Comparative analysis of Internet of Things Techniques

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Abstract
With the growing boom of IoT now a days. IoT systems is responsible for not only sensing things but also able to monitor specific users' behavior in different real time applications like tracking system. IoT can be explored to different synergetic activities conducted in different fields such as social, healthcare and agriculture. The main objective of this paper is to provide comparative analysis of the most relevant protocols, technologies and application of IoT which will enable researchers and application developers to develop application in emerging trends on IoT. The various paradigm of Internet of Things are analyzed and enabling technologies reviewed thoroughly.

Keywords
Internet of Things, Pervasive computing, Cloud computing, MQTT, AMQP, Raspberry pi, Arduino Uno, Artificial Neural Network, Big data, DNS, Machine learning, Star topology.

Introduction:

With the growing urge to make smart world, IoT becomes talk of town. Motivated towards smart world Internet of Things (IoT) connects everything in the smart world. Internet of Things (IoT) provides ability to sense and collect data from devices, and then share it through Internet where it can be refined, analyzed and utilized for various real time applications. The IoT includes smart machines which are interacting and communicating with other machines, objects, environments and infrastructures through internet. IoT applications provide real time responses and therefore it can deal with real time application. Considering the example of smart homes one might want to receive timely alert about the gas reaches below some threshold value. With the growth of internet in today's era IoT will be helpful to solve many problems and so it is gaining popularity day by day. Through IoT we can communicate between

sensor and actuator, Actuator and sensor are the input and output interfacing of controller or processor. Basically internet of things is a collaboration of hardware and software .The hardware can consist of sensor, actuator, relay, zigbee, RFID, Bluetooth, GPRS,

controller, processor and software may comprise of some protocols in IoT such as Message queue telemetry transport (MQTT), Advance message queue protocols, TCP/IP, LORA technology etc.

Sr.No	Title	Author	Year of publications	Technique	Accuracy	Advantages	Limitations
1	Intelligent traffic information system based on integration of internet of things and agent technology	Hasan Omar Al- Sakran	2015	• Wireless Sensor Network. • Infra Red Sensor. • Global positioning system. • Active RF-ID tags. • Cloud Computing.	Medium	• It is automatic traffic system that's why less time consuming. • No manual intervention.	• This system is valid only in ideal conditions; practically result is not very good.
2	Home automation using Internet of Things	Vinay sagar K N, Kusuma S M	2015	• Internet of Things. • Cloud networking. • Wi-Fi. • Intel Galileo Microcontroller.	Medium	• Automatically operated electronic devices using Wi–Fi. • Free from electrically shocks.	• Limited range of communications because of Wi-Fi. • Need static IP address. • Always need to type URL in web browser. • System cost is very high.
3	Environment monitoring system based on wireless sensor networks using open source	Venkatesh Neelapala, Dr. S. Malarvizhi	2015	• Zigbee • Wireless sensor Network • Arduino Uno. • Raspberry pi. • Apache server. • Mysql database.	Low	• Monitor wireless data. • All hardware is open source. • Open source software packages are	• This system is compatible only FTP server. • Need static IP address.

	hardware.					available.	
4	Research directions for the Internet of Things.	John A. Stankovic.	2014	• Internet of Things. • Mobile Computing. • Pervasive computing • Wireless Sensor Network. • Cyber Physical System. • Machine learning.	Medium	• Massive scaling architecture, big data is explained. • Architecture and dependencies. • Creating knowledge and big data. • Robustness. • Openness. • Security. • Privacy and humans in the loop.	• Not practical oriented only theoretically approach.
5	Review on IOT Technologies.	Govinda K, Saravanaguru R. A. K	2016	• Internet of Things. • RF-ID. • Actuator. • Wireless Sensor Network.	Medium	• Core architecture of Internet of Things has been given.	• Not practical oriented
6	Green IOT Agriculture and Healthcare Applications (GAHA)	Chandra Sukanya Nandyala, Haeng-Kon Kim	2016	• Internet of Things. • Cloud Computing. • Sensor Cloud.	Medium	• Users can easily access required sensory data from cloud anytime and anywhere if there is network. • The sensor- Cloud infrastructure is a cost effective approach.	• Broker is essential to execute this system.

7	Smart hospital using Internet of Things (IOT)	Pooja Kanase, Sneha Gaikwad	2016	• Internet of Things. • Arduino Uno. • Ultra sonic sensors (HC-SR04). • Temperature sensor. • Message queue telemetry transport protocols.	Low	• It assure data transmission and efficient distribution. • No manual intervention. • Power consumption is less.	• Data transmission is not secure over the internet. • Trigger is required.
8	RF based node location and mobility tracking in IOT	J. Ann Roseela, Dr. S. Ravi, Dr. M. Anand	2016	• RF server. • Received signal strength indicator. • Wireless Sensor Network. • Arduino Uno. • Artificial Neural Network.	low	• Proved by using mathematical model.	• When IOT nodes going far away from RF server, then signal strength become weak, not able to achieve good communication due to interference. • Given path of IOT node is static we cannot change once system install.
9	Challenges in IOT Networking via TCP/IP Architecture.	Wentao Shang, Yingdi Yu, Ralph Droms, Lixia Zhang	2016	• Internet of Things. • TCP/IP. • Network architecture.	medium	• The challenges of applying TCP/IP to IOT network that arise from the network and transport layers. • Direction, how to use application layer protocols.	• Not practical oriented only theoretically approach.
10	Devlopment of	T.	2016	• Advance Risk Machine 7.	low	• It provide advantages	• Data transmission rate

	ARM& based sensor interface for industrial wireless sensor network (WSN) in IOT environment.	Balakrishna, R. Naga Swetha		• Wireless Sensor Network. • GPRS module. • ZIGBEE wireless technology.		in deployment, cost, size and distributed intelligence when compared with wired network. • Allow users to set up a network quickly.	is low as compare to other. • Limited communication range of nodes (i.e 100 feet).
11	Smart city implementation model based on IOT technology	Jaehak Byun, Sooyeop Kim, Jaehun Sa, Sangphil Kim, Yong-Tae Shin, Jong Bae Kim	2016	• Network Architecture. • Wireless Senor Network. • Internet of Things	low	• It is automatic traffic system that's why less time consuming. • Cashless transaction.	• Practical oriented results not available.
12	Internet of Things: A survey on enabling Technologies, Protocols and Applications	Ala Al-Fuqaha, Mohsen Guizani, Mehdi Mohammadi, Mohammed Aledhari, Moussa Ayyash	2015	• RF-ID. • Smart Sensor. • Internet Protocols. • Big data analytics. • Message queue telemetry transport. • Advance message queue protocol. • Cloud Computing.	High	• Address the research and practical gaps. • It presents the need for better horizontal integration among IOT services. • Addressing the IOT objects is critical to differentiate between object ID and it's	• For Message queue telemetry transport and Advance message queue protocols broker is third party.

				• Domain Name Server.		address. • IOT divided into Identity related services, information aggregation, collaboration aware services and ubiquitous services.	
13	Advanced Message Queuing Protocol	Steve Vinoski	2006	• Synchronous messaging. • Internet Inter ORB protocol. • Remote method innovation.	low	• The AMQP implementation is the open source Qpid project, which is currently a poding project under apache software. • Water fall approach is used.	• AMQP implantation must obey to be interoperable with other implementation. • Always fallow First In First Out order.
14	An Ingestion and analytics architecture for IOT applied to Smart city use cases	Paula Tashma, Adanan Akbar, Guy Gerson, Guy Hadash, Francois Carrez, Klaus Moessner	2017	• Big data. • Complex event processing. • Context aware. • Energy management. • Internet of things. • Machine learning.	medium	• It allow data to be captured and ingested autonomously avoiding the human data entry bottleneck. • System is flexible with respect to the choice of specific analysis algorithm. • Support real time problems of	• Message broker is essential.

						transportation and energy management.	
15	Performance and interoperability evaluation of radio frequency home automation protocols and Bluetooth low energy for smart grid and smart home applications.	S. Courrege, S. Oudji, V. Meghdadi, C. Brauers. R. Kays.	2016	• Radio frequency. • Zigbee. • Bluettoth. • Linky e-meter.	high	• It allows powering the system either by a combination of batteries and AC main power or by batteries only. • Simulated practical results.	• Limited range between e- meter and radio frequency box. • Low data speed.
16	Realisation of a smart plug device based on Wi-Fi technology for use in home automation systems.	Sava jakovljev, Milos subotic, Istvan papp	2017	• TCP/IP. • Microcontroller. • Star topology. • Bluetooth. • Message Queue Telemetry Transport.	high	• Practically proved, communication time latency of Wi-Fi devices is less than zigbee devices. • High security and high data rate (11Mbps). • Practical results are given based on response time.	• Maximum 30 devices communicate at a time to system. • Communication range is limited (10 to 30 meter).
17	Evaluating publish/	Trude H. Bloebaum,	2015	• Web services. • Publish/Subscribe.	Medium	• Addressing performance of the	• AMQP exhibited large delay due to poor

	subscribe approaches for use in tactical broadband	Frank T. Johsen		• Service oriented architecture.		MQTT, WS notifications, and AMQP protocols. • Determined publish/ subscribe approach could used in the tactical broadband.	networking connections and correspondingly high packet loss.
18	The implementation of smart electronic locking system based on Z – wave and internet.	Ching chuan wei, Yan ming chen, Chao chieh chang , chi han yu	2015	• Z-wave. • Raspberry pi. • Domain name service. • Remote control.	Low	• Low power consumption. • No need of static IP address. • It is wireless lock system.	• Communication range of system is limited to local area network.
19	Cost analysis of smart lighting solutions for smart cities.	Giuseppe Cacciatore, Claudio Fiandrino, Dzymitry Kliazovich, Fabrizio Granelli, Pascal Bouvry	2017	• Heuristics. • Internet of Things. • Lampposts.	Medium	• Dimming light intensity in absence of users in the vicinity. • Smart lighting solution can significantly decrease energy costs of street lighting municipalities.	• The street lighting solutions practically implanted in cities are not energy efficient.
20	Improving home automation security;		2016	• Identity management system. • Fingerprint. • JavaScript.	High (97.93%)	• Highlights security issue associated with home automation. • Good security	• Number of client and devices (mobiles) are fixed.

	Integrating device fingerprinting into smart home.			• Access control.		because of firewall is used.	
21	Practical lessons from the deployment and management of a smart city Internet of Things infrastructure: The smart Santander testbed case	Pablo Sotres, Juan Ramon Santana, Luis Sanchesz, Jorge Lanza	2017	• Wireless Sensor Network. • Near field communication. • LORA Technology. • Internet of Things.	High	• It presents practical solution to the main challenges faced during the deployment and management of city scale IoT infrastructure. • Addressing different functionalities within smart city: Security, Resource subsystem, Information subsystem.	• The amount of information that can be sent to the air by battery- powered devices is not only limited by bandwidth, but is also limited by the battery capacity.
22	Network – based fire detection system via controller area network for smart home automation.	Kyunf chang lee, Hong hee lee	2004	• Control Area Network. • Internet of Things. • Gateway.	High	• Response time is very small in microsecond (10-100us).	• A weakness to noise of various form including impulses or short circuit and a lack of awareness of the actual location of a fire.

Proposed system:

Using Internet of Things we can control any electronic devices over the world. As in detailed we have explained our proposed system .

Beagle Bone Black: Beagle bone black is a minicomputer and heart of the system. In BBB there is ARM processor which has 2GB on board flash memory. Beagle bone black support Linux operating system. There are total 92 GPIO pins available for input output operation. Beagle bone black has its own cloud for server application. BBB has on chip ADC and DAC.BBB is one of the best controlling units in embedded system . BBB is acting as a server in IoT. It has an Ethernet port. The interfacing of the Ethernet cable is very easy to use. When we connect an Ethernet cable to BBB then it will automatically connected to the internet, but for Wi-Fi connection there is some configuration is required.

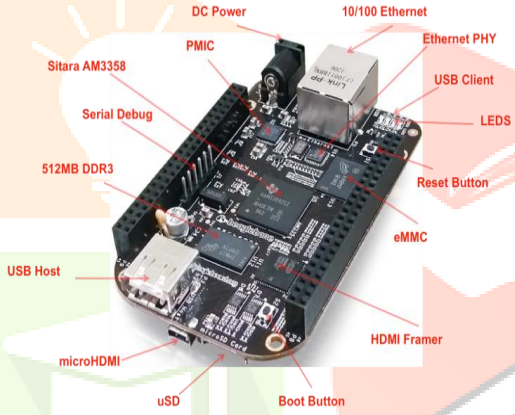

Figure 1. Beagle Bone Black [25]

Smart phone: This is client side remote access. In smart phone, first you have to install application software, which is developed in Java language. In application there are different radio buttons available for different operation Like ON/OFF. When ON radio button is pressed then high signal is send to the cloud using internet. Then cloud is connected to the server using the same.

Server: In our system Beagle Bone Block is a server which can control all the operation of our systems. When sending high signal from client mobile to the server, then BBB can receive that high signal in the form of 3.3V. The BBB analyzes this data and decide which operation is to be performed. Suppose at client side user has pressed ON radio button, then high signal is getting on server side with the help of internet. BBB sets the GPIO pins and send it relay circuit.

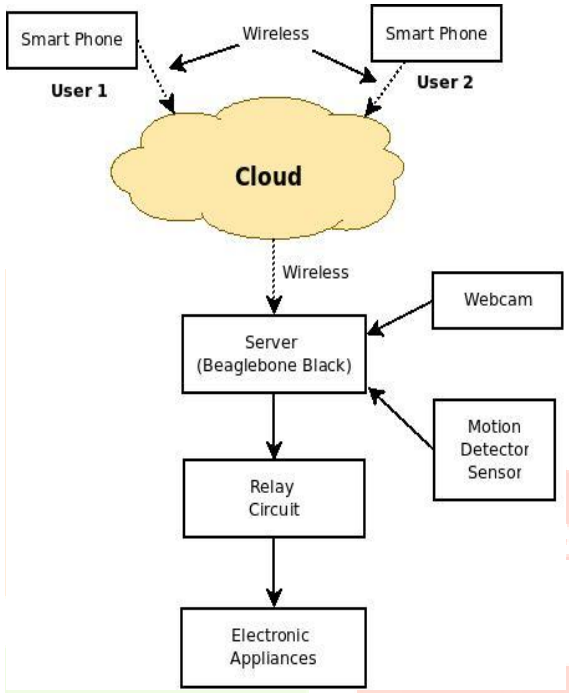

Figure 2. Proposed system.

Relay circuit. It is an electronic component and acts as a switch. The principle of relay is based on right hand thumb rules. According to right hand thumb rule, folded finger indicate the direction of the magnetic field and thumb indicates the direction of current.

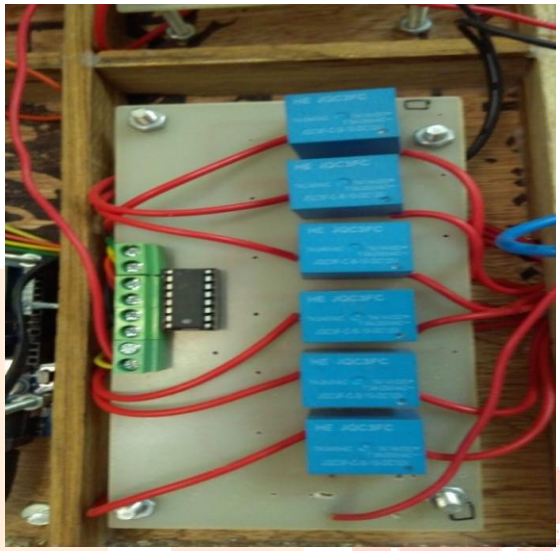

Fig. Relay circuit

Conclusion:

There are many different protocol are available in Internet of Things. Thus, we have studied few of them as namely message queue telemetry transport protocol. It is light weighted protocol same as _le transfer protocols but there are some problem regarding to security. This problem is overcome by protocol, message queue telemetry transport security protocol. In that some security is provided in such way that third party will not able to see the data. It is advance version of message queue telemetry transport protocol. In that data is transfer in the form of character and receiver side they will compare and perform defined operation. Another protocol is Advance message queue protocol. The data transfer in MQTT and MQTTs is in the form of character we cannot send string over the protocol. In AMQP we have studied that we can send string over the internet using these protocols. The main issue of Internet of Things is that security. Now currently we have to focus on security.

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