IoT Using Raspberry Pi

Dnyanraj Subhash Patil[1] Prof. G. Anandhi[2]
[1]Student [2]Professor
[1,2]Department of Master of Computer Application
[1,2]YMT College of Management

Abstract— The internet is one of the most important and transformative technologies ever invented. The internet is like a digital fabric that's woven into the lives of all of us in one way or another the internet of people change the world well there's a new internet is not just about connecting people it's about connecting things and so it's named the Internet of Things. IoT platforms that we can add the ability to sense, communicate, touch and control and there we can get an opportunity for things to interact and collaborate with other things. The Raspberry Pi hardware board is the platform are cheap, small, flexible and programmable hardware is powerful single board computer created by the not-for-profit. One of them, consider in this paper, is the Raspberry Pi essentially a small credit card sized PC. Comparative analysis of its performances and key elements with some of existing IoT model computer board platforms have shown advantages and some disadvantages. The Raspberry Pi remains a reasonably priced computer with it is very successfully usage in the diverse range of research applications in IoT vision.

Key words: Internet of Things, Raspberry Pi, Arduino, Phidgets, BeagleBone, Udoo

I. INTRODUCTION

The Internet of Things is changing much about the world we live in from the way we drive to how we make purchases and even how we get energy for our homes sophisticated sensors and chips are embedded in the physical things that surround us each transmitting valuable data that lets us better understand. How these things work and work together but how exactly do all these devices share such large quantities of data and how do we put that information to work whether we're improving the production of a factory giving city residents real-time updates on where to park our monitoring our personal health it's the common Internet of Things platform [5]. That brings this diverse information together and provides the common language for the devices and apps to communicate with each other process starts with the devices themselves which securely communicate with an Internet of Things [2]. IoT platform systems should allows being deployed new systems in parallel with existing systems. It allows an adequate level of interoperability so that innovative and applications can be developed and competitive cross-domain systems and allows being built new applications on the top of existing systems.

II. RASPBERRY PI AND OTHER IOT BOARDS

Raspberry from fruit name and pi from python Lang together makes raspberry pi [1]. The popular credit card size computer which is not only famous for its size and price but also works really well So you can buy this pi for as low and almost use it as fully functional computer by running several version of linux operation system. Few years back Broadcom joined hand with university of Cambridge to co-founded - Raspberry Pi foundation. And after few years this Raspberry Pi was born. Though, initially it was designed for kids to learn programming and for third-world countries can have access to cheap yet functional computer. Later when the geeks found about Raspberry Pi, they start doing all sought of cool projects with it and the rest is history. Raspberry Pi becomes a massive success. On the first day of sale, more than 100,000 Raspberry Pi units were sold apparently, more than 5 million units of Raspberry Pi has been sold worldwide. Giving a decent computing power to the latest version of raspberry pi. But it's not like raspberry pi is the only kid in the town there are other solid competitor for raspberry pi as well like the banana pi, orange pi , Arduino, Phidgets, BeagleBone, Udoo etc. Though each one of them are strength and their weakness but nothing's beat raspberry pi on online documentation and resources. This research is to present and describe advantages and disadvantages of Raspberry Pi and ability of its usage in the development of the next generation of IoT [1].

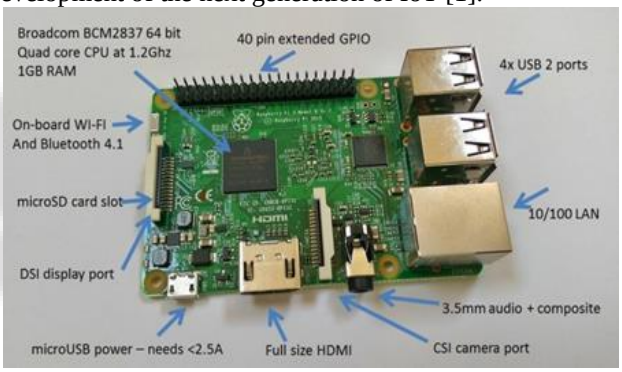

Fig. 1: The Raspberry Pi components
(http://goo.gl/HV96Nm)

The Development board for IOT so about software or the operating system of choice for the raspberry pi 3 is Linux have it isn't the only operating system available it can also run Windows 10 IOT core to look there are a plethora of different distribution available that it can run on your raspberry pi over there is an official one called Raspbian which is supported by the road with pi foundation and installing it really is a bridge it just download the zip file from the Raspberry Pi website to extract its contents onto an SD card and everything will be installed and we always talk about 64 bit processors it might think that the vote of Linux that comes with a raspberry pi 3 is in fact a 64-bit version well unfortunately, it isn't at the moment all of the major Linux distributions for the raspberry pi 3 are still 32bit [1].

Arduino – The Arduino Uno model the most widely distributed device the hardware itself is an open-source design and all of the components are off the shelf so what this means is that anyone can freely copy the design and sell their own clone or derivative product, in fact, we could put together your own Arduino just by purchasing all of the components individually. The Arduino is nothing unique but it's the combination of the hardware design the

software. The advent of microcontrollers making something complex with relatively few lines of computer code has become very easy. Arduino supports two operational modes, standalone and connected to devices via USB cable.

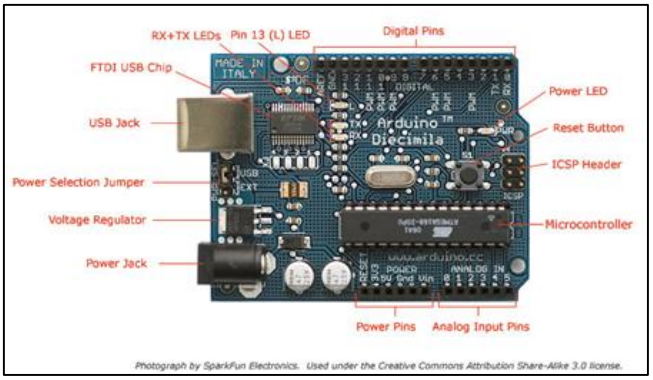

Fig. 3:Arduino components (https://goo.gl/KDkXsI)

BeagleBone Black – A single board computer based on less power Texas Instruments processors, using the ARM. Cortex A8 core (Fig 4). It is a small size (credit card size) computer which can run an operating system such as Linux and Android. The major difference between it and Arduino board is to support small OS to run, thereby practically converting it into a mini computer that can run programs on these OS. BeagleBone is designed to function is the difference and much higher level and also it processing capacity more than Arduino board.

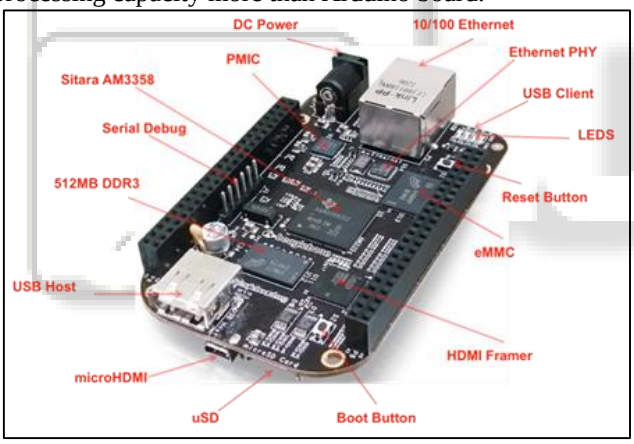

Fig. 4: BeagleBone Black components (http://goo.gl/weu9Kf)

Phidgets – Phidgets is a reliable board to control components, need some sensors for reading voltage or current, if we need to monitor temperature or if we want to incorporate a sound or touch sensor - Phidgets are here to help and can do so much more. Phidgets - derived from "Physical Widget" - are devices that interface computers and technology to the real world. With more than one hundred different sensors and more than twenty different controllers, we can use them in robots, simulators, interactive installations, measurement tools, monitoring devices, responsive automation systems, and pretty much any electronics project. The Falcon Robotics team in Phoenix Arizona built an autonomous underwater vehicle using Phidgets components as key sensors and controllers. Phidgets work with windows, iOS, Apple, Android and Linux and you can program Phidgets directly with a variety of popular programming languages like python, java, C++, visual basic.

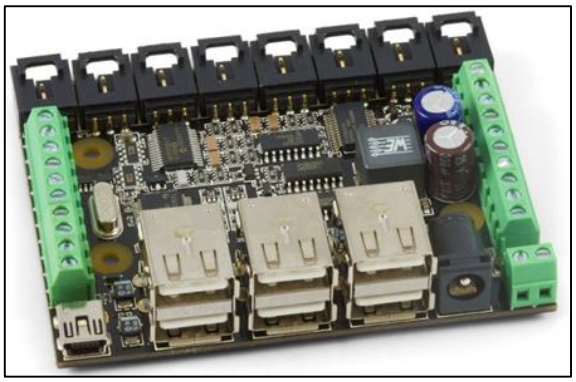

Fig. 5: Phidgets (http://goo.gl/87dQax)

Udoo - It is a powerful prototyping board for new engineers, designers, and software developers, give a boost to the do-it-yourself world. It allows for easy project development with a minimum knowledge of hardware. UDOO is an open hardware, low-cost platform equipped with an ARM i.MX6 Free scale processor and an Arduino Due compatible section based on ATMEL SAM3X8E ARM Cortex-M3 CPU. Udoo board(Fig 6) also provide communication ports Ethernet, USB, Wi-Fi, SATA, HDMI digital and analog input or output and a microcontroller with a standard pin out for fast prototyping applications.

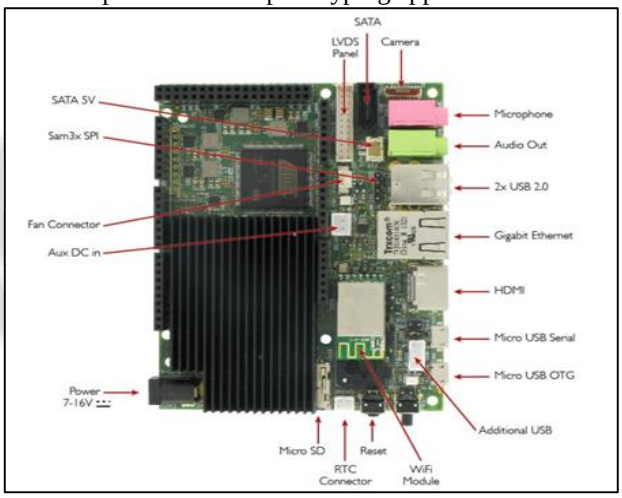

Fig. 6: Udoo board components (http://goo.gl/fQgFLp)

A. Size and Cost (Table 1)

In other words, used as sensor nodes, smaller components can be placed in more locations and used in more scenarios. On the other side, one of the main goals of every network is to collect data from as many locations as possible without exceeding fixed budget. A reduction in per-platform cost will result in the ability to purchase additional of them, to deploy a collection network with higher density, and to collect extra data. In the Table 1 give details for size, weight and cost of Raspberry Pi compared to above-mentioned prototype platforms [3].

Name	Size (mm)*	Weight (g)*	Cost (₹)*
Raspberry Pi 3	85.60 × 56.5	45	2700-3000
Arduino	75 x 53	~30	1000-1500
BeagleBone Black	86.3 x 53.3	39.68	3500-4000
Phidgets	81.3 x 53.3	60	5000-5500
Udoo	110 x 85	120-170	5500-6000

Table 1: Comparison of Platforms' Size, Weight and Cost
*(The smaller value is better)

B. Power and Memory (Table 2)

The main goal of wished-for platforms is low power consumption in order to meet the multiyear application requirements. Ultra-low-power operation can only be achieved by combining both low-power hardware components and low duty-cycle operation techniques [3].
The Raspberry Pi has 4 distinct power modes:

- The run mode - the CPU and all functionality of the ARM11 core are available and powered up.
- The standby mode – the CPU components that process instructions are shutdown although the power circuits on the core are still active.
- The shutdown mode - no power.
- The dormant mode - the core is powered down and every cache is left powered on.

Board	Processor	RAM*	Power
Raspberry Pi 3	4× ARM Cortex-A53, 1.2GHz	1GB DDR2	5V/ USB
Arduino	ATmega328P Microcon troller	16-32 KB	7-12V /USB
BeagleBone Black	AM335x 1GHz ARM® Cortex- A8	512 MB	5V
Phidgets	PhidgetSBC	64 MB	6-15V
Udoo (Quad)	4 x ARM® Cortex™-9 Core	1 GB	6-15V

Table 2: Comparison of Platforms' CPU, Memory And Power

C. Flexibility

The architecture must be flexible and adaptive in order to be used in wide range of applications. In addition for cost reasons it must make it easy to assemble just the right set of software and hardware components. Thus, these devices require an unusual degree of hardware and software modularity while simultaneously maintaining efficiency [4].

However, the strength of any device is its flexibility and universality. One of the main things about the Raspberry Pi 3 is that it is very flexible and there's no single way to use it. For example, it can be used for: general purpose computing, learning to program or integrate it with electronics projects. What enables a wide range of its usage are next core-components.

- Two USB 2.0 ports allow connecting peripherals and storage devices while one micro USB serve for the powering device.
- The 3.5mm analog audio jack allows connecting headphones and speakers to the Raspberry Pi what is especially useful for media player based projects and audio.
- Composite RCA port for attaching the yellow video cable from TV allows using TV as a monitor.
- The High Definition Multimedia Interface (HDMI) port allows the Raspberry Pi to be hooked up to high-definition.
- Support for DSI (Display Serial Interface) - Raspberry Pi can be expanded with the display.

Operating systems and Programming Languages (TABLE 3)

Regardless of the hierarchical approach each device, as part of Internet of things, still needs a program, and the most common approaches to programming each smart device, is to either program it using some form of operating system or to choose a higher level of abstraction. The operating systems vary from traditional operating systems in terms of goals and technique and each system differs substantially in the approach to memory protection, dynamic reprogramming, thread model, real-time features [4].

Board	Board operating system	Programming language
Raspberry Pi 3	Raspbian, Ubuntu, Android, ArchLinux, FreeBSD, Fedora, RISC OS	C, C++, Java, Phyton
Arduino	/	Arduino
BeagleBone Black	Linux Angstrom	Arduino
Phidgets	Linux	
Udoo	Ubuntu, Android, Linux, ArchLinux	Arduino, C, C++, Java

Table 3: Operating Systems And Programming Languages

III. RASPBERRY PI'S PERFORMANCE AND CONSTRAINTS

Raspberry pi advantages can be summarized as follows [2]:-

- The Raspberry Pi is a small independent computer that runs on the various distribution of Linux operating system and can be programmed as needed. It has a very large working memory(RAM memory)
- It has an expandable memory to store the data.
- Raspbian has a desktop environment similar to Windows and Mac called Lightweight X11 Desktop Environment (LXDE), so it provides an easy transition for those not familiar with Linux.
- It comes pre-installed with software useful for writing codes.
- The operating system has been tailored to run on the Raspberry Pi. The code compilation is optimized for on-chip floating-point calculations (hard-float) rather than a slower software-based method.
- There is wide spread community support for the operating system.
- It works on multi Operating Processor.
- It operates at speed from 700MHz to 1000MHz.
- It has support for USB 2.0 which allows its expansion with a large number of peripherals.
- Depending on the needs it is possible to expand the raspberry pi with wifi and Bluetooth adapters.
- Expansion and communication with network devices over a LAN adapter are possible.
- It can be expanded with various prototype shields (GSM/GPRS and GPS).
- C python or object oriented languages such as C++ and java can be used for programming.
- It can be powered from a battery or solar cell (5v).
- It can be run in server mode.
- Various web servers can be installed on the raspberry pi.

Based on the above mentioned it can be noted that for a small amount of money the raspberry pi comes with a lot of nice features.

The main disadvantage of raspberry pi is as follows:-

- It does not have a real-time clock (RTC).
- It does not have basic BIOS so it always boots from an SD card.
- It does not support Bluetooth or wifi but the support can be added from the USB dongles.
- Unfortunately, most of the Linux distributions are still a bit picky about their hardware, so it should be first checked whether the flavor of Linux supports a particular device.

IV. CONCLUSION

Raspberry pi's performance is compared with some popular boards. The size, overall cost & computing power is compared. Based on the analysis, it can be stated that Udoo has the best performance among other IoT hardware platforms, at the same time its price is quite high. On the other side of analysis Raspberry Pi has shown ultra-cheap computer board, also supports a large number of IO peripherals. Raspberry Pi brings the advantages of PC to the sensor network, what makes the perfect platform for interfacing with wide variety of external peripherals. Coupling it with WIFI and providing access to the internet it is possible to make a set up for remote communication, what the Raspberry Pi makes very suitable for applications in IoT concept. Even there are large differences between platforms in their use cases, power requirement, operation systems etc, it can be noted that all of them can be very successively applied to IoT.

REFERENCES

[1] Raspberry Pi Guide - Quick Start Guide for RaspberryPi (https://www.raspberrypi.org/help)
[2] Research Directions for the Internet of Things John A. Stankovic, Life Fellow, IEEE
[3] Raspberry Pi as Internet of Things hardware Mirjana Maksimovic and Vladimir Vujovic Conference Paper • June 2014
[4] Author name- Dhaval Chheda(computer dpt) V.E.S Institute of Technology Paper name-'smart projector using Remote Controlled Raspberry Pi
[5] Raspberry Pi Based Interactive Home Automation System through Internet of Things by Soundhar Ganesh and Venkatash.

