Automatic Control for Home Applications using IoT

[1]Veeramani R, [2]Subesh S, [3]Sathishkumar

[3]Assistant Professor, [1,2,3]Department of Computer Science Engineering,
Nehru Institute of Engineering and Technology Coimbatore.

[1]veeramanivmofficial@gmail.com, [2]subeshselvaraj@gmail.com, [3]nietsatishkumar@gmail.com

Abstract:

Smart home has become more and more popular in recent years. Due to the rapid development in the field of the Automation industry, human life is becoming more advanced and better in all aspects. In the present scenario, Automated systems are being preferred over the non-automated system. With the rapid growth in the number of consumers using the internet over the past years, the Internet has become an important part of life, and IoT is the newest and emerging internet technology. Internet of things plays an important role in human life as well as in the educational field because they are able to provide information and complete the given tasks while we are busy doing some other work. In this project, a prototype and implementation of Smart Home Automation with Wi-Fi technology are demonstrated. ESP8266 is used as a Wi-Fi technology. The proposed system consists of a hardware interface and software interface. In the hardware interface, the integration of ESP8266 Wi-Fi technology for controlling home appliances, door lock and unlock and sensors is manifested, and an application is provided for controlling to multiple users of home, with smart phones, tablets, and laptops. This system is one of the best methods for controlling home devices with ease with multiple users and one of the best methods for an energy management system. The access to the whole system is given by its admin only to different users. This system is also expandable for controlling various appliances used at home and also for the security and safety purpose of the home through sensors as long as it exists on Wi-Fi network coverage.

Key words: Home automation; Smartphone; Arduino; Wifi; Home appliances.

Corresponding Author: *Veeramani R,*
Department of CSE, Nehru Institute of Engineering and Technology Coimbatore.
Mail: veeramanivmofficial@gmail.com

INTRODUCTION

With the development of IOT (internet of things), the concept of smart device has become more and more popular. Devices are connected to the internet and stretch their reach. Mobile phone is not the only common smart device. Smart watch, smart rings, smart TV, smart air monitor, smart sensors, all kinds of traditional devices turn to smart and have the capability to access the internet. This contributes to the promotion of wireless home automation. Since home appliances can become smart, the home or the work area can be a smart area with easy automation control. Smart home system can connect the smart units together and provide a unified interface for users to interact with the home appliances.

SMART HOME

A smart home refers to a residence equipped with a communication network, high-tech household devices, appliances, and sensors that can be remotely accessed, monitored, and controlled and that provide services responding to the residents' needs. Although the widespread diffusion of high-speed Internet in the late 1990s provided the opportunity for the home network business to grow, it was not until the late 2000s that smart homes began to be installed, which is when smart phones were popularized. Initially, a smart home was defined using various names, such as a home network, a digital home, home automation, and an intelligent home. In the mid-2010s, it has been leaning towards a combination of Internet of Things (IoT) and a situation-aware smart home

A smart home is an advanced form of traditional home automation. An early definition of a smart home, which was influenced by home automation, is using common communication devices to integrate with a variety of services at home, assuring economic, secure, and comfortable operation of the home. Thus, smart home service was used to manage environmental systems like lighting and heating. These days due to technological development, a smart home service monitors user activity and the internal environment at home (Figure 1). Moreover, a smart home provides services that fulfill the demands and needs of a user.

SYSTEM DESCRIPTION.

In this project, we present a low cost internet based wireless smart home system where home local network are established through WiFi technology. We will introduce the concept of Smart Home Proxy and Smart Units. We use smart home proxy to manage the smart units in home

network and to communicate with the user control units. Home proxy can act as a proxy to connect to the central remote server, thus implementing the remote control access for the remote user where XMPP is used. Different smart units such as smart switch, smart light, smart appliances and smart sensors etc can smart door cooperate with each other smartly. The central remote server can offer services for millions of homes or offices and provide a unified manage platform, so it is of much possibility to be popularized. Phones or tablets with the special application can interact with the system remotely or locally as control units.

- **Lighting, cooling and home entertainment system:**

Lights, fans, television and music system can be controlled using cell phones. The Arduino and the mobile phones connect via Bluetooth module Hc-05. Thus cell phone and Arduino is wirelessly connected reducing the cable networking. This also reduces the human effort.

- **Smart locks.**

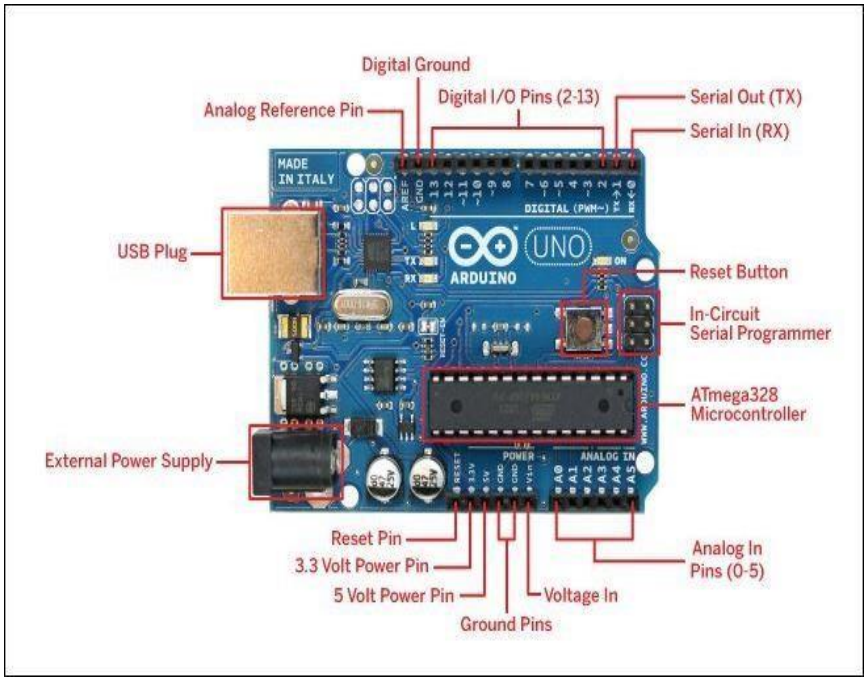
Among smart home technology IoT-based locks were one of the first connected devices adopted at a wide scale. August locks stand out among others in the market for the great attention the company puts in its products' compatibility and user experience. These smart locks have everything—outstanding security features, a sleek app for users, plenty of features, easy access (remote via WiFi and local via Bluetooth) and integration with the most popular virtual assistants (Alexa, Siri, Google Home).

HARDWARE ARCHITECTURE

The proposed home automation system contains three hardware components smartphone, Arduino board and Wifi module. Smartphone is used to communicate with Arduino board using a smartphone application and Wifi technology. In this research work Wifi module and Arduino Uno are used for hardware implementation.

Arduino Uno

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer (e.g. Flash, Processing.)



The boards can be assembled by hand or purchased preassembled; the open source IDE can be downloaded for free. The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

NODE MCU

NODE MCU Node MCU is an open source IOT platform. It includes firmware which runs on the ESP8266 Wi-Fi SOC from Systems, and hardware which is based on the ESP-12 module. The term "Node MCU" by default refers to the firmware rather than the dev kits. It's having 128KBytes of memory and its storage space is 4Mbytes and power is supplied through an USB and it is a single board microcontroller and also it is having 16 GPIO pins.

CHANNEL RELAY BOARD

Channel Relay Board is a simple and convenient way to interface 4 relays for switching application in your project. Very compact design can fit in small area, manly this board is made for low voltage application.

Features:

- 4-Channel Relay interface board, and each one needs 15-20mA Driver Current
- Both controlled by 12V and 5V input Voltage
- Equipped with high-current relay, AC250V 10A ; DC30V 10A
- Standard interface that can be controlled directly by microcontroller (Arduino , 8051, AVR, PIC, DSP, ARM, ARM, MSP430, TTL logic active
- low)
- Opto-isolated inputs
- Indication LED's for Relay output status.

Proposed diagram:

SOFTWARE ARCHITECTURE

In this research work two software Arduino Integrated Development Environment (IDE) and Bluetooth terminal application are used.

A. Arduino IDE

IDE stands for Integrated Development Environment, entire programming for proposed system is done in Arduino IDE tool. Baud rate is set to 9600 bits per second for serial communication between Arduino board and smartphone. Arduino IDE command "Serial. A vailable 0" is used to receive data serially from smartphone and "Serial.printlnO" command is used to transmit data serially from Arduino board to smartphone. The code to receive data serial from smartphone.

State variable is used to store the value of received byte and then it is compared with different condition and perform the specific operation. The Arduino IDE code for turn ON and OFF Light is shown below.

```
if (state == '0') %condition check
{
Serial.println("LIGHT ON");
digitalWrite(LIGHT, HIGH); %Turn On the Light
}
if (state == '1 ') %condition check
{
```

```
Serial.println("LIGHT OFF");  digitalWrite(LIGHT, LOW); %Turn OFF the Light
}
```

CONCLUSION

In this paper we have introduced design and implementation of a low cost, flexible and wireless solution to the home automation. The system is secured for access from any user or intruder. The users are expected to acquire pairing password for the Arduino BT and the cell phone to access the home appliances. This adds a protection from unauthorized users. This system can be used as a test bed for any appliances that requires on-off switching applications

REFERENCES

1. E. S. A. Ahmed, “Internet of things applications, challenges and related future technologies,” Internet of Things (IoT) Applications, vol. 67, no. 2, pp. 126–148, 2017, https://www.researchgate.net/profile/Zeinab_Kamal2.View at: Google Scholar
2. R. Piyare, “Internet of things: ubiquitous home control and monitoring system using android based smart phone,” International Journal of Internet of Things, vol. 2, no. 1, pp. 5–11, 2013.View at: Publisher Site | Google Scholar
3. K. Mandula, R. Parupalli, C. A. Murty, E. Magesh, and R. Lunagariya, “Mobile based home automation using internet of things (IoT),” in Proceedings of the 2015 International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT), pp. 340–343, IEEE, Kumaracoil, India, December 2015.View at: Publisher Site | Google Scholar
4. B. Kang, S. Park, T. Lee, and S. Park, “IoT-based monitoring system using tri-level context making model for smart home services,” in Proceedings of the 2015 IEEE International Conference on Consumer Electronics (ICCE), pp. 198-199, IEEE, Las Vegas, NV, USA, January 2015.View at: Publisher Site | Google Scholar
5. M. Darianian and M. P. Michael, “Smart home mobile RFID-based internet-of-things systems and services,” in Proceedings of the 2008 International Conference on Advanced Computer Theory and Engineering, pp. 116–120, IEEE, Phuket, Thailand, December 2008.View at: Publisher Site | Google Scholar
6. A. D. Plessis and B. Theron, “Virtual world—physical world: what is the real world?” International Journal of Management Science and Business Administration, vol. 2, no. 6, pp. 43–57, 2016.View at: Publisher Site | Google Scholar

7. G. Lobaccaro, S. Carlucci, and E. Löfström, “A review of systems and technologies for smart homes and smart grids,” Energies, vol. 9, no. 5, p. 348, 2016.View at: Publisher Site | Google Scholar
8. O. Bingol, K. Tasdelen, Z. Keskin, and Y. E. Kocaturk, “Web-based smart home automation: PLC-controlled implementation,” Acta PolytechnicaHungarica, vol. 11, no. 3, pp. 51–63, 2014.View at: Publisher Site | Google Scholar
9. A. ElShafee and K. A. Hamed, “Design and implementation of a wifi based home automation system,” World Academy of Science, Engineering and Technology, vol. 68, pp. 2177–2180, 2012.View at: Google Scholar
10. T. A. Abdulrahman, O. H. Isiwekpeni, N. T. Surajudeen-Bakinde, and A. O. Otuoze, “Design, specification and implementation of a distributed home automation system,” Procedia Computer Science, vol. 94, pp. 473–478, 2016.View at: Publisher Site | Google Scholar
11. M. Sarwar and T. Soomro, “Impact of smartphone’s on society,” European Journal of Scientific Research, vol. 98, 2013.View at: Google Scholar
12. M. Fahim, I. Fatima, S. Lee, and Y. K. Lee, “Daily life activity tracking application for smart homes using android smartphone,” in Proceedings of the 2012 14th International Conference on Advanced Communication Technology (ICACT), pp. 241–245, IEEE, PyeongChang, South Korea, February 2012.View at: Google Scholar
13. S. Otoum, B. Kantarci, and H. T. Mouftah, “On the feasibility of deep learning in sensor network intrusion detection,” IEEE Networking Letters, vol. 1, no. 2, pp. 68–71, 2019.View at: Publisher Site | Google Scholar
14. K. Gill, S.-H. Yang, F. Yao, and X. Lu, “A zigbee-based home automation system,” IEEE Transactions on Consumer Electronics, vol. 55, no. 2, pp. 422–430, 2009.View at: Publisher Site | Google Scholar
15. N. Sriskanthan, F. Tan, and A. Karande, “Bluetooth based home automation system,” Microprocessors and Microsystems, vol. 26, no. 6, pp. 281–289, 2002.View at: Publisher Site | Google Scholar
16. A. R. Al-Ali and M. Al-Rousan, “Java-based home automation system,” IEEE Transactions on Consumer Electronics, vol. 50, no. 2, pp. 498–504, 2004.View at: Publisher Site | Google Scholar
17. T. Baudel and M. Beaudouin-Lafon, “Charade,” Communications of the ACM, vol. 36, no. 7, pp. 28–35, 1993.View at: Publisher Site | Google Scholar
18. A. S. Abdulraheem, A. A. Salih, A. I. Abdulla et al., “Home automation system based on IoT,” 2020.View at: Google Scholar
19. M. A. Hoque and C. Davidson, “Design and implementation of an IoT-based smart home security system,” International Journal of Networked and Distributed Computing, vol. 7, no. 2, pp. 85–92, 2019.View at: Publisher Site | Google Scholar

20. L. M. Satapathy, S. K. Bastia, and N. Mohanty, “Arduino based home automation using internet of things (IoT),” International Journal of Pure and Applied Mathematics, vol. 118, no. 17, pp. 769–778, 2018.View at: Google Scholar
21. S. Pirbhulal, H. Zhang, M. E. E Alahi et al., “A novel secure IoT-based smart home automation system using a wireless sensor network,” Sensors, vol. 17, no. 1, p. 69, 2017.View at: Publisher Site | Google Scholar
22. P. Kumar and U. C. Pati, “Iot based monitoring and control of appliances for smart home,” in Proceedings of the 2016 IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), pp. 1145–1150, IEEE, Bangalore, India, May 2016.View at: Publisher Site | Google Scholar
23. S. B. Sangeetha, “Intelligent interface based speech recognition for home automation using android application,” in Proceedings of the 2015 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), pp. 1–11, IEEE, Coimbatore, India, March 2015.View at: Publisher Site | Google Scholar
24. D. Javale, M. Mohsin, S. Nandanwar, and M. Shingate, “Home automation and security system using android ADK,” International Journal of Electronics Communication and Computer Technology (IJECCT), vol. 3, no. 2, pp. 382–385, 2013.View at: Google Scholar
25. R. PiyareM. Tazil, “Bluetooth based home automation system using cell phone,” in Proceedings of the 2011 IEEE 15th International Symposium on Consumer Electronics (ISCE), pp. 192–195, IEEE, Singapore, June 2011.View at: Publisher Site | Google Scholar
26. G. Chong, L. Zhihao, and Y. Yifeng, “The research and implement of smart home system based on internet of things,” in Proceedings of the 2011 International Conference on Electronics, Communications and Control (ICECC), pp. 2944–2947, IEEE, Ningbo, China, September 2011.View at: Publisher Site | Google Scholar
27. Z. U. Haq, G. F. Khan, and T. Hussain, “A comprehensive analysis of XML and JSON web technologies,” New Developments in Circuits, Systems, Signal Processing, Communications and Computers, pp. 102–109, 2013.View at: Google Scholar
28. Y. J. Song, S. B. Ou, and J. W. Lee, An Analysis of Existing Android Image Loading Libraries: Picasso, Glide, Fresco, AUIL and Volley, DEStech Transactions on Engineering and Technology Research, Lancaster, PA, USA, 2016.
29. Y. Upadhyay, A. Borole, and D. Dileepan, “MQTT based secured home automation system,” in Proceedings of the 2016 Symposium on Colossal Data Analysis and Networking (CDAN), pp. 1–4, IEEE, Indore, India, March 2016.View at: Publisher Site | Google Scholar
30. Karthick, R., et al. “Overcome the challenges in bio-medical instruments using IOT–A review.” Materials Today: Proceedings (2020). https://doi.org/10.1016/j.matpr.2020.08.420
31. Karthick, R., et al. “A Geographical Review: Novel Coronavirus (COVID-19) Pandemic.” A Geographical Review: Novel Coronavirus (COVID-19) Pandemic (October 16, 2020). Asian

Journal of Applied Science and Technology (AJAST)(Quarterly International Journal) Volume 4 (2020): 44-50.

32. Sathiyanathan, N. “Medical Image Compression Using View Compensated Wavelet Transform.” Journal of Global Research in Computer Science 9.9 (2018): 01-04.
33. Karthick, R., and M. Sundararajan. “SPIDER-based out-of-order execution scheme for Ht-MPSOC.” International Journal of Advanced Intelligence paradigms 19.1 (2021): 28-41. https://doi.org/10.1504/IJAIP.2021.114581
34. Sabarish, P., et al. “An Energy Efficient Microwave Based Wireless Solar Power Transmission System.” IOP Conference Series: Materials Science and Engineering. Vol. 937. No. 1. IOP Publishing, 2020. doi:10.1088/1757-899X/937/1/012013
35. Vijayalakshmi, S., et al. “Implementation of a new Bi-Directional Switch multilevel Inverter for the reduction of harmonics.” IOP Conference Series: Materials Science and Engineering. Vol. 937. No. 1. IOP Publishing, 2020. doi:10.1088/1757-899X/937/1/012026
36. Karthick, R., and M. Sundararajan. “Hardware Evaluation of Second Round SHA-3 Candidates Using FPGA (April 2, 2014).” International Journal of Advanced Research in Computer Science & Technology (IJARCST 2014) 2.2.
37. Karthick, R., et al. “High resolution image scaling using fuzzy based FPGA implementation.” Asian Journal of Applied Science and Technology (AJAST) 3.1 (2019): 215-221.
38. Subramanian, AT Sankara, et al. "A review on selection of soft magnetic materials for industrial drives." Materials Today: Proceedings 45 (2021): 1591-1596
39. Meenalochini, P., and S. P. Umayal. "Comparison of Current Controllers on Photo Voltaic Inverters Operating as VAR Compensators." Journal of Electrical Engineering The Institution of Engineers, Bangladesh Vol. EE 38.
40. Kalavalli, C., et al. "Dual loop control for single phase PWM inverter for distributed generation." Materials Today: Proceedings 45 (2021): 2216-2219.
41. Karthick, R., A. Manoj Prabaharan, and P. Selvaprasanth. "A Dumb-Bell Shaped Damper with Magnetic Absorber using Ferrofluids." International Journal of Recent Technology and Engineering (IJRTE) 8 (2019).
42. Haq, S. Syed Abdul, et al. "A sinusoidal pulse width modulation (SPWM) technique for capacitor voltage balancing of nested I-type four-level inverter." Materials Today: Proceedings 45 (2021): 2435-2439.
43. Rohini, S., and J. Jeyashanthi. "Improved Performance of Photovoltaic Inverters Utilizing in VAR Mode." Irish Interdisciplinary Journal of Science & Research (IIJSR) 4.1 (2020): 15-20.

44. P. Sabarish, R. Karthick, A. Sindhu, N. Sathiyanathan, Investigation on performance of solar photovoltaic fed hybrid semi impedance source converters, Materials Today: Proceedings, 2020, https://doi.org/10.1016/j.matpr.2020.08.390
45. Karthick, R., A. Manoj Prabaharan, and P. Selvaprasanth. "Internet of things based high security border surveillance strategy." Asian Journal of Applied Science and Technology (AJAST) Volume 3 (2019): 94-100.
46. Karthick, R., and M. Sundararajan. "A novel 3-D-IC test architecture-a review." International Journal of Engineering and Technology (UAE) 7.1.1 (2018): 582-586.
47. Karthick, R., and M. Sundararajan. "Design and implementation of low power testing using advanced razor based processor." International Journal of Applied Engineering Research 12.17 (2017): 6384-6390.
48. Karthick, R., and M. Sundararajan. "A Reconfigurable Method for TimeCorrelatedMimo Channels with a Decision Feedback Receiver." International Journal of Applied Engineering Research 12.15 (2017): 5234-5241.
49. Karthick, R., and M. Sundararajan. "PSO based out-of-order (ooo) execution scheme for HT-MPSOC." Journal of Advanced Research in Dynamical and Control Systems 9 (2017): 1969.
50. Karthick, R. "Deep Learning For Age Group Classification System." International Journal Of Advances In Signal And Image Sciences 4.2 (2018): 16-22.
51. Karthick, R., and P. Meenalochini. "Implementation of data cache block (DCB) in shared processor using field-programmable gate array (FPGA)." Journal of the National Science Foundation of Sri Lanka 48.4 (2020). http://doi.org/10.4038/jnsfsr.v48i4.10340
52. Suresh, Helina Rajini, et al. "Suppression of four wave mixing effect in DWDM system." Materials Today: Proceedings (2021). https://doi.org/10.1016/j.matpr.2020.11.545
53. M. Sheik Dawood, S. Sakena Benazer, N. Nanthini, R. Devika, R. Karthick, Design of rectenna for wireless sensor networks, Materials Today: Proceedings, 2021. https://doi.org/10.1016/j.matpr.2020.11.905
54. M. Sheik Dawood, S. Sakena Benazer, R. Karthick, R. Senthil Ganesh, S. Sugirtha Mary, Performance analysis of efficient video transmission using EvalSVC, EvalVid-NT, EvalVid, Materials Today: Proceedings,2021. https://doi.org/10.1016/j.matpr.2021.02.287.