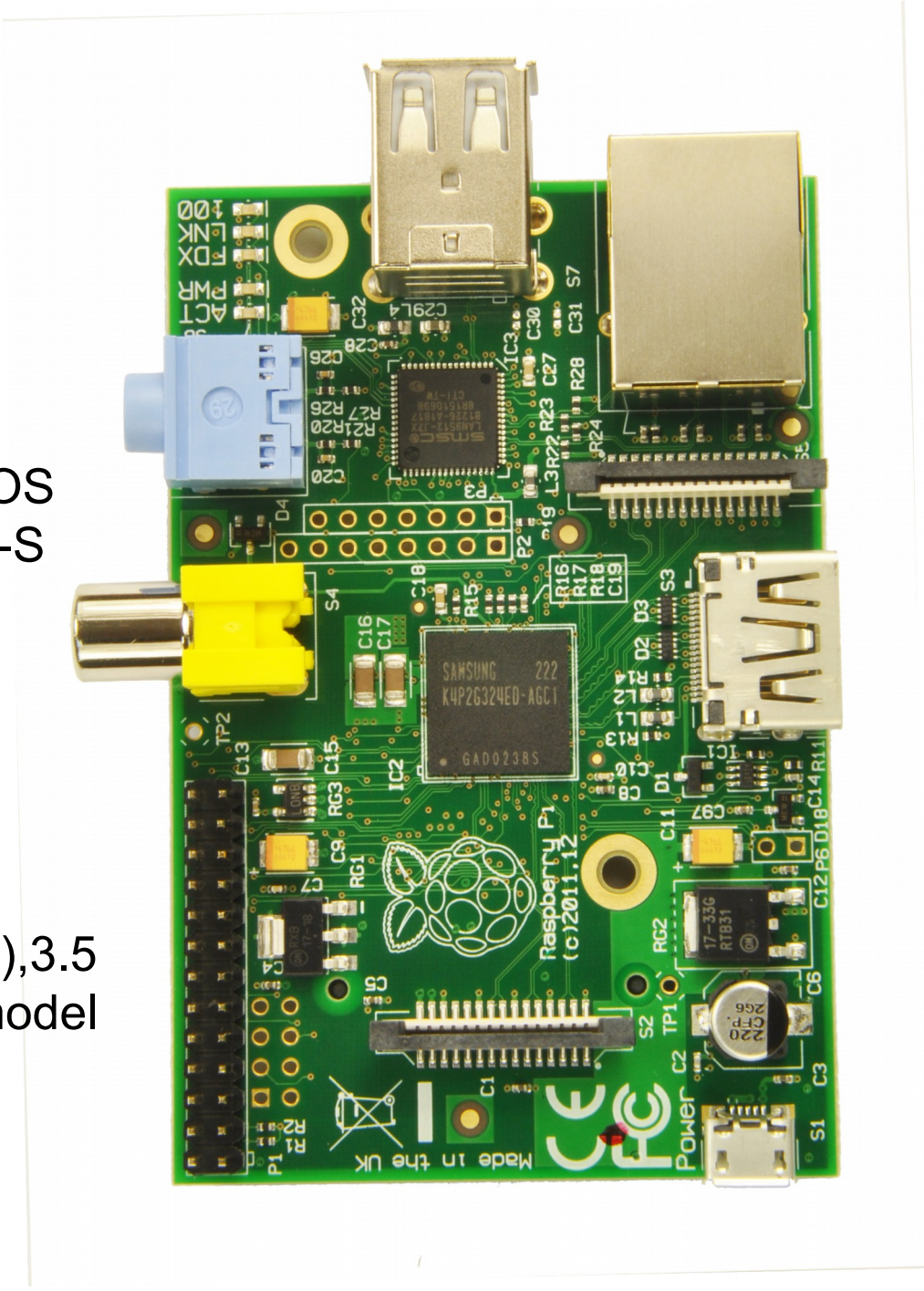


	Microcontrollers	Single-Board Computers
Processor Speed	~50 Mhz	1 Ghz +
Onboard Storage	64 Kb	Flash, SD cards ~Gb
Memory (RAM)	64 Kb	~ 1 Gb
Power Consumption	12 mA (2200 mAh battery -> 183hr)	500 mA+ (2200 mAh battery-> 4.4 hr)
Reboot Time	<1 sec	~ Multiple seconds
Other Features		Operating system Extendable Storage Network Connection

Offerings...

Raspberry Pi B & B+

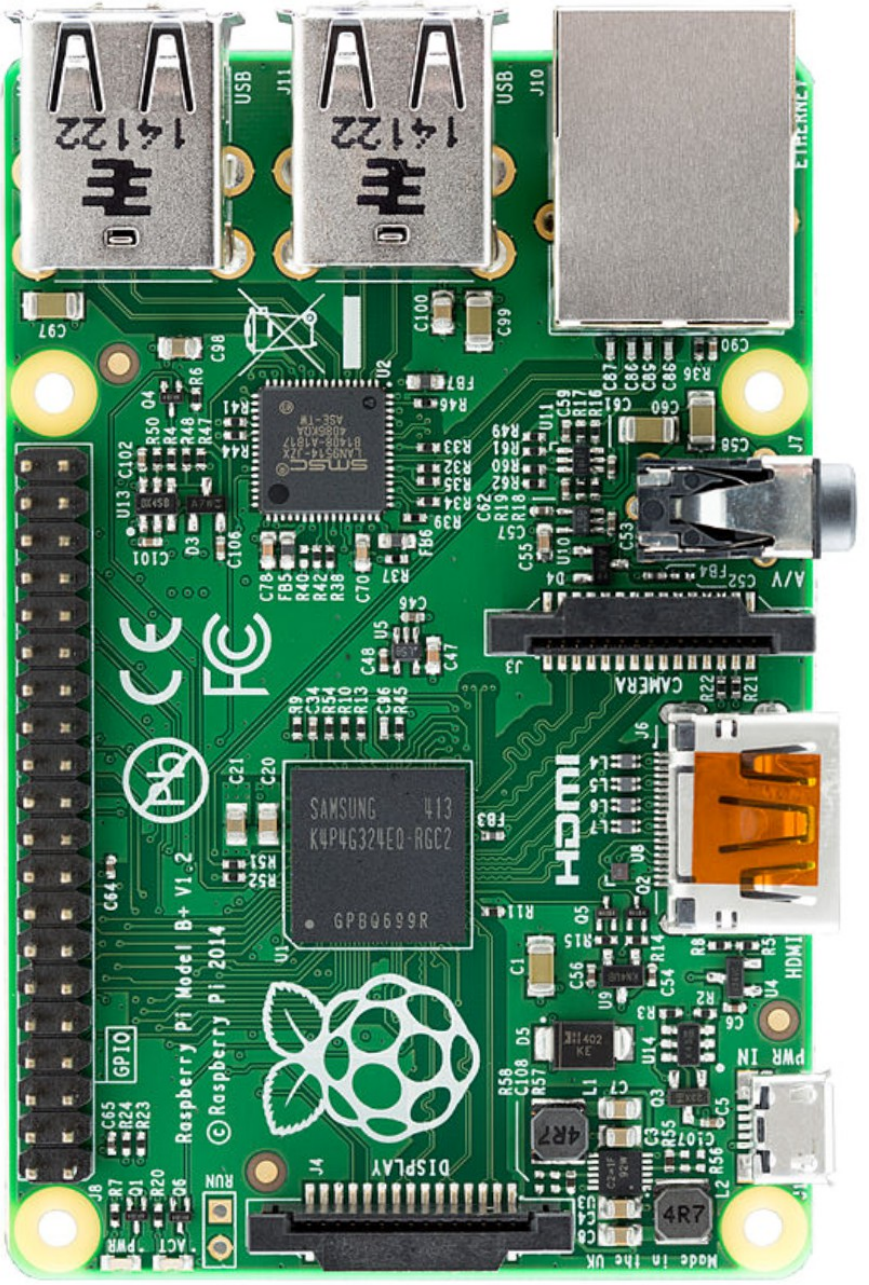
Release date: February 2012;
Operating system:
Linux (e.g. Raspbian), RISC OS,FreeBSD, NetBSD, Plan 9, Inferno,AROS
CPU: 700 MHz single-core ARM1176JZF-S
Memory: 256 MB (model A, A+, B rev 1)
512 MB (model B rev 2, B+, CM)
Storage: SDHC slot (model A and B), **MicroSDHCslot** (model A+ and B+), 4 GB eMMC IC chip (model CM)
Graphics: Broadcom VideoCore IV[2]
Power: 1.5 W (model A), 1.0 W (model A+),3.5 W (model B), 3.0 W (model B+) or0.8 W (model Zero)



Offerings...

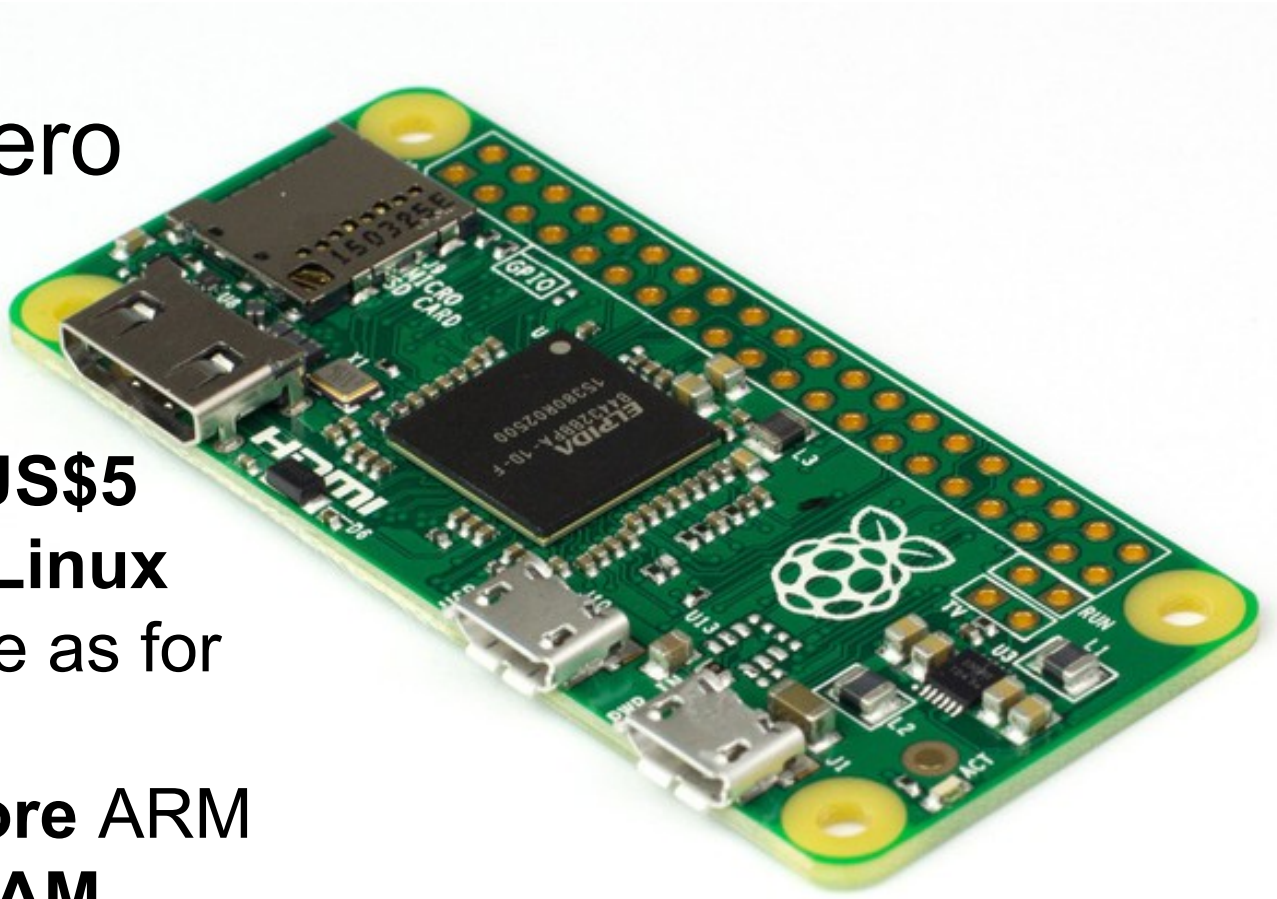
Raspberry Pi 2

Release date: February 2015;
Introductory price: US$35
Operating system: Same as for Raspberry Pi 1 plus **Windows 10 IoT Core** and additional distributions of Linux such as **Ubuntu**
CPU: 900 MHz quad-core ARM Cortex-A7
Memory: 1 GB RAM
Storage : MicroSDHC slot
Graphics: Broadcom VideoCore IV
Power: 4.0 W



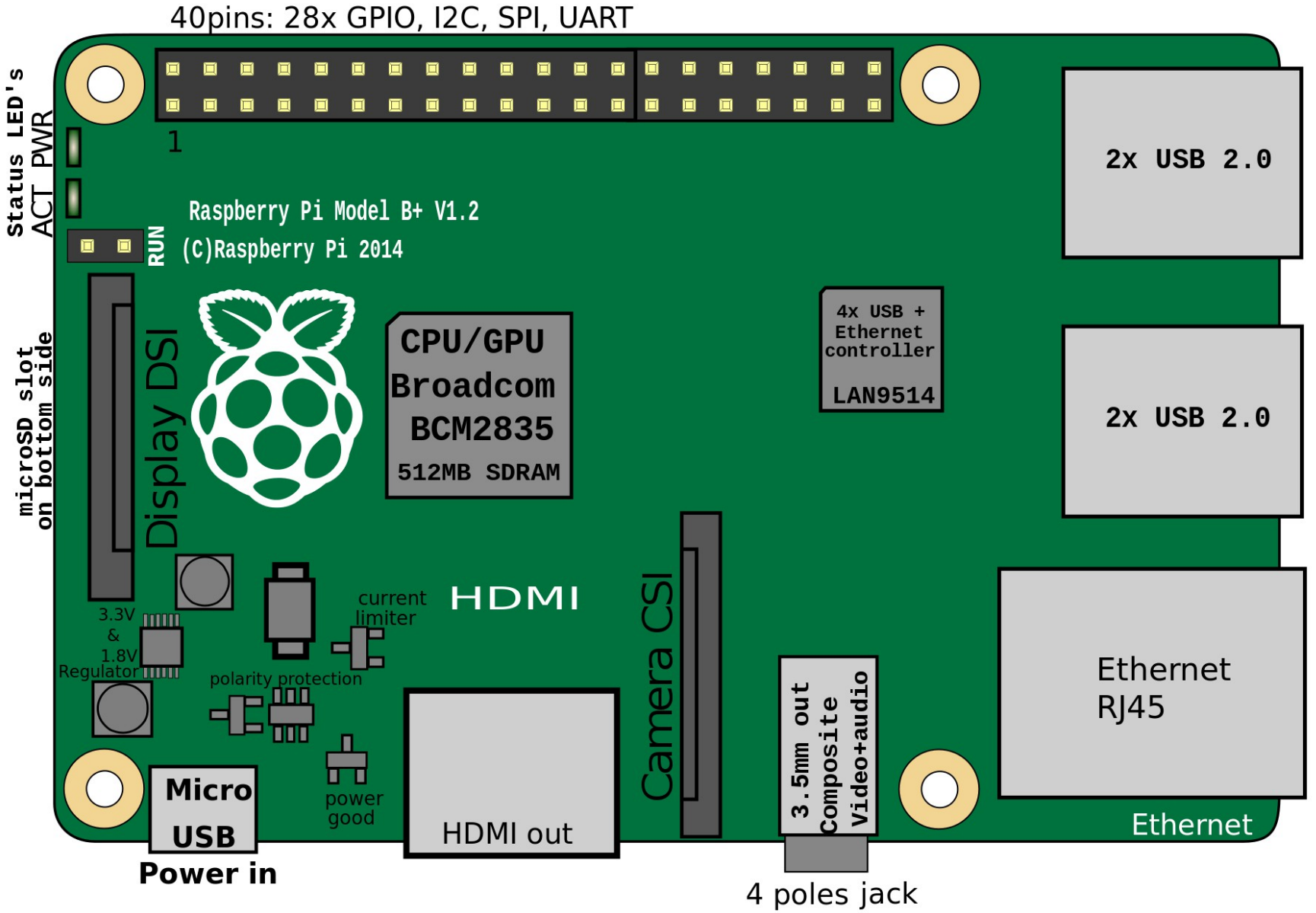
Offerings...

Raspberry Pi Zero

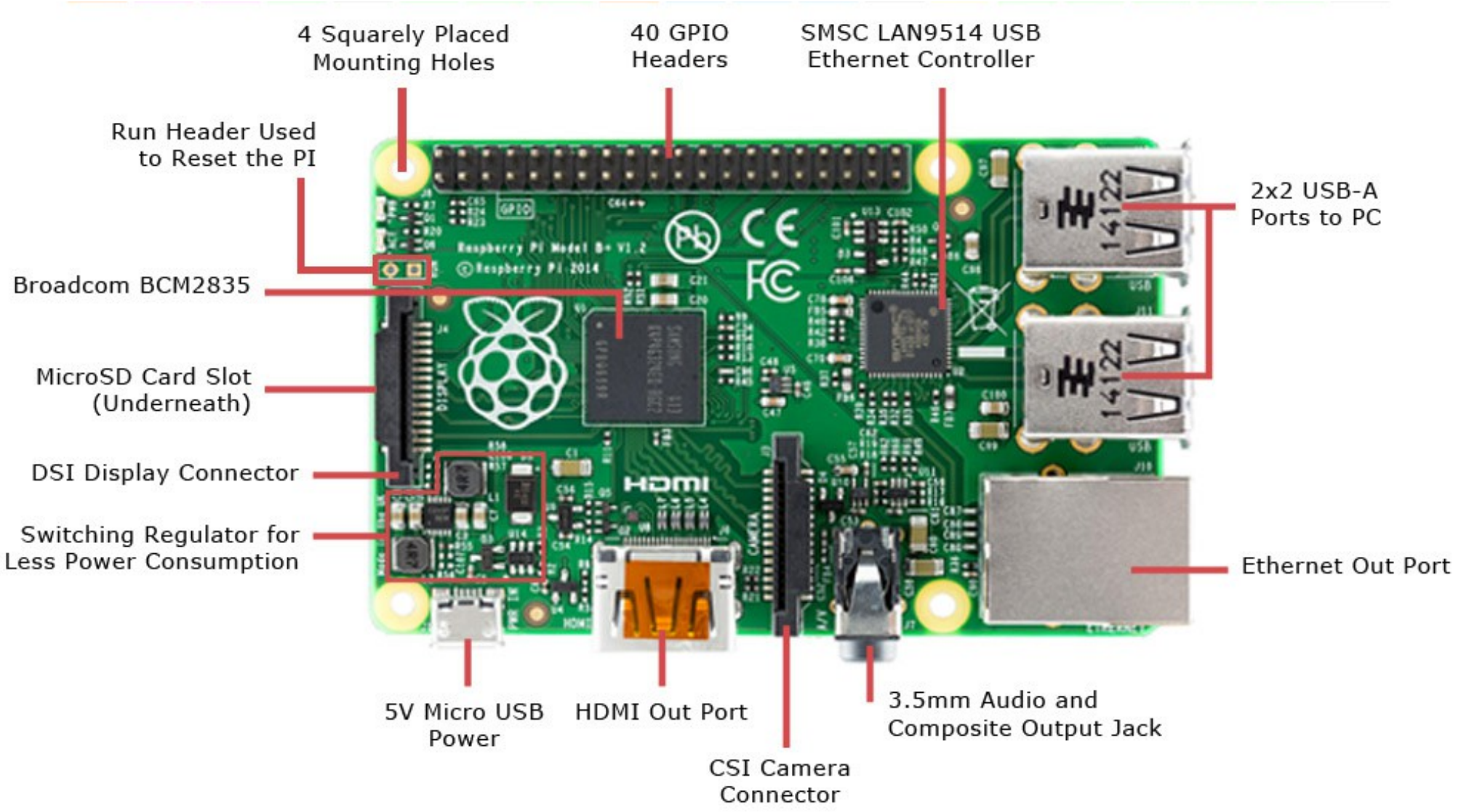


Release date:
November 2015
Introductory price: US$5
Operating system: Linux
(Raspbian) or the same as for Raspberry Pi 1
CPU: 1 GHz single-core ARM
Memory: 512 MB RAM
Storage: MicroSDHC slot
Power: 0.8 W

Architecture..!

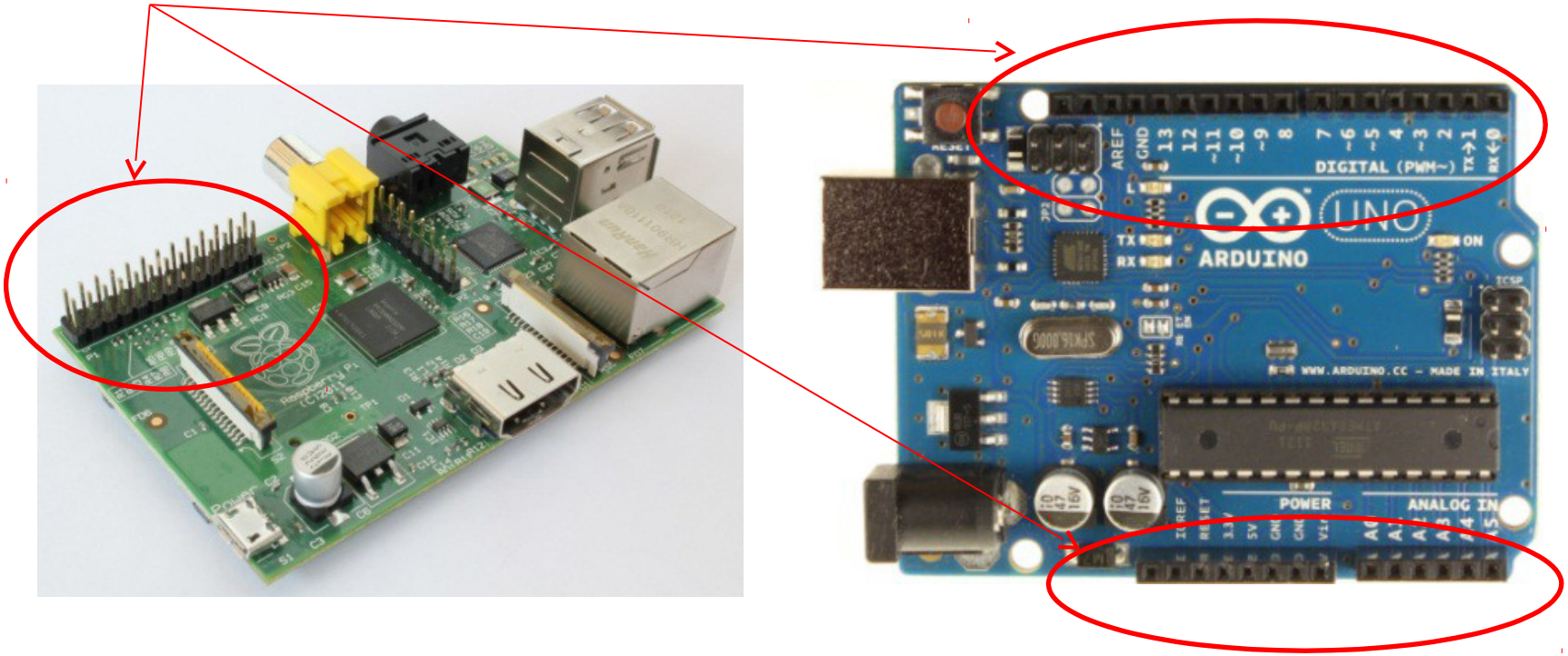


Components of Raspberry Pi…



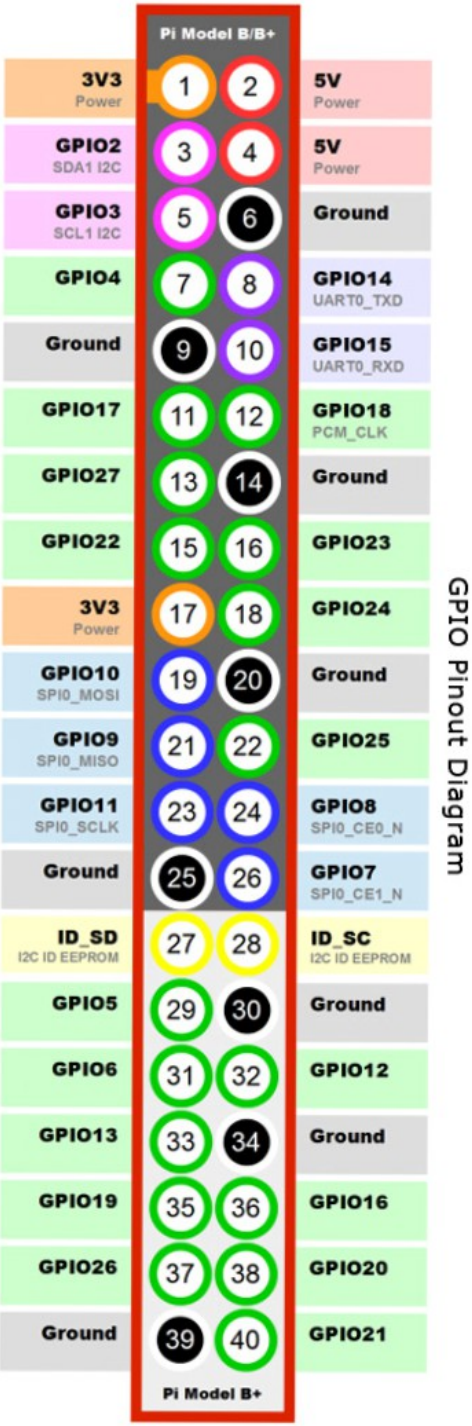
Why are they so popular?

- They are cheap
- They sense and manipulate the physical world
  - GPIO pins (reading values/sending instructions)



GPIO Pins...

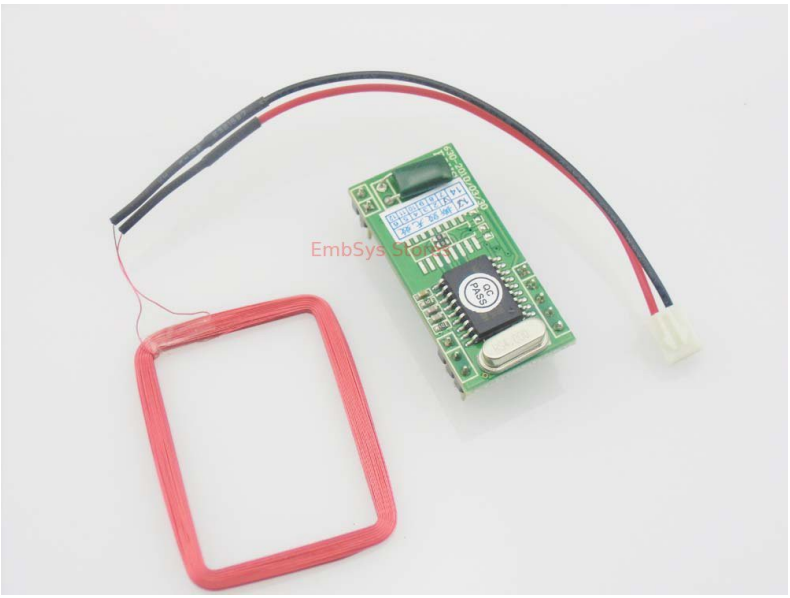
These pins are a physical interface between the Pi and the outside world.
At the simplest level, you can think of them as switches that you can turn on or off (input) or that the Pi can turn on or off (output)
You can program the pins to interact in amazing ways with the real world.
Inputs don't have to come from a physical switch. It could be input from a sensor or a signal from another computer or device
If the Raspberry Pi is on a network, you can control devices that are attached to it from anywhere and those devices can send data back



UART..

Universal Asynchronous Receiver/Transmitter
A UART is usually an individual (or part of an) integrated circuit used for serial communications over a computer or peripheral device serial port. UARTs are now commonly included in microcontrollers.

UART WiFi Module



UART RFID Module

SPI...

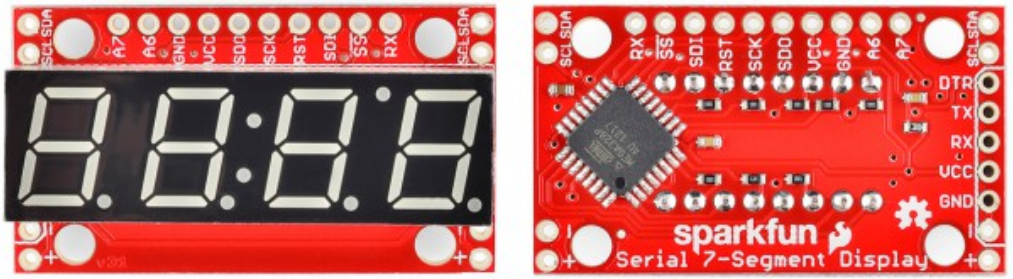
The Serial Peripheral Interface (SPI) bus is a synchronous serial communication interface specification used for short distance communication, primarily in embedded systems

MOSI - Master Out Slave In;

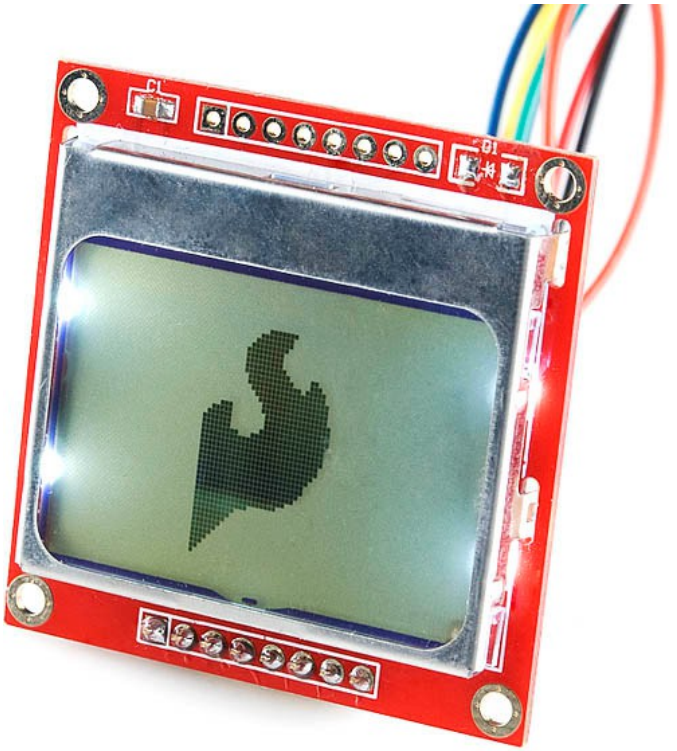
MISO - Master In Slave Out;

SCK - Clock signal from master to slave;

SS - Slave Select signal selects salve devices.



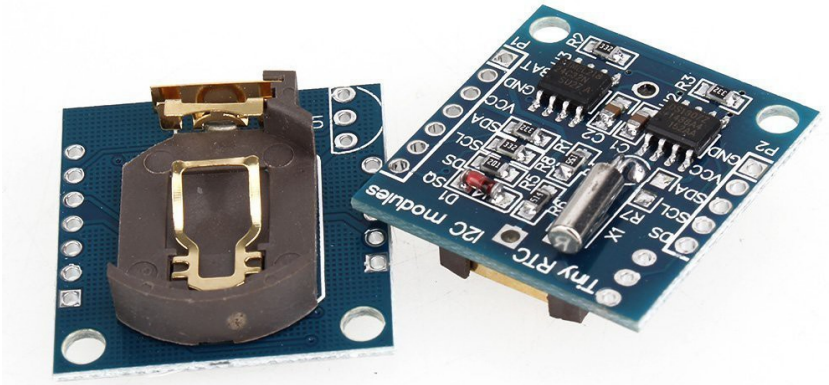
SPI 7 Segment Display



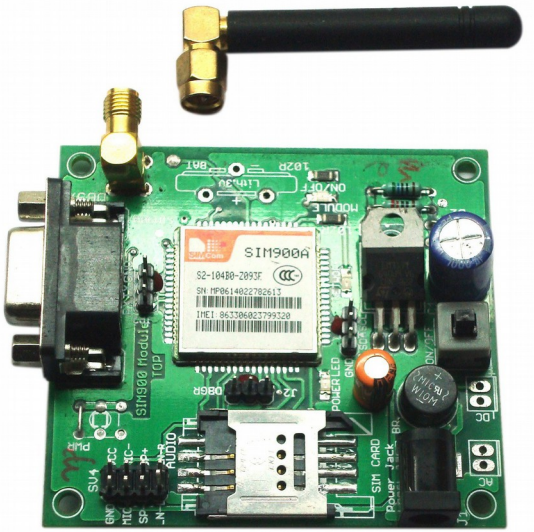
SPI Graphic LCD

I2C...

I²C (Inter-Integrated Circuit), pronounced I-squared-C, is a multi-master, multi-slave, single-ended, serial computer businvented by Philips Semiconductor (now NXP Semiconductors).
It is typically used for attaching lower-speed peripheral ICs to processors and microcontrollers.
Alternatively I²C is spelled I2C (pronounced I-two-C) or IIC (pronounced I-I-C).



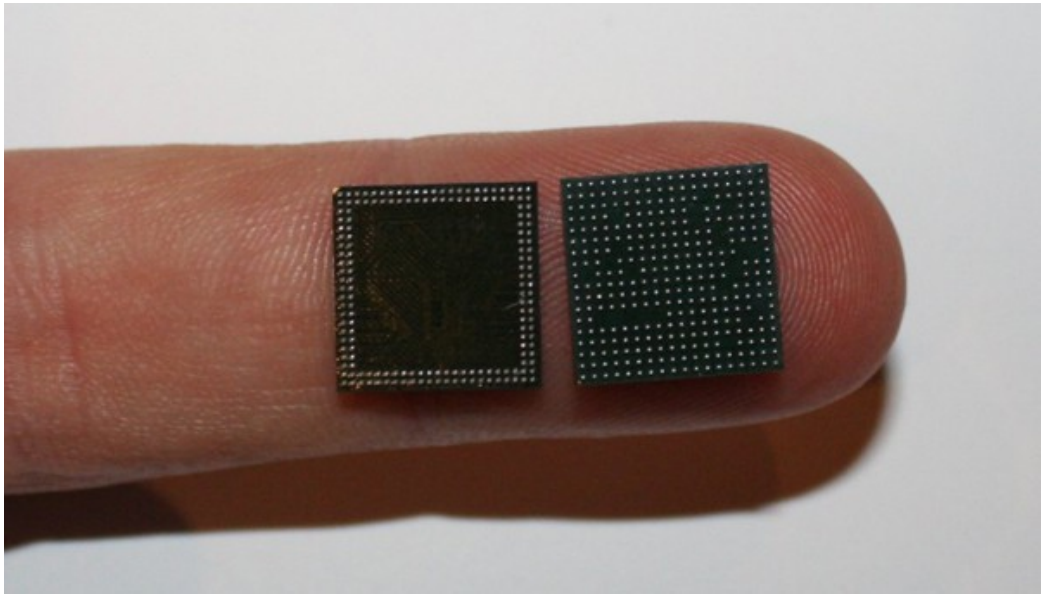
I2C Real Time Clock Module



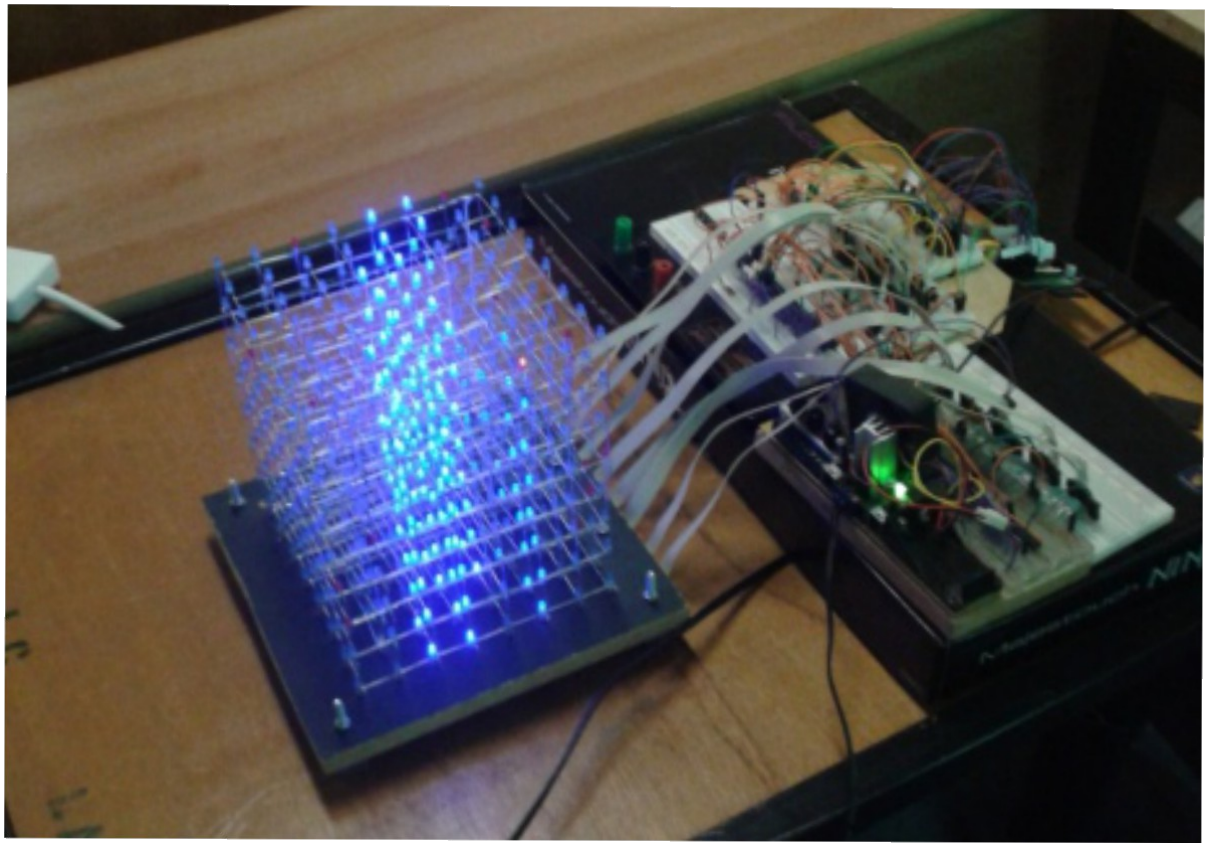
I2C GSM Module

SoC (System on Chip)
Broadcom BCM2835/BCM2836...

The Broadcom chip used in the Raspberry Pi Model A, B, B+, Compute Module and Raspberry Pi Zero is Broadcom BCM2835.
The Broadcom chip used in the Raspberry Pi 2 Model B is Broadcom BCM2836
The underlying architecture in BCM2836 is identical to BCM2835.
The only significant difference is the removal of the ARM1176JZF-S processor and replacement with a quad-core Cortex-A7 cluster.



Some of the Applications...



Programmable 3-D LED cube

SRC: http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/engineering/computing/newssummary/news_1-7-2014-13-2-0

Some of the Applications...

Thermal Printer

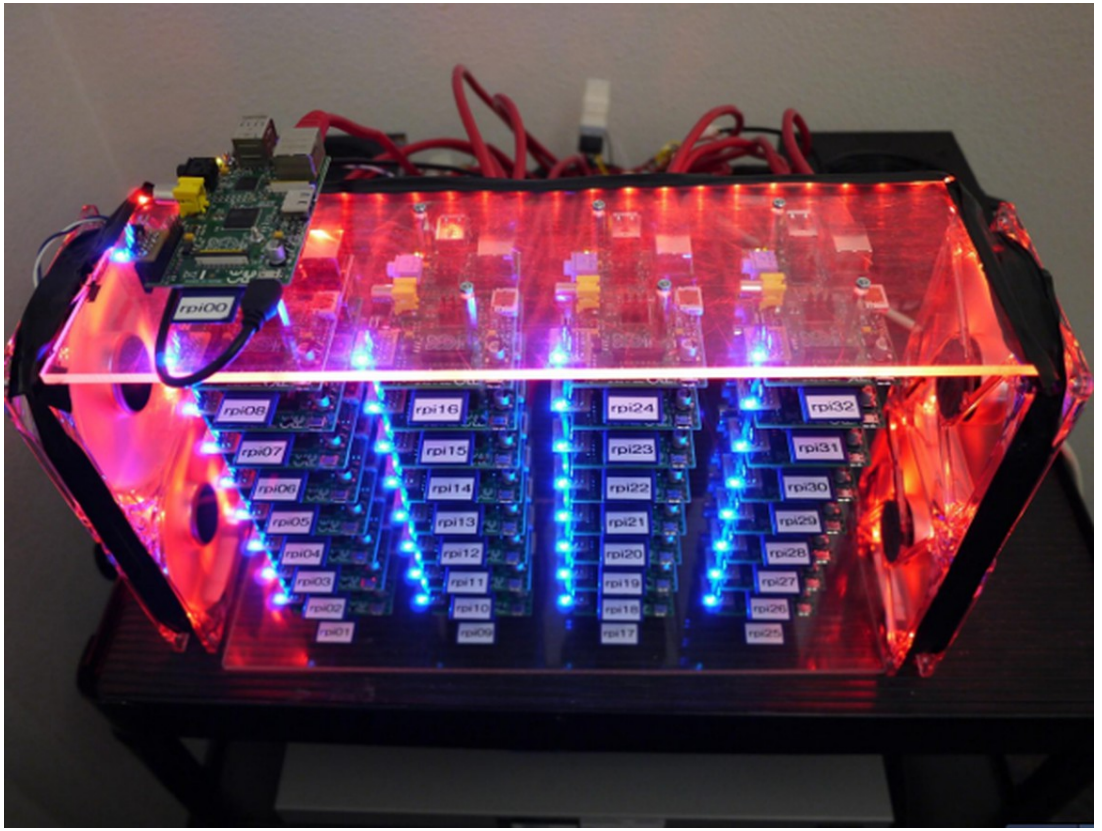
SRC:http://www.digitaltrends.com/computing/raspberry-pi-projects/

Some of the Applications...

RPi UAV

SRC:http://www.cnet.com/how-to/25-fun-things-to-do-with-a-raspberry-pi/

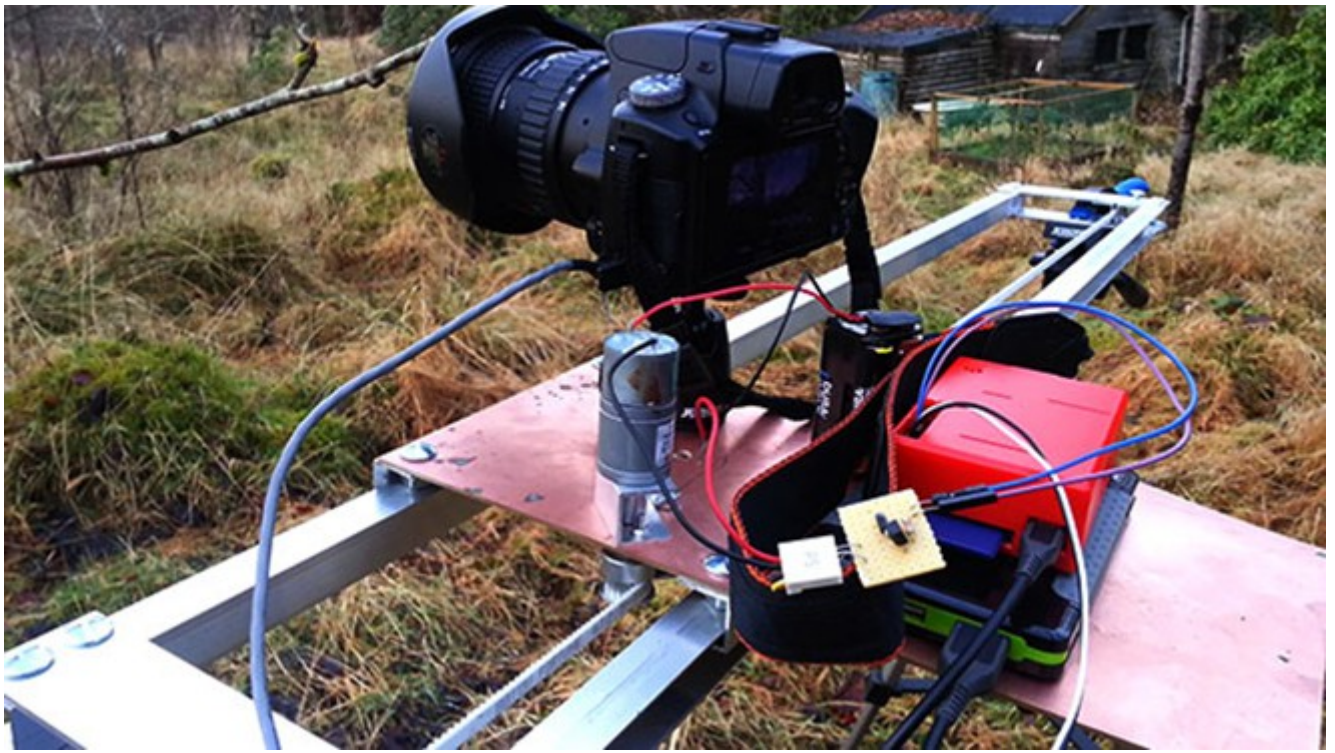
Some of the Applications...



Raspberry Pi Supercomputer

SRC:http://www.zdnet.com/pictures/six-clicks-insanely-great-raspberry-pi-devices-you-can-build-yourself/

Some of the Applications...



Raspberry Pi to Automate Time-Lapse Photos

SRC:http://lifehacker.com/5978871/ten-more-awesome-projects-for-your-raspberry-pi

Some of the Applications...

Raspberry Pi to monitor entire house

SRC:https://blog.adafruit.com/2014/12/12/connected-thermostat-uses-old-iphone-and-raspberry-pi-to-monitor-entire-house-piday-raspberrypi-raspberry_pi/

Some of the Applications...

Raspberry Pi in the sky

SRC:http://arstechnica.com/information-technology/2012/12/10-raspberry-pi-creations-that-show-how-amazing-the-tiny-pc-can-be/

Some of Our Projects...

Raspberry Pi based Location Tracker (2014)

Raspberry Pi based Wearable Device For Blind with Face Recognition & Face Tagging Facility (2015)

Raspberry Pi based Smart Door (2016) -- Sponsored by KSCST

Raspberry Pi based Car Driver Alert System (2016)

Raspberry Pi based UAV (MAVEN) (2016)

And Many More...!!