The Application of the Internet of Things to Enhance Smart Cities

Samar Hameed Majeed and Ali Hadi Abdulwahid

Elect.Power Eng.Tech., Engineering Technical College, Southern Technical University;
Email: Samar.alhusseini@stu.edu.iq

Abstract. This paper explores the application of the Internet of Things (IoT) as a tool to promote sustainable urban development in the context of Smart City campaigns. As an important element of the smart city concept, IoT is expected to enhance urban sustainability through sensor networks that detect and transmit data. However, challenges remain, adding a layer of difficulty to the process of using the Internet of things to achieve the goals. This paper affirms the concept and relationship of smart city and Internet of things. Then the use of the Internet of things technology in all aspects of supporting the sustainable development of the city was discussed. Therefore, the field of urban planning must cooperate to make good use of the Internet of things technology to achieve sustainable development. The development and application of IoT technology is closely related to the smart city movement. The current trend towards the use of information communication technology (ICT) in cities and architecture may pose new problems and challenges than urban planners. In the context of the smart city movement, urban planners need to understand the role that every ICT is playing in order to make better use of these technologies.

Keywords: Microcontroller, Smart Home, Smart Street Lighting, Traffic Light.

1. Introduction

The generation of the internet begins with the "computer network", the computer through a global network, whose services, such as the World Wide Web, plays a key role and usually consumes information[1-3]. After many years, the internet became "the Internet of people", people in addition to using information, but also through social networks and other means to create the internet, people can create content through social networks, the last generation of the internet system "Internet of things" as mentioned, things will generate and use information, to help people play a key role in daily life[4-7].

Smart cities are a place where services are become more resilient, efficient and sustainable by harnessing information, digital technologies and communications to improve services for the benefit of its residents.

Smart cities are greener, safer, and faster. Different components of smart cities include Smart Infrastructure, Smart Transportation, Smart Energy, Smart Healthcare and smart technologies. To enable smart cities to respond efficiently, There are two active technology frameworks connected together: the Internet of Things (IoT) and big data (BD)[8-10].
Proposed system

This study is significant in outlining general information about IoT, which has become a hot IT topic nowadays [11, 12]. It is divided into:

1. Smart Home
2. Street Lighting
3. Traffic Light

2. Results and discussions

2.1. Smart Home

In this project, demonstrates control home appliances from anywhere in the world using the internet. The small residential design consists of a group of sensors connected to the controller (NODEMCU). This controller through the cloud (www.cloudmqtt.com) connects to the internet and sends an alert in it. These notifications are received through home mobile applications and Computer Applications of the system [13-16].

![Figure 1](image1)

**Figure (1)** Cloud idea

The mobile application sends a notice to the keyboard, and the controller receives it. The controller informs it of the work. The controller then receives the signal from the sensor and checks it. Only if the received signal is sent to the keyboard as a notification on the form of "Topic" and "Message". The mobile application and the application of the computer listen to notify the sender depending on the (Topic), if received a notice from the Claude, who will display it as notice in the face of the application as in the Figure 2:

![Figure 2](image2)

**Figure (2)** Cloud idea
2.1.1. The Components:

1. Arduino Miga
2. ESP8266
3. Finger print sensor
4. Micro servo motor
5. PIR motion sensor
6. RFID
7. FC_22(MQ2)
8. Flam sensor
9. Keypad 4*4

2.1.2. Connection method:

That method connects all hardware component with microcontroller (nod MCU) and (arduino) as shown in the Figure 5.
2.1.3. Work Method:

A-THE door of the home is controlled in sensor ways:
1- RFID device
2- Finger print
3- applying mobile phone
4- Keypad
All the systems are connected to the microcontroller arduino more than one method and more than one control system where chosen in order to give the user greater freedom to chose his or her preferred system of protection for his or her home. See appendix (1,2,4)

B- protection sensor:
The home is equipped with arrange of protection system using sensor
1- Flam sensor
2- MQ-2
3- PIR
The sensor are connected to the microcontroller nod mcu thus console is connected to the internet cloud mat when a sensor is detected when there is something abnormal inside the house (fire, theft, gas leak) anotice is sent to the mobile program alerted by the owner of the home in addition an alert is sent according to the status of the home to both the police station and the fire station closest to the home to take necessary.

2.2. Street Lighting:

Smart lights operate automatically and depend on their work on the amount of power of the surrounding light, as shown in the Figure 6

2.2.1. The Components:

1- LED
2- Rely
3- Arduino_mega
4- Light resistance

2.2.2. Connection Method:

![Figure(7) street lighting connection](image)
2.3. Traffic Light:

In this paper, a new traffic light controller was built to optimization using the Arduino microcontroller board. The system tries to reduce traffic jams, caused by traffic lights, as possible. The system is based on microcontroller. The system contains sensors on the side of the roads. Also the system contains switches to control the traffic light manually. It consists of four columns installed on a round calf and works to control and control the movement of cars. See appendix Figure (3).

2.3.1. The Component:

1-LED  
2_Arduino_Miga

2.3.2. Connection Method:

Each column has three lights connected to the numbers analog of the Arduino, as shown in the Figure 8.

2.3.3. Work Method:

Act as traffic signals synchronized with each other and separate each column and the other an equal amount of time.
Figure (10) Traffic light

3. Conclusion

In short, there are many benefits that will be generated through the use of the Internet of Things in our daily lives, such as reducing costs and power. The Internet of Things has the potential to drive integrated solutions that can make a difference. By using the Internet of Things in our lives, the adoption of the Internet of Things in urban services and infrastructure has changed the way cities operate and deliver services.

The Internet of things works on physical devices, vehicles, buildings, and other internet-connected projects, so that these objects can collect and exchange data. It creates opportunities for more direct integration of the physical world into computer systems and increases efficiency, accuracy and economic benefits. It finds many applications in the field of smart grids, smart homes, smart transportation and smart cities. This article discusses the Internet of Things (IoT) and its applications in the smart cities. The emerging technology of the Internet of things makes smart cities efficient and responsive.

Appendix

The codes that used to create the application program:

Figure(11) keypad code
Figure (12) Fingerprint code

Figure (13) traffic light
Figure(14) servo motor and RFID

4. Acknowledgments:
   The author would like to thank the editors and reviewers for their constructive comments and suggestions on the article. The project was supported by Southern Technical University/ BETC.

5. Reference:
[1] E. Jacob, P. Sivraj, "Performance analysis of MANET routing protocols in smart city message passing", 2016 International Conference on Advances in Computing Communications and Informatics (ICACCI), pp. 1255-1260, 2016.
[2] D Yogavani, NK Prakash, "Implementation of Wireless Sensor Network based Multi-core Embedded System for Smart City", International Journal of Computer Technology and Applications (IJCTA), vol. 10, no. 02, pp. 119-123, 2017.
[3] N Kabilan, M S Selvi, "Surveillance and steering of irrigation system in cloud using Wireless Sensor Network and Wi-Fi module", Recent Trends in Information Technology (ICRTIT) 2016 International Conference, pp. 1-5, 2016 Apr 8.
[4] MH Memon, W Kumar, A Memon, BS Chowdhry, M Aamir, P Kumar, "Internet of Things (IoT) enabled smart animal farm", Computing for Sustainable Global Development (INDIACom) 2016 3rd International Conference, pp. 2067-2072, 2016 Mar 16.
[5] SH Yang, X Chen, X Chen, L Yang, B Chao, J Cao, "A case study of internet of things: A wireless household water consumption monitoring system", Internet of Things (WF-IoT) 2015 IEEE 2nd World Forum, pp. 681-686, 2015 Dec 14.
[6] S Saseendran, V Nithya, "Automated water usage monitoring system", Communication and Signal Processing (ICCSP) 2016 International Conference, pp. 0099-0103, 2016 Apr 6.
[7] J Mohammed, CH Lung, A Ocneanu, A Thakral, C Jones, A Adler, "Internet of Things: Remote patient monitoring using web services and cloud computing", Internet of Things (iThings) 2014 IEEE International Conference on and Green Computing and Communications (GreenCom) IEEE and Cyber Physical and Social Computing (CPSCom), pp. 256-263, 2014 Sep 1.

[8] Mohamad Amin Hasbini, Martin Tom-Petersen; The Smart Cities Internet of Access Control, opportunities and cybersecurity challenges Sept 25, 2017.

[9] Nathan David, AbaforChima. Design of a Home Automation System Using Arduino. International Journal of Scientific & Engineering Research ISSN 2229-5518 ; 2015 ; 06 : 795 - 803.

[10] Arun Cyril Jose, Reza Malekian. Smart Home Automation Security: A Literature Review. Smart Computing Review ; 2015 ; 05 : 269 – 285.

[11] Arun Cyril Jose. Smart Home Systems. University of Central Florida ; 2015.

[12] Zaid Abdulzahra Jabbar, R.S. Kawitkar. Implementation of Smart Home Control by Using Low Cost Arduino& Android Design. International Journal of Advanced Research in Computer and Communication EngineeringISSN (Online) 2278-1021 ISSN (Print) 2319 5940 ; 2016 ; 05 : 248 – 256

[13] Zaid Abdul Zahra Jabbar, R.S. Kawitkar. Home Automation and Smart Home Control. International Journal of Scientific & Engineering ; 2016 ; 07 : 983 – 987

[14] Boban Davidović, Aleksandra Labus. A Smart home system based on sensor technology. Electronics and Energetics ; 2016 ; 29 : 451 – 460.

[15] Boban Davidović, Aleksandra Labus presents a new approach to utilize technology in a practical and meaningful manner within; 2016;22;567_645

[16] https://en.wikipedia.org/wiki/Internet_of_things.