

HOME AUTOMATION USING ARTIFICIAL INTELLIGENCE

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Abstract—Smart-home concept has been around for many years and played a very important part in the design and implementation of future houses. Early research focus on the control of home appliances but current trends are moving into a creation of self-thinking home. Home automation refers to the control of home appliances and domestic features by local networking or by remote control. Artificial Intelligence provides us the framework to go real-time decision and automation for Internet of Things (IoT). The work deals with discussion about different intelligent home automation systems and technologies from a various features standpoint. The work focuses on concept of home automation where the monitoring and control operations are facilitating through smart devices installed in residential buildings In the recent years many research papers were performed utilizing artificial intelligence tools and techniques. This paper is about home automation using artificial intelligence

Keywords: Home Automation, Raspberry pi, Artificial Intelligence, ESP8266, Voice recognition system.

I. INTRODUCTION

Automation is a technique, method, or system of operating or controlling a process by electronic devices with reducing human involvement to a minimum. The fundamental of building an automation system for an office or home is increasing day-by-day with numerous benefits. Industrialist and researchers are working to build efficient and affordability automatic systems to monitor and control different machines like lights, fans, AC based on the requirement. Automation makes not only an efficient but also an economical use of the electricity and water and reduces much of the wastage [1].

Homes of the 21st century will become more and more self-controlled and automated due to the comfort it provides, especially when employed in a private home. A home automation system is a means that allow users to control electric appliances of varying kind. Home automation is the residential extension of building automation and involves the control and automation of lighting, heating, ventilation, air conditioning (HVAC), appliances, and security. Modern systems generally consist of switches and sensors connected to a central hub sometimes called a "gateway" from which the system is controlled with a user interface that is interacted either with a wall-mounted terminal, mobile phone software, tablet computer or a web interface. Home automation systems are quickly emerging and becoming popular nowadays in the world and its end users are specifically the disabled and elderly but due to their complexity and cost it is not always accepted. Population

ageing is taking place in nearly all the countries of the world with rapid economic growth, living standards are also rising day by day, the modern society wants safe, economic, comfortable and convenient life which is ideal for every family. "Home automation is a very promising area. Its main benefits range from increased comfort and greater safety and security, to a more rational use of energy and other resources, allowing for significant savings. It also offers powerful means for helping and supporting the special needs of people with disabilities and, in particular, the elderly. This application domain is very important and will steadily increase in the future. Home automation is known as the automation of the home, housework or household activity. It commonly defines a residence that integrates technology and services through home networking to improve the quality of living. Home automation is not a new term for science society and has been around for a significant time. Home automation include mainly centralized control of lighting, temperature, appliances, and other systems, to provide improved comfort, convenience, efficiency and security. For disabled and elderly person home automation can be the substitute of institutional care.

In recent years, wireless systems like Wi-Fi have become more and more common in home networking. Also in home and building automation systems, the use of wireless technologies gives several advantages that could not be achieved using a wired network only.

1) Reduced installation costs: First and foremost, installation costs are significantly reduced since no

cabling is necessary. Wired solutions require cabling, where material as well as the professional laying of cables (e.g. into walls) is expensive.

2) System scalability and easy extension: Deploying a wireless network is especially advantageous when, due to new or changed requirements, extension of the network is necessary. In contrast to wired installations, in which cabling extension is tedious. This makes wireless installations a seminal investment.

3) Aesthetical benefits: Apart from covering a larger area, this attribute helps to full aesthetical requirements as well. Examples include representative buildings with all-glass architecture and historical buildings where design or conservatory reasons do not allow laying of cables.

4) Integration of mobile devices: With wireless networks, associating mobile devices such as PDAs and Smartphones with the automation system becomes possible everywhere and at any time, as a device's exact physical location is no longer crucial for a connection (as long as the device is in reach of the network). For all these reasons, wireless technology is not only an attractive choice in renovation and refurbishment, but also for new installations [2].

The application of automation technology to residential environments holds a lot of benefits. Still, much of the potential available in a typical present-day home automation system lies fallow since the control strategies linking sensors and actuators are not as flexible as they should be. Tuning such a system precisely to the requirements of its users and the characteristics of both building structure and building services equipment is a task reserved to those with specialist knowledge. Moreover, it is almost never done in full due to the large effort required. For the same reason, once the system is installed, necessary re-adjustments are foregone almost as a rule. The task gets even harder as more design disciplines are involved. Only with control getting more intelligent, comfort and energy savings can be maximized and investments in sensors and actuators repaid in full. An automation system cannot be feasibly provided with this information in the way today's systems are configured. Although, for e.g., it could be preloaded with an understanding of the laws of physics, the entire wealth of knowledge described quite obviously cannot be engineered manually. Therefore, systems must be able to acquire this specific context autonomously.[3] Future home automation controllers must be enabled to learn from any user – not only qualified personnel and experienced users – and, as much as possible, by themselves from what they perceive about their environment. All the tasks described are classic examples of artificial intelligence (AI). Another feature in this home

automation is Voice recognition system. Voice recognition method offers a more user interactive approach in delivering control commands. The principle of voice/speech recognition is employed as the basic concept. The term "voice recognition" means the systems must be trained to a particular speaker's voice. Speech recognition applications include voice user interfaces such as call routing, domestic appliance control, voice dialing, search, simple data entry, preparation of structured documents, speech-to-text processing, etc. The concept of speech recognition involves the study of speech patterns of various individuals. All the patterns contain basic similarities, which can be grouped together into quantities called 'Phonemes'. Phonemes are described as semantic units. They are the sounds that group together to form our words, although quite how a phoneme converts into sound depends on many factors including the surrounding phonemes, speaker accent and age[4]. The most common speech recognition systems uses Hidden Markov Models for continuous speech recognition[13]. The popularity of home automation has been increasing vastly in recent years due to much higher affordability and simplicity. Being able to control aspects of our houses, and for having the feature to respond automatically to events, it is becoming more and more popular and necessary due to security and cost purpose [5].

II. LITERATURE SURVEY

The first smart homes were ideas, not actual structures. For decades, science fiction has explored the idea of home automation. Prolific writers, such as Ray Bradbury, imagined a future where homes were interactive, and seemingly ran themselves. In Bradbury's cautionary short story, "There Will Come Soft Rains" he describes an automated home that continues to function even after humans have died out. It's all well and frightening, until you consider the actual benefits of home automation, and then the idea becomes more comforting than chilling. Although the idea of home automation has been around for some time, actual smart homes have only existed a short while. This timeline focuses on hardware; meaning actual inventions leading up to the smart homes we know today and can expect from the near future [6].

A. 1901 – 1920:– The invention of home appliances – Although home appliances aren't what we'd consider "smart," they were an incredible achievement in the early twentieth century. These achievements began with the first engine-powered vacuum cleaner in 1901. A more practical electricity-powered vacuum was invented in 1907. Throughout two decades refrigerators would be invented, as well as clothes dryers, washing machines,

irons, toasters, and so much more. It was a fantastic time for anyone who was employed as a maid by a very affluent family.

B. 1966 - 1967:— ECHO IV and the Kitchen Computer – Although it was never commercially sold, the ECHO IV was the first smart device. This clever device could compute shopping lists, control the home's temperature and turn appliances on and off. The Kitchen Computer, developed a year later, could store recipes. But no models were sold.

C. 1991:— Gerontechnology. Gerontechnology combines gerontology and technology and makes the lives of senior citizens easier. In the 1990s, there was a lot of new research and technology in this sector [12]. Life Alert is one example of gerontechnology.

D. 1998 – Early 2000s: – Smart Homes – Smart homes, or home automation, began to increase in popularity in the early 2000s. As such, different technology began to emerge. Smart homes suddenly became a more affordable option, and therefore a viable technology for consumers. Domestic technologies, home networking, and other gadgets began to appear on store shelves [7].

E. Today's Smart Homes: – Today's smart homes are more about security and living greener. Our smart homes are sustainable, and they help to ensure that our homes aren't expending unnecessary energy. They also help alert us to intruders (whether we're home or not) [8]. Current trends in home automation include remote mobile control, automated lights, automated thermostat adjustment, scheduling appliances, mobile/email/text notifications, remote video surveillance and gesture control [9].

III. PROPOSED SYSTEM

In this paper, we propose the central part or brain of this system to be raspberry pi. It controls and coordinates all other devices and tasks.

A. BLOCK DIAGRAM

The ESP8266 acts as nodes to various devices and is connected to raspberry pi through Wi-Fi network. ESPs are placed in each and every room of the building, with raspberry pi central control in living room. On the software side the raspberry pi has Jasper which enables voice control, a DBMS (Data Base Management System)

based on MySQL, and a custom AI for controlling all functions.

The DBMS maintains a record on all available sensors, electrical appliances and ESP nodes. The AI written in python, reads all the entries in the database and takes decision based on these entries. The entries may include sensor thresholds, timing details of electrical appliance activation, various sensor outputs that lead to device activation etc. The entry may also include individual power consumption details of each appliance.

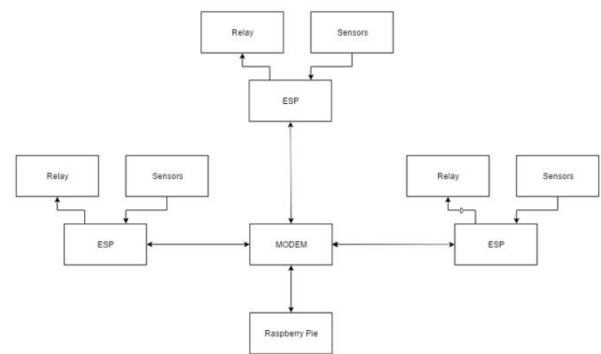


Figure 1: Design of Home Automation using AI

Any other stimuli which cause device activation is considered abnormal and will cause database up gradation. The AI program is also in charge of updating the database. The database together with AI, may be able to detect behavior of the occupant and make correct decisions. Any incorrect decision is detected by a correcting response from the occupant leads to database upgradation and prevent same mistake being repeated again. The AI-database union acts as a replacement for a neural network. The central control system also has a user interface system for customizing the system. The user can also schedule tasks to be done by the system.

Various sensors are connected to each ESP nodes. Electrical appliances are connected to relays which are controlled by ESPs. The ESPs in each room collects sensor data and sends it to raspberry pi. The raspberry pi hosts the DBMS which monitors the entire devices. The Jasper system at control center can accept voice commands. New home security measures can also be employed using another dedicated ESP node. The ESP node base system makes the entire system modular enabling new features to be added later.

The entire system is connected to the internet. This enables the system to be controlled through any internet connected device. This feature also enables the user to be

notified of various situations even if he/she may not be home, like intruder alert etc.

IV RESULT

We started by training the AI by giving the arbitrary data. After the training process, the test data were recolonized with an accuracy of about 60-75%.

We trained the voice recognition system with a 100 words, we got 60-70% correct. As we reduced to simple 15-words, we got virtually 80% correct even with some background noise and non-American accent.

V CONCLUSION

In this paper we started our discussion with home automation system by defining four major applications of these systems which are comfort ability, remote control, optimal resource utilization and security. After that we see the detailed structure of home automation for implementing these services one by one explaining the working of each system and use of heuristic based tools in these systems. At the last we discuss about the applications of AI tools in all four types of home automation systems. From this discussion it is clear that AI is emerging as a very useful and applicable technology for Home automation. On the other hand, home automation systems provide AI a vast range of Application

REFERENCES

- [1] Ahmed ElShafee, Karim Alaa Hamed, "Design and Implementation of a WiFi Based Home Automation System", International Journal of Computer, Electrical, Automation, Control and Information Engineering Vol: 6, No: 8, 2012.
- [2] C. Douligeris, Intelligent Home Systems, IEEE Communications Magazine, Vol. 31, Issue 10, October 1993.
- [3] Sira PR, Cook DJ (2004). Identifying Tasks and Predicting Action in Smart Homes using Unlabeled Data. International Journal on Artificial Intelligence Tools. 13(1): 81-100.
- [4] Chetana Sarode, Prof.Mr.H.S.Thakar , " Intelligent Home Monitoring System", International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 3, Issue 1, January - February 2013
- [5] 61 R. J. C. Nunes and J. C. M. Delgado, An Internet Application for Home Automation, 10th Mediterranean Electro technical Conference, MeleCon 2000, Vol. I
- [6] Rajeev Piyare (2013), "Internet of Things: Ubiquitous Home Control and Monitoring System Using Android Based Smart Phone", International Journal of Internet of Things.
- [7] Bharanialankar S R and Manikanda Babu C S (2014), "Intelligent Home Appliance Status Intimation Control and System Using GSM", International Journal of Advanced Research in Science and Software Engineering, Vol. 4, No. 4.
- [8] Jinsung Byun, Insung Hong, Byoungjoo Lee, and Sehyun Park, Member Intelligent Household LED Lighting System Considering Energy Efficiency and User Satisfaction, IEEE paper February 201
- [9] Kim, D. & Kim, D., 2006. An Intelligent Smart Home Control Using Body Gestures. In International Conference on Hybrid Information Technology., 2006. IEEE Conference Publications
- [10] Jia-Ching Wang, Senior Member, IEEE, Yuan-Shan Lee, Chang-Hong Lin, Ernestasia Siahaan, and Chung-Hsien Yang "Robust Environmental Sound Recognition With Fast Noise Suppression for Home Automation" in IEEE transactions on automation science and engineering.
- [11] Dhawan S. Thakur and Aditi Sharma . Voice Recognition Wireless Home Automation System Based On Zigbee in IOSR Journal of Electronics and Communication Engineering e-ISSN: 2278-2834, p-ISSN: 2278-8735. Volume 6, Issue 1 (May. - Jun. 2013), PP
- [12] Ministry of Community Development, Committee on Ageing Issues (2006). Report on ageing population, Opportunities and challenges . Archived from the original on October 28, 2007. Retrieved July 31, 2008.
- [13] Morgan, Bourlard, Renals, Cohen, Franco (1993) "Hybrid neural network/hidden Markov model systems for continuous speech recognition. ICASSP/IJPRAI".