JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Internet of Things (IoT) – an Overview of its Characteristics and Applications

Dr.M.Thilagavathi
Assistant Professor, Department of Computer Science, Shree Raghavendra Arts and Science College, Keezhamoongiladi, Chidambaram

Abstract

IoT plays a vital role in technology discussions due to its rapid growth. The computing devices embedded in our everyday objects are interconnected through internet to enable them to send and receive data. Huge investments are made by many organizations after realizing the potential growth of IoT. The IoT enabled things could be sensed easily while controlling them through remote access and improves accuracy and efficiency with minimum human intervention. This paper aims at giving an awareness about the characteristics, software and hardware selection and usage of IoT.

Keywords : IoT applications, characteristics, Heartbeat Sensor, Ultrasonic Sound Sensor, Gas Sensor, Gyro Sensor.

I. Introduction

Data is everywhere and everything. The data is analysed and a meaningful action is generated and triggered subsequently through the interchange of data with the help of IoT. The scope of IoT is not just limited to the connection of devices through network but more than that in the exchange of required information among the devices to obtain the purposeful result. IoT is a combination of several technologies and knowledge. The raw data has to be combined accurately by incorporating technological parameters to get accurate results. The interpretation holds value only if the data received from the sensors are understood properly and should know where to use and how to use. Otherwise it is futile.

Application of IoT to achieve smart cities would be achieved using radio frequency identification and sensors. A lot of benefits that IoT application offers in the healthcare sector is categorized into tracking of patients, staff and objects, identifying, as well as authenticating individuals and the automatic gathering of data and sensing [1]. MEMS are an enabling technology for the IoT in view of the MEMS manufacturing makes possible small, affordable, high level performance actuators and sensors. The MEMS sensors on the other hand, especially when coupled with huge information processing power, do not get overwhelmed and can incessantly at the same time monitor a very huge number of important parameters of interest in the

environment without distress sensory overload circumstances [2]. This makes for a protected, more productive and pleasing environment.

In [3] connectivity empowers Internet of Things by bringing together everyday objects. Connectivity of these objects is pivotal because simple object level interactions contribute towards collective intelligence in IoT network. It enables network accessibility and compatibility in the things. The environmental monitoring applications of the IoT typically use sensors to assist in environmental protection by monitoring the atmospheric situations like monitoring the movements of wildlife and their habitats [9].

II. Characteristics of IoT

1. **Architecture :** The architecture of IoT is heterogeneous in nature. It supports different manufacturer's products. Hence it should be hybrid.
2. **Connectivity :** Nothing makes sense without connection. All time connectivity should be guaranteed. IoT things should be connected to the IoT infrastructure.
3. **Scalability :** The devices connected in the IoT network is increasing day by day. Hence handling of such a massive expansion is a challenging work and the IoT setup should be capable of doing it.
4. **Intelligence and identity :** It is important to extract the knowledge from the collected data. The data generated by the sensors should be interpreted properly. Then only it will be useful for further processing. The devices connected in the IoT network should be identified uniquely with IP address. Such identification helps in tracking system.
5. **Dynamic and self-adapting :** Dynamic adaption is required for IoT devices in the changing scenarios. For example the surveillance camera should be capable of working at different locations and lightings.
6. **Safety :** Data security is a major challenge. It is danger and cause loss if the personal details of the user are compromised when their devices are connected to the internet. Also the equipment used in the network may also in risk.

The objects around us in our day to day life is connected altogether as a network in IoT as shown in Fig.1.

" THINGS " = HARDWARE + SOFTWARE + SERVICE

Figure 1. Things in IoT

III. Types of Sensors

A. Gas Sensor

In many malls smoke sensors are found on the ceilings, which are designed to detect smoke and water is sprinkled during accidental fire. MQ-02 sensor is capable of detecting LPG, H2, alcohol, CH4 and smoke. In most of the places this type of sensor is placed due to its quick and rapid response. When flammable gas flows through this sensor, the coil inside burns and its resistance decreases. Because of this, the output voltage starts increasing and is detected using a microcontroller.

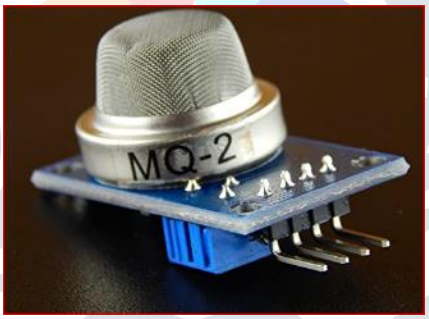

Figure 2. MQ-2 Gas Sensor

B. Obstacle Sensor

IR sensors are used for detecting obstacles. IR sensors give either 0 or 1 as its digital output based on the presence of the obstacle. The IR sensors are inserted in to robot. The robot is deployed to detect and alert the presence of obstacles in the path.

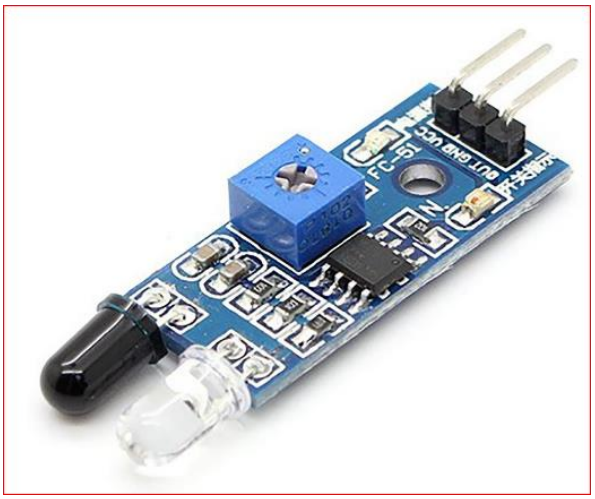

Figure 3. Obstacle Sensor

C. Heartbeat Sensor

Many applications use this sensor such as wearable applications that monitor a person's heartbeat accurately. The applications are in the healthcare domain and the sensor is interfaced with Arduino UNO board and the data is loaded in to the cloud.

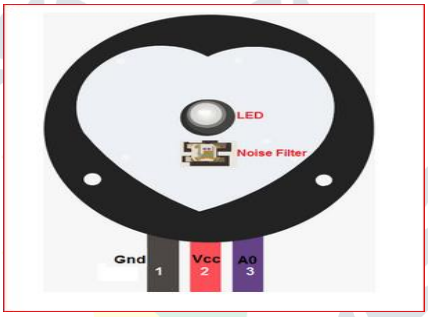

Figure 4. Heartbeat Sensor

D. Ultrasonic Sound Sensor

Ultrasonic sound sensors are used to measure the distance of an object. These sensors emanate ultrasonic sound which travels and hit the surrounding object. The ultrasonic pulse received is captured by the sensor. Some math is to be performed on the obtained value to get the distance of the object from the sensor. This type of sensor could only measure the distance of the object and not find what type of object it is.

Figure 5. Ultrasonic Sound Sensor

E. Gyro Sensor

The angle of rotation or posture of a body is found using this sensor. These sensors can sense changes in orientation and rotational motion. This sensor is fabricated with 12C bus, which is a two wire communication protocol. It is used to communicate with a large number of devices at a time.

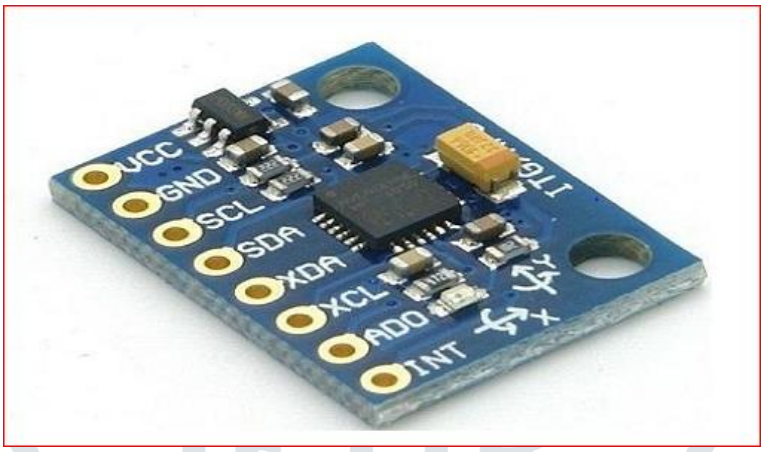

Figure 6. Gyro Sensor

IV. IoT Applications

IoT is used to build applications for assets tracking, agriculture, energy sector, defence, safety and security sector, embedded applications, waste management, education, healthcare products, smart city, telemedicine, etc.

A. Smart Healthcare

Most of the elder people suffer from joint pain, back pain, knee pain and are not able to walk properly and confined to bed. Immobility, chronic health impairment and fragility of bones cause them to fall. Due to ageing, the healing capacity diminishes in old people and falls can be fatal for them. People suffering from heart diseases suffer a lot if they fall. Their heartbeat rises to abnormal rate which could lead to cardiac arrest. These risks in elderly people could be reduced by an affordable and economic system that could monitor and detect their fall. Immediately after a person falls , the systems alerts the caretaker to make necessary actions to save him. The sensors and data analytics are used in this IoT system. The falls could be detected by means of the wearable proposed in this system

Figure 7. Health Care Devices

B. Smart perishable tracking system

Fruits, vegetables and all eatables are cultivated at one place and taken over the other parts of the world. The market place for selling them is far away from the place of cultivation. Hence, they are transported to that place by various means of transportation. It is a challenging work to monitor the quality of the perishables during transport. It could be done by IoT and sensors and may be ensured that the quality of the perishables would be ensured while consuming it before getting spoiled. Once the quality tracking system is established, the temperature, humidity and odour data is collected and is transferred to the cloud. From there it is transferred to Google sheets and data analytics is done here. Processed data shows the grade of the perishables and based on that the products are delivered at the location before getting spoiled.

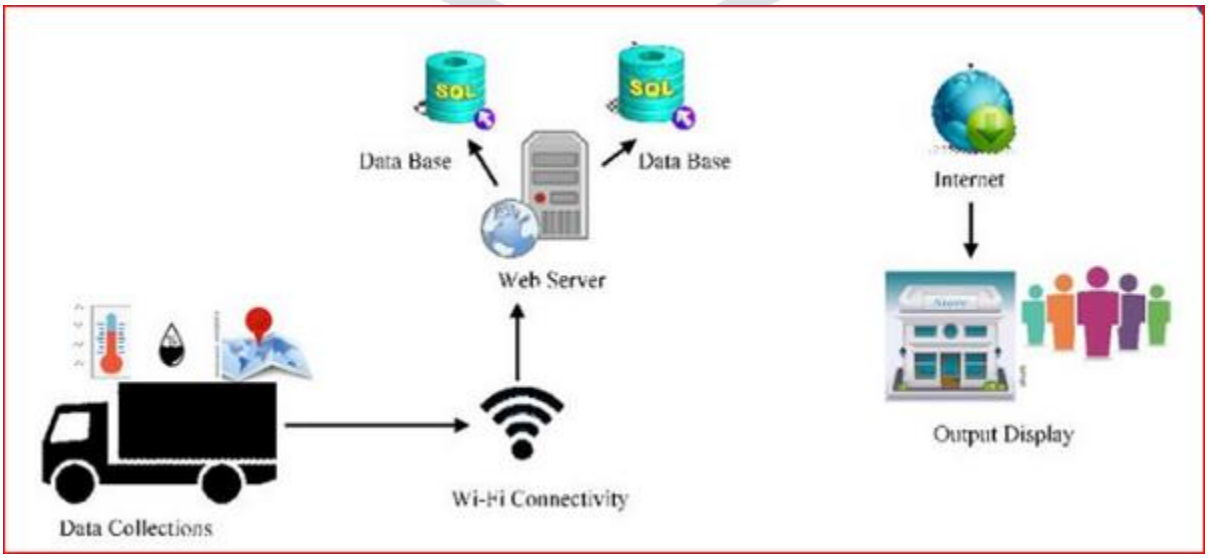

Figure 8. Smart tracking system

C. Smart Inflight Lavatory Maintenance with IoT

The inflight hygiene and comfort quality is an important factor that influences the choice of airlines for air travellers. The inflight hygiene is to be kept in top quality to give due importance to the passenger comfort. Unclean lavatories in flights may cause number of diseases. Technology has been developed for automating the lavatory monitoring process and an alert is initiated for cleaning to the crew. The methane level present in the lavatory is assessed by MQ-05 gas sensor. Clean lavatory is identified by the threshold value of methane level. If the level goes above the threshold value then an alert will be triggered to the concerned crew for necessary cleaning.

D. Monitoring water quality

At different parts of the rivers, sensors are placed to monitor the quality of water. The data is collected at regular intervals by the sensors and is transferred to the internet. This system replaces the traditional manual method and helps in monitoring the water quality. To analyse the data in the cloud, machine learning techniques are used. The choropleth map of the waterbody is plotted by the algorithm. The maps generated are stored in the cloud which could be easily interpreted by the end user. The end user can get the updated information about the waterbody through the applications developed for mobile and web platforms.

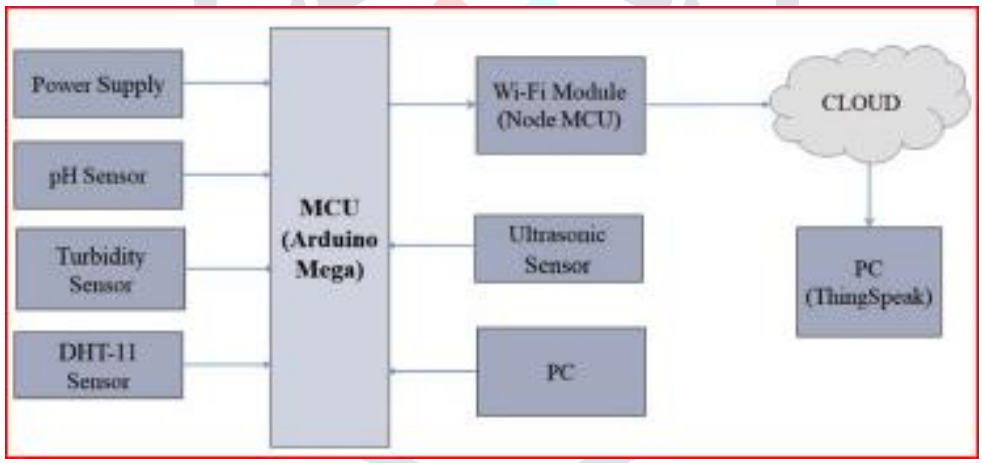

Figure 9. Water Quality Monitoring System

E. Smart Warehouse monitoring

The need for this approach and innovation is manifold. The first reason is the chance of human error ie. miscounting and the second one is when the human effort is involved, it could take a lot of time. Next reason is most of the warehouses have tall racks. The warehouse personnel climbing tall ladders are always risky. Hence, there is a need for automating the entire process of inventory management. We can use IoT. Here, drones and data analytics are implemented for automating inventory management. Inside the warehouse, the drone will fly, track the goods and components rack-wise, and give an update to the warehouse manager through a web interface and android application. The drone will be driven by the pilot with the appropriate flying directions and information. It will be fully automated which require zero manual intervention.

Figure 10. Warehouse Monitoring System

V. Conclusion

The Internet of Things is an empowering environment in connecting the objects in our day to day life and constructing a smarter bridge between the digital, physical and human spheres altogether in to a safe networked environment. The various areas of applications enable services based on the type of users and their needs. This paper highlights the different field areas where the smart devices will be used with the implementation of sensors. These IoT applications will definitely influence our human life and make it a smarter world by means on unbelievable sources.

References

1. AbdelRahman H.Hussein, "Internet of Things(IOT) : Research Challenges and Future Applications", International Journal of Advanced Computer Science and Applications, Vol. 10, No. 6, pp. 77- 82, 2019.
2. Yusuf Perwej, Majzoob K. Omer, Osama E. Sheta, Hani Ali M.Harb, Mohmed S.Adrees, "Future of Internet of Things (IoT) and its Empowering Technology, International Journal of Engineering Science and Computing, Vol. 9, No. 3, pp.20192-20203, 2019.
3. Mohit Kumar Saini, Rakesh Kumar Saini, Internet of Things (IoT) Applications and Security Challenges : A Review, International Journal of Engineering Research & Technology, Vol. 7, No.12, pp. 1-7, 2019.
4. Abhishek Malik, Amrit Thapa Magar, Harsh Verma, Meeta Singh, Pinki Sagar, A Detailed Study Of An Internet Of Things (IoT), International Journal of Scientific & Technology Research, Vol. 8, No. 12, pp. 2989-2994, 2019.
5. Mardiana Binti Mohamad Noor, Wan Haslina Hassan, Current Research on Internet of Things (IoT) security : A survey, Computer Networks, Vol.148, pp. 283-294, 2019.
6. AndreasKorte, Victor Tiberius, Alexander Brem, Internet of Things (IoT) Technology Research in Business and Management Literature : Results from Co-Citation Analysis, Journal of Theoretical and Applied Electronic Commerce Research, Vol. 16, pp. 2073-2090, 2021.
7. Keyur K Patel, Sunil M Patel, Internet of Things-IOT : Definition, Characteristics, Architecture, Enabling Technologies, Application & Future Challenges, Vol. 6, No.5, pp. 6122-6131, 2016.

8. Sachin Kumar, Prayag Tiwari, Mikhail Zymbler, Internet of Things is a revolutionary approach for future technology enhancement: a review, Journal of Big Data, Vol. 6, pp. 1-21, 2019.
9. Tirupathi Reddy M, Krishna Mohan R, Applications of IoT : A Study, Special Issue Published in International Journal of Trend in Research and Development (IJTRD), National Conference on Emerging Trends in Computing, Godavari Institute of Engineering and Technology, Rajahmundry, Andra Pradesh, pp. 86 -87 , 7th and 8th April 2017.
10. Jing Li, Weifa Liang, Zichuan Xu, Xiaohua Jia, Wanlei Zhou, Service Provisioning for Multi-source IoT Applications in Mobile Edge Computing, ACM Transactions on Sensor Networks, Vol. 18, No. 2 pp. 1-25, 2022.
11. Yaru Fu , Xiaolong Yang, Peng Yang, Angus K. Y. Wong, Zheng Shi, Hong Wang, and Tony Q. S. Quek, Energy – efficient offloading and resource allocation for mobile edge computing enabled mission – critical Internet – of- things systems, EURASIP journal on Wireless Communications and Networking, pp. 1-16, 2021.
12. N.Sathiyanathan, Selvakumar S, Selvaprasanth P, A Brief Study on IoT Applications, International Journal of Trend in Scientific Research and Development, Vol. 4, No. 2, pp.23-27, 2020.