A critical review on IoT-Big Challenges and Applications

Rashmi Gupta
Assistant Professor
Computer Science & Engineering
Amity University Haryana, Gurugram, India

Abstract : ***In the current era, our lives have started to become more and more dependent on embedded system, digital information technology that is embedded in our environment. This paper presents IOT applications and their challenges. Among various applications, this paper focused on home automation system, agriculture system and ICU Patient Monitoring System. IOT (Internet of Things) based ICU (Intensive Care Unit) patient monitoring system is a system, which measures the patient blood pressure, heart beat rate and temperature constantly that is admit in ICU room.***

IndexTerms - Microcontroller, IOT (Internet of Things), Smart home, Relay, PIR sensor

---

1. Introduction

The spectrum of medical devices ranges from simple stand-alone devices such as blood sugar meters, which function completely independently of other systems, right up to complex devices such as magnetic resonance imaging (MRI) systems and ventilators. If we look deeper into the applications of the embedded system, we will find out that in almost every field of life, embedded systems are used. Embedded systems are becoming of great interest in the medical field. Basically, embedded systems were introduced in this field to cater with medical issues that necessitated monitoring and maintenance frequently in a day. Patients that are hospitalized needs constant attention that can happen using medical embedded technologies. The sensors retrieve data regarding patient's health, such as its heartbeat and then these signals are sent wirelessly to the doctors for scrutiny. Medical devices nowadays lean greatly on sensors as they provide aid in monitoring, diagnosing and treating the medical health of the patient.

2. Applications

1) **Home automation** using internet also increasing the building automation which helps us an easier and safer life. The automation can be used in home, office, school, or in colleges also. [1]

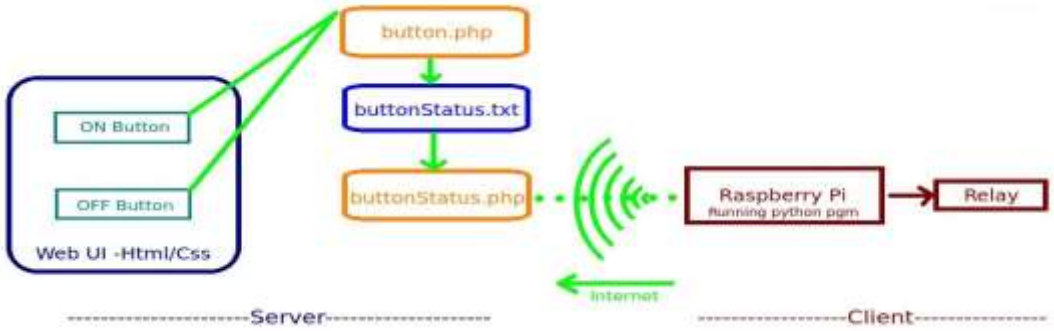

Figure 1: Block diagram of Home Automation using IoT [2-3]

We can control lighting, heating, ventilation, conditioning, locks for security purpose etc. It increases the comfort, flexibility, security, convenience. IoT for home automation include two part server and client. Server part includes the user interface coded in HTML language. Client includes the microprocessor like arduino, raspberry pi etc. server and client communicates using internet.

2) Agriculture

The IoT contributes fundamentally towards advancing cultivating techniques. Cultivating challenges caused by populace development and environmental change have made it one of the principal enterprises to use the IoT. The reconciliation of remote sensors with rural portable applications and cloud stages helps in gathering imperative data relating to the natural conditions – temperature, precipitation, humidity, wind speed, pest infestation, soil humus substance or supplements, other than others – connected with a farmland, can be utilized to enhance and mechanize cultivating procedures, take educated choices to enhance quality and amount, and limit dangers and wastes. The application based field or product observing likewise brings down the issues of overseeing crops at numerous areas. For instance, farmers would now be able to recognize which regions have been treated (or mistakenly missed), if the land is excessively dry and anticipate future yields [4].

3) IOT based ICU patient monitoring system

It measures the patient blood pressure, heart beat rate and temperature constantly who is admit in ICU room. After measuring, this system also sends this data to dedicated website through IOT system, where every respective doctor could easily see their respective patient data all the time from any place.

This IOT based ICU patient monitoring system works on the principle of monitoring patient body temperature and blood pressure. When this system is installed in ICU room then blood pressure device cuff is inflated permanently around the patient arm or wrist and temperature sensor is also attached with patient body. Temperature sensor is the resistance base sensor whose resistance is changed by changing the patient body temperature; similarly the blood pressure sensor is the oscillation or vibration base sensor whose value is transduced into electrical signal. When blood oscillation or vibration is changed then this electrical signal value is changed. Both sensors measurements values are received by the controller which is the main or intelligent controller of this whole system. After receiving these values, the microcontroller displays these values on LCD display as well as these values are also send toward IOT system using programmed

algorithms. The IOT system which consists of Wi-Fi module, which displays these values on doctors dedicated website using Wi-Fi sources and here for this purpose Gecko website, has been used. Using this website, the doctor's society can easily know the blood pressure and temperature of their respective patient any time form anywhere [5-7]

3.Challenges

1.Security

Security is an essential pillar of the Internet and one that ISOC perceives to be equally essential and 'the' most significant challenge for the IoT. Increasing the number of connected devices increases the opportunity to exploit security vulnerabilities, as do poorly designed devices, which can expose user data to theft by leaving data streams inadequately protected and in some cases people's health and safety (implanted, Internet-enabled medical devices and hackable cars) can be put at risk. Many IoT deployments will also consist of collections of identical or near identical devices. This homogeneity magnifies the potential impact of any single security vulnerability by the sheer number of devices that all have the same characteristics.To deal with these and many other unique challenges, a collaborative approach to security will be needed, a sentiment that APNIC's security specialist Adli Wahid often blogs about. For many users, they will ultimately need to consider the cost vs. security trade-offs associated with mass-scale deployment of IoT devices [8].

2. Privacy

The IoT creates unique challenges to privacy, many that go beyond the data privacy issues that currently exist. Much of this stems from integrating devices into our environments without us consciously using them.This is becoming more prevalent in consumer devices, such as tracking devices for phones and cars as well as smart televisions. In terms of the latter, voice recognition or vision features are being integrated that can continuously listen to conversations or watch for activity and selectively transmit that data to a cloud service for processing, which sometimes includes a third party. The collection of this information exposes legal and regulatory challenges facing data protection and privacy law.In addition, many IoT scenarios involve device deployments and data collection activities with multinational or global scope that cross social and cultural boundaries. In order to realize the opportunities of the IoT, the ISOC whitepaper suggests that strategies will need to be developed to respect individual privacy choices across a broad spectrum of expectations, while still fostering innovation in new technologies and services [8].

3.Standards

Lack of standards and documented best practices have a greater impact than just limiting the potential of IoT devices. As APNIC's Geoff Huston has pointed out previously, absence of standards can enable stupid behaviour by IoT devices. Without standards to guide manufacturers, developers sometimes design products that operate in disruptive ways on the Internet without much regard to their impact. If poorly designed and configured, such devices can have negative consequences for the networking resources they connect to and the broader Internet.A lot of this comes down to cost constraints and the need to develop a product for release quicker than competitors.Add to this the difficulties with managing and configuring larger numbers of IoT devices, the need for thoughtful design and standardization of configuration tools, methods, and interfaces, coupled with the adoption of IPv6, will be essential in the future [9].

4. Regulations

Like privacy, there are a wide range of regulatory and legal questions surrounding the IoT, which need thoughtful consideration. Legal issues with IoT devices include cross border data flow; conflict between law enforcement surveillance and civil rights; data retention and destruction policies; and legal liability for unintended uses, security breaches or privacy lapses. Further, technology is advancing much more rapidly than the associated policy and regulatory environments. Regulatory analysis of IoT devices is increasingly being viewed from a general, technology-neutral perspective legal lens, which seeks to prevent unfair or deceptive practices against consumers [9].

Conclusion

With the decrement in size and increment in processing power, small devices with the embedded system are capable of collecting patient data and making control decisions that may help in providing patients with better treatments and medications. In short, this system is replacing the need for having doctor to visit the patient and examine his symptoms. This has been a great advancement in the medical field in which not only the quality of the healthcare is augmented but the cost of medical management is also diminished with these programmed automatic technologies introduced. These challenges should be minimized to make the IoT System effective.

References

[1] Home Automation System via Bluetooth Home Network", 2003, SICE Annual Conference, Fukui, Vol. 3, pp. 2824 - 2829.

[2] Baki Koyuncu, "PC Remote Control of Appliances by Using Telephone Lines", 1995, IEEE Transactions on Consumer Electronics, Vol. 41(1), pp. 201-209

[3] Eddie M C Wong, "A Phone Based Remote Controller for Home and Office Automation", 1994, IEEE Transactions on Consumer Electronics, Vol. 40(1), pp. 28-34.

[4] "Connected Crops By Root Info Solutions Heralds The Era Of Smart Farming". Times Internet Ltd. Retrieved 27 June 2017.

[5] http://microcontrollerslab.com/embedded-systems-medical-applications/

[6] L. A., Drake, J. C. Rutledge, and J. Cohen, "Wavelet analysis in recruitment of loudness compensation", IEEE Transaction on Signal Processing, vol.41, pp.3306 – 3312,1993.

[7] British Society of Audiology (2011), Pure tone air and bone conduction threshold audiometry with and without masking and determination of uncomfortable loudness levels,2011.

[8] M. P., "Computers to accquire control of the physical world," Gartner Research Report, 2001.

[9] M. Shane, "The Internet of Everything for Cities: Connecting People, Process, Data, and Things To Improve the 'Livability' of Cities and Communities," Cisco Systems, 10 July 2014.