Internet of Things

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Abstract:
Internet Of Things is about connectivity, integration, and interfacing with *"THINGS"*. In this paper, we are proposing – The basic explanation, Its uses and applications, Future enhancements and, as we know, there are two sides of a coin, therefore, short fallings of Internet Of Things.

1.INTRODUCTION

Nowadays many companies are jumping for "Internet of Things". Even Indian Government came up with policy paper in their Ministry of Information Technology. By looking towards words, there are two words, one is "Internet" and other word is "Things". In simple way we can say "Internet of things" is to do operations(things) smartly using Internet. What are these operations, these operations can be any intelligent work which will induce smartness in the devices.

For example our home made "electric meters" ,now company person is coming at every bodies home to read your power consumption. If Electric meter started sending your electric consumption to directly to computer server (cloud server), we have saved so many man hours which we can use for other work or reduce work force so that electric companies can become more competitive.

We can see technical definition of "Things" also.

WHAT IS A THING?

The definition of a "Thing" in the Internet of based device. The capabilities of these embedded devices have been expanding at the speed of Moore's law.

Lets take look of component of IoT, Fig 1 shows some fine components of IoT infrastructure.

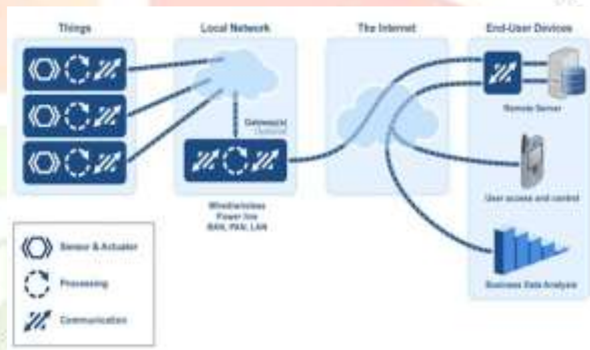

Fig : IoT from embedded point of view

"Things" of IoT are sensing or actuating, processing, or communicating. Things can be small device which can survive by own for many years. We should able to put this device in to Dam bridges or soil which will work for years and keep sending signals to the Gateway. This Gateway can support various technologies for communication. It is not necessary that Devices should send signals by wire signal, Device can use wireless, pinging, variety of ways. There should be more scope in the protocols to accommodate theses communicating technologies. Other best part of IoT is Local Networks.

WHAT ARE THE LOCAL NETWORKS?

As mentioned above, the value in IoT is in interconnected devices, and the data and

Things varies a lot. "Thing" as an embedded computing device (or embedded system) that transmits and receives information over a network for the purpose of controlling another device or interacting with a user. A Thing is also a microcontroller- or microprocessor number of different ways—in clothing, houses, buildings, campuses, factories.
For an installation of IoT devices in a specific location (say, a factory), a large number of sensors and actuators may be scattered over a wide area. A wireless technology is the best fit for such devices. There are as many types of edge/sensing node as there are system types, and some of these systems already have associated standards. This is why there are so many machine-to-machine (M2M) communication technologies in use. Industry is using CAN (Control Area Network), USB, I2C for communication. Whether this can be replaced by Internet technologies by putting de facto "TCP/IP" protocol in the devices? Slowly Wirelesssensor networks are becoming part of IoT because our sensor nodes are huge in number. Sensor nodes may be 1k, 10k, 100k in number. How to provide scaling for these kinds of operations?
Figure 2 shows the position of the nodes and edge nodes in a Wireless Sensor Network. A description of these devices follows below.

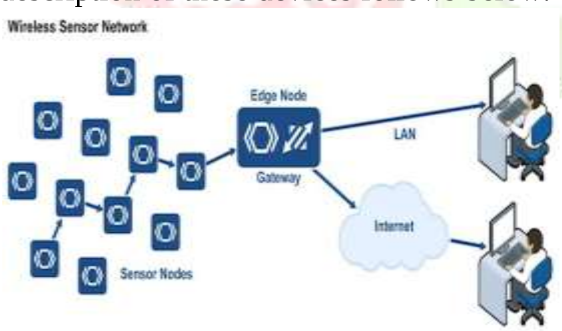

Fig 2 : Wireless sensor Network

WIRELESS SENSOR NETWORK WSN NODE

This type of embedded system will likely represent the largest product volume. A WSN node is an embedded system performing one, or a very few, functions (reading an environmental variable like temperature or pressure, turning on a light or a motor). WSN Nodes are very low cost, so they can be metadata they will generate. The choice of communication technology affects the amount of software required, which in turn affects hardware requirements and cost. Furthermore, IoT devices are deployed in such a huge numb Energy harvesting is a new technology which derives energy from external sources (e.g. solar power, thermal energy, wind energy, electromagnetic radiation, kinetic energy and more), captures and stores it for small, low power wireless autonomous devices, like the nodes on a WSN

WSN EDGE NODE:

A WSN edge node is a WSN node with IP connectivity. It acts as a gateway between the WSN and the IP network. It can also perform additional local processing, local storage, and can have a user interface.

WSN TECHNOLOGIES

The battle for the position of preferred networking protocol is far from over. There are multiple technologies. Initially, there were proprietary mesh networking stacks such as EmberZNet and TinyOS from Berkeley. But market growth required the use of standards-based solutions to allow for interoperability, and multiple sourcing for suppliers. The application protocols are the last element developed for mesh networking and wireless sensor networks (WSN). These efforts lead to emerging standards such as Zigbee, Z-Wave and Ant.
The first networking technology candidate for an IoT device is Wi-Fi, because it is so ubiquitous. Certainly, Wi-Fi can be a good solution for many applications. Almost every house that has Internet connectivity has a WiFi router. Any other device in the house can use this Wi-Fi access point, and it is IP capable. A good example is the thermostat by NEST Labs, (now part of Google) or garage door openers by Craftsman, Inc.
However, Wi-Fi needs a fair amount of power. In the "Thing" category, there are many devices that can't afford that level of power—battery operated devices, for example, or sensors positioned in locations that are difficult to power from the grid.
Newer networking technologies for wireless

deployed in very high volume. They are also very low power so that they can run on battery or even use energy harvesting.

technologies support the creation of very large networks of very small intelligent devices for sensing and collecting data. Currently, major R&D efforts are concentrated on:

- Low-power and efficient radios, allowing several years of battery life
- Energy harvesting as a power source for IoT devices, especially considering the new low power radios
- New reliable mesh networking and protocols for unattended long-term operation without human intervention (e.g., M2M networks)
- New standard application protocols and data formats, enabling autonomous operation

One of the major IoT enablers is the IEEE 802.15.4 radio standard, which was released in 2003. Commercial radios meeting this standard provide the basis for low-power systems. This IEEE standard was extended and improved in 2006 and in 2011 with the 15.4e and 15.4g amendments. Power consumption of commercial RF devices is now cut in half compared to only a few years ago, and we are expecting another 50% reduction with the next generation of devices.
EnOcean, for example, is one of the companies that have patented energy-harvesting wireless technology to meet the power consumption challenge. EnOcean's technology works in the frequencies of 868 MHz for Europe and 315 MHz for North America. The transmit range is up to 30 meters in buildings and up to 300 meters outdoors.
For a device to take advantage of energy-harvesting technology, the processor and the software running on the device must be able to perform their tasks in the shortest time possible, which means that the transmitted messages must be as short as possible. This requirement has implications for protocol design. And it is one of the reasons why 6LoWPAN (short for IPv6 over Low power Wireless Personal Area Networks) has been

sensor networks are pushing the development of low-cost, low-power solutions. These Cisco (ArchRock acquisition), as its encapsulation and header compression mechanisms allow for briefer transmission times.

Standard	IEE 802.15.4	Bluetooth	Wi-Fi
Frequency	868/915 MHZ, 2.4 GHZ	2.4 GHz	2.4, 5.8 GHz
Data rate	250 Kbps	723 Kbps	11 to 105 Mbps
Range	10 to 300 m	10 m	10 to 100 m
Power	Very Low	Low	High
Battery Operation	Alkaline (months to years)	Rechargeable (days to weeks)	Rechargeable (hours)

Table 1 Wireless Radio Technologies

There are many wireless networks available that are specialized for various industries. The following is a brief list:

- 6LoWPAN
- ZigBee and ZigBee IP
- ANT
- Z-Wave
- Bluetooth
- Wireless HART
- Wireless M-Bus
- ISA100
- DASH7

The connectivity requirements for IoT devices are so diverse that a wide range of different technologies are needed. One technology cannot meet all the range, power, size and cost requirements.

IP VERSION 6 — A GREAT IOT ENABLER:

If the system envisioned is local and M2M only, the wireless protocols discussed above are all good candidates. But if the goal is to remotely control a device over the Internet, or take the device's sensor data and store it on a remote server, the Internet Protocol (IP) must beinvolved. If the M2M network does not handle IP natively (or uses IP in a modified form), this can still be done using an intermediate gateway that translates the local protocol into an Internet-capable one.
Bluetooth Low Energy (BLE), are becoming de facto standards in certain vertical segments, such as the health care industry. But in the The requirements for IoT device

adopted by ARM (Sensinode acquisition) and fields of industrial control and automation, the battle for the preferred standard – between ZigBee, low-power Wi-Fi technologies, and 6LowPAN – has just begun.

If at all possible, it is crucial that local area networks (LANs), personal area networks (PANs) or body area networks (BANs) all make use of the suite of Internet Protocols (IP, UDP, TCP, SSL, HTTP, and so on).

The usefulness of IoT devices resides not only in local communication, but also in global communication. This means using the Internet, but not necessarily the Internet as we understand it today, with HTTP and browsers. Other protocols are being developed to better address the IoT needs. Furthermore, these networks must support IP version 6, as the current IP version 4 standard faces a global addressing limitation, as well as limited multicast support and poor global mobility. IPv6's addressing scheme provides more addresses than there are grains of sand on earth — some have calculated that it could be as high as 1030 addresses per person (Compare that number to the fact that there are 1028 atoms in a human body!) IPv6 was designed to never run out of IP addresses. With IPv6, it is much simpler for an IoT device to obtain a global IP address, which enables efficient peer-to-peer communication.

The importance of IP to the Internet of Things does not automatically mean that non-IP networks are useless. It just means that where such networking technologies are used, a gateway is required to reach the Internet. The gateway does the translation between the IP realm and the specific networking technology used by the IoT device. An example is the ZigBee IP gateway; ZigBee is a communications protocol for low-power devices, and cannot carry IP packets. However, in March 2013, the situation as changed when the ZigBee Alliance released ZigBee IP, which is an open standard for transmitting IPv6 over low power wireless personal area networks (6LoWPAN).

We can use Temboo website to transfer data from local sensor to User interface. Temboo is communication dictate the requirements for the device's software. Any one of the above-mentioned communication stacks, together with the application implemented in the device, represents a significant amount of software. The IoT device hardware design is greatly impacted by these choices.

The industry would prefer to build WSN nodes at the lowest possible cost, and to that end, a lot of work has been done to integrate the microcontroller and its peripherals onto a single chip. The software requirements put heavy demands on the microcontroller's flash memory and RAM. For the next few years, the cost of WSN nodes may still be slightly too high to allow for wide market penetration of these devices.

Internet of things is catching up with fast rate. Many big companies are spending money on that. Many companies are acquiring small companies. This is first technology where Electronics Engineer can jump and start coding. Before that Electronics engineer must know Data structure in C and deep C programming and some cloud services which can be catch fast by Googling.

How to use Arduino Yun for IoT design?

We can use IoT for medical field. We can keep watch of blood pressure, weight, heartbeat, blood sugar. We can putthese parameters continuously on Internet. This is becoming Internet- ICU.

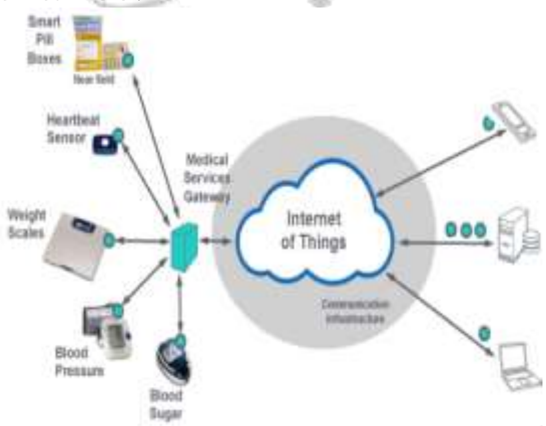

Fig :IoT in medical field

Arduino Microprocessor

Processor	Atheros AR9331

providing cloud platform to upload parameters.

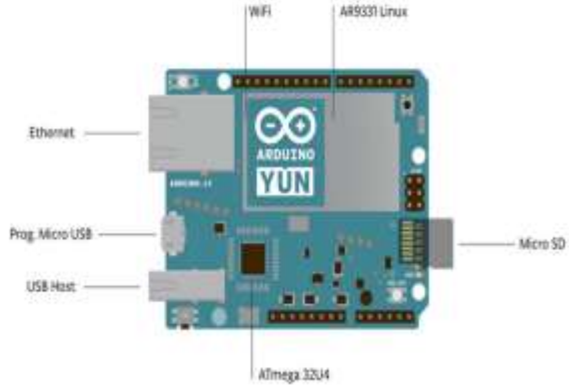

Fig : Arduino YUN board for IoT work

TECHNICAL SPECS OF YUN BOARD

Because the Yún has two processors, this section shows the characteristics of each one in two separate tables.

AVR ARDUINO MICROCONTROLLER

Microcontroller	ATmega32U4
Operating Voltage	5V
Input Voltage	5V
Digital I/O Pins	20
PWM Output	7
Analog I/O Pins	12
DC Current per I/O Pin	40 mA on I/O Pins; 50 mA on 3,3 Pin
Flash Memory	32 KB (of which 4 KB used by bootloader)
SRAM	2.5 KB
EEPROM	1 KB
Clock Speed	16 MHz

REFERENCE

- Dr. John Barrett TEDxCIT , TEDx Talks
- How it works: IBM Thinks Academy
- Intel IoT : Intel

Architecture	MIPS
Operating Voltage	3.3V
Ethernet	802.3 10/100Mbit/s
WiFi	802.11b/g/n 2.4 GHz
USB Type	2.0 Host
Card Reader	Micro-SD
RAM	64 MB DDR2
Flash Memory	16 MB
SRAM	2.5 KB
EEPROM	1 KB
Clock Speed	400 MHz

Fig : Block Diagram of Arduino YUN Board

Conclusion:

IoT promises far-reaching payoffs for logistics operators and their business customers and end consumers. These benefits extend across the entire logistics value chain, including warehousing operations, freight transportation, and last-mile delivery. And they impact areas such as operational efficiency, safety and security, customer experience, and new business models. With IoT, we can begin to tackle difficult operational and business questions in exciting new ways.

- Swimming with sharks : TEDx Talks
- DIKW wikepedia,TEDxCIT.
- Dr.John Barrett, Head of Academic Studies at Nimbus Centre of Embedded system Research, CIT
- QAI worldwide
- AIDC Automatic Identification and Data Control
- IDTechx
- Utopian Thought in the Western World (1979), by Frank Manuel &Fritzie Manuel. Oxford: Blackwell.
- Roth, Mitchel P (2006), Prisons and prison systems : a global encyclopedia, Greenwood, p. 33
- "The Open Market Internet Index". Treese.org. 1995-11-11. Retrieved 2013-06-15.
- "World Stats". Internet World Stats. Miniwatts Marketing Group. 30 June 2012.
- "The 8th continent needs a bill of rights". The Hive Reporters.
- "Smart devices to get security tune-up". *BBC News*