Smart Home Using Artificial Intelligence

Moupriya Sarkar*1, Sushmita Pramanik*2

Department of Computer Science

Bijoy Krishna Girls' College, Howrah

5/3, Mahatma Gandhi Rd, Howrah, West Bengal 711101, India

*1sarkar.moupriya2000@gmail.com; *2spsushmita@gmail.com

Abstract – Smart home is a very common approach to make our life smoother nowadays. Smart home helps to access electric devices and other home appliances quickly without using any man power, just one command is enough to do a task. Artificial Intelligence (AI) is the main pillar to build up this smart home approach. With the help of AI we can implement the concept of smart hone using some sensors which will be attached with our devices so we can control them using a button or voice command only.

Keywords – DTMF; Artificial Intelligence (AI)

I. INTRODUCTION

Smart-home concept has been around for many years and played a very important part in the design and implementation of future houses. The main objectives of home automation are controlling, management and co-ordination of home appliances in a comfortable, effective and secure way. It contains large number of sensors which can be monitored. On other hand, Artificial Intelligence is evolving as a technology for developing automatic systems and can make decision using case based reasoning. Using, decision making and reasoning the AI provides a better solution for almost all automatic systems. The sensor can be specialized in measuring temperature, humidity, light, and movement the system also supports voice command for naïve users with command sensing .it decodes the users voice command and extracts the exact meaning of his command. The design is based on a standalone Arduino BT board and the appliances are connected to this board using Relays. Purpose of creating a home automation using artificial intelligence means user can easily controlled electronics appliances. So, the problem in saving electricity can be resolved, and main motto is to uses the home automation without being use internet. Let's imagine the universe of things a house can be aware of: it can be aware of the presence of the people who live in the house (along with their personas); it can be aware of what they're doing; it can even be aware of what every device in the house is doing. If you want the house to think like a human, the house needs to be able to analyse the data a human would analyse before making a decision. Think of Artificial Intelligence as computing power that is able to perform particularly complex tasks that would otherwise require a human brain to perform. A motion sensor might trigger a light to turn on. But if a home had Artificial Intelligence, it might consider the time of day, the person walking around the home, and where she was walking in deciding which light to turn on and how long to keep it on for a truly smart home is a home that doesn't only connect devices to their users, but also understands the people that live in it and their needs. Due to the ever expanding applications of AI, it'll not only change our workplace but will also change the way we live in our homes.

II. HISTORY

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. In 1975, the first general purpose home automation network technology, X10, was developed. It is a communication protocol for electronic devices. It primarily uses electric power transmission wiring for signalling and control, where the signals involve brief radio frequency bursts of digital data, and remains the most widely available. By 1978, X10 products included a 16 channel command console, a lamp module, and an appliance module. Soon after came the wall switch module and the first X10 timer.

III. GENERATIONS OF HOME AUTOMATION SYSTEM

According to Li et al. (2016) there are three generations of home automation:

A. First generation: wireless technology with proxy server, e.g. ZigBee automation;

B. Second generation: artificial intelligence controls electrical devices, e.g. Amazon Echo;

C. Third generation: robot buddy who interacts with humans, e.g. Robot Rovio, Roomba.

IV. LIST OF PLATFORMS TO BUILT A SMART HOME

Ranging from a list of platforms, some of them are as follows:

- Nest
- HomeKit
- Wink
- Z-Wave
- Zigbee
- SmartThings
- Brillo

These are just a handful list of platforms which you can inculcate in building your smart home.

V. SOME DEVICES TO USE FOR CREATING A SMART HOME

A. Some aspects of daily usages in a smart home with examples:

1. *SMART GATEWAY:* Zigbee project gateway, WIFI+ Project Gateway,

2. SMART LIGHTING: Smart bulb lamp, Smart Socket, Smart wired and wireless Switch, Scene Switch, Radar Induction Switch.
3. SMART APPLIANCE: Smart Wall Socket, Smart Mobile Socket, Smart Remote Control, Air Conditioner Assistant
4. SMART DOORAND WINDOW: Control panel, smart curtain, environmental sensors, Intelligent window opener, intelligent lock, wireless magnetometer, Smart sensor, smart controller.
5. BACKGROUND MUSIC: music host, control panel.

B. Some devices which are available in the market:

1. Amazon Echo
2. Philips Hue
3. TP-Link HS200
4. Ecobee4
5. NetGear Arlo Q
6. Char-Broil Digital Electric Smoker with Smart Chef Technology
7. Perfect Bake Pro
8. Ecovacs Deebot N79S

C. About some devices:

Wink Hub 2 supports smart home protocols including Bluetooth LE, Kidde, Lutron Clear Connect, Wi-Fi, Z-Wave, and more. If you're looking to create a fully integrated smart home with kitchen and wall appliances in-sync, this might be the best option.

Ranging from a pool of IOT devices which can change the dynamics of your house, Amazon Echo can be the best option. With a designing around your voice, it has 7 microphones and comes with a beam-forming technology for performing various operations. With the all-new Amazon Echo, one can switch off or on the lights without the need of lifting your finger. Also, it can be connected to Alexa for providing the daily news updates, weather conditions, play music and so much more.

Either, you can go for a Nest Thermostat or a Philips Hue Light bulb and can add a great amount of Intelligence to your existing home.

The easiest way as of today is buying a hub i.e. buying yourself an Amazon Echo or a Google Home and then picking the rest of the kit which is compatible with your current home system.

D. The various modules that can be used to construct a smart home:

1) Bluetooth module- This module is used for sending a voice command to the Arduino board with the help of android app we can make connection of app to the Bluetooth module (HC05).

2) Relay Module – A Relay is used for controlling high voltage electrical appliances like light or fan. without relay module we cannot control high voltage appliances.

3) PIR SENSOR - PIR sensor detects a human being moving around within approximately 10m from the sensor. In our project this module is used for the detecting human motion in the room and send signal to the Arduino board.

4) Light Intensity Sensor Light Intensity sensor provide light intensity of the room and send to the Arduino.

5) Arduino Board-Arduino is a backbone of this project; Arduino board collect all data from the components and decide whether turn on or turn off electrical appliances. In Arduino digital pin no 7 provide output for the PIR sensor and Humidity sensor.

6) Humidity sensor-This sensor is used for measure the humidity and temperature of the room and sends the values to the Arduino board.

VI. ACCESSIBILITY OFFERED THROUGH HOME AUTOMATION

A. Appliance control and settings:

Appliances can be controlled through apps, from any given location.

B. Distributed automation and affordability

New-age products provide the flexibility to install and control a few needed devices, instead of requiring to automate the whole home or office.

Home automation products can be easily installed by any trained electrician, in a matter of few minutes, providing instant control of devices.

C. Integration with voice-controlled devices

Several new age home automation products easily integrate with existing products like Google Assistant and Amazon Alexa, for further ease of use.

VII. BENEFITS

A. Safety and Security

It automatically locks the doors and arm the alarm system when everyone has left the house. Protection of family and belongs is one of the highest priorities for consumers. Better meet consumers' needs by enabling automatic home protection solutions that includes learned customizations such as "night mode" capabilities and reminders that match the consumers' family. Similarly, through a facial recognition algorithm, an AI-powered system builds a catalogue of known individuals through your social media connections and home visits, which helps it to understand between family members, guests, and visitors. Through this technique, there will be a substantial reduction in false alarms. These self-monitored security systems coupled with motion detectors, sensors, and security cameras will easily assess a potential break-in and even call for emergency services. This eliminates the need for human monitoring.

B. Energy and Cost Management

The smart devices can detect that everyone fell asleep and turn off the TV, dim the lights, and lower the A/Cs power for the night to save energy. Energy saving is not only crucial for our pockets but also for our planet. Off late, energy efficiency is a hot topic due to the increase in climate changes and energy challenges globally.

While buying home appliances we always check their energy efficiency but what about the times when they are not in use but still drain energy and raise the electricity bill? It is commonly known as "Vampire energy" or "Phantom load". An AI-powered Home automation can reduce the energy consumption and carbon footprints by controlling smart thermostats, smart plugs, and automated lighting sensors.

So if you forgot to switch off the lights upstairs or went to play outside without turning off the television, no worries! Your AI home automation system will take care of it.

Wasting energy impacts the environment and wastes money. The proper smart home helps to manage both by, automatically regulating thermostats, lighting, and water to match our lifestyles.

C. Comfort and Entertainment

The system prepare the home based on the user's situation when arriving (turn on the AC when the user is returning home from a run).

When Smart Home products anticipate a user's needs and preferences, they become invaluable to a user's life and comfort. Whether making coffee and open blinds when an user wakes up or preparing the home for a user's arrival, knowing the user's throughout their day improves the experience with products at home.

VIII. SOME LATEST SMART HOME AUTOMATION PROJECTS

A. ZIGBEE Based Home Automation

- Home Automation using ZigBee Protocol:-This paper presents a home automation system using zigbee and microcontroller. Here a PC is used for controlling the home appliances.
- Wireless Home Automation System Using Zigbee: The automation system controls the appliances wirelessly using zigbee and voice. The system has been tested and verified. 80.05% of these commands were recognized correctly.

B. DTMF Based Home Automation

- Smart homes using DTMF and AVR:-This System explains automation of homes using DTMF technology and Atmega8 microcontroller. DTMF means dual tone modulation frequency . This frequency is used for communication between controller and the appliances in the home.
- DMTF home automation without microcontroller:-Home automation can be done without using any microcontroller also. This system provides complete information about home automation without using any microcontroller.
- Home Automation using 8051:-This system uses 8051 microcontroller along with DTMF technology.

C. BLUETOOTH Based Home Automation:

- Home automation Bluetooth project Using 8051:-Home automation system uses Bluetooth technology here.8051 microcontroller plays a key role in this project. An android device is used for controlling the appliances. This device communicates with the home appliances using 8051 microcontroller.
- Android App Home Automation via Bluetooth Using PIC16F628A Microcontroller:-Here android device is communicated with the PIC microcontroller. This uses a Bluetooth app which can control maximum of 8 appliances.

D. WI-FI Based Home Automation:

- Home automation project using Wi-Fi: -This paper explains prototype implementation of new home automation system using Wi-Fi technology. This System supports a wide range of home automation devices like power, management components and security components.
- Android and Arduino Wi-Fi Control Home Devices with ESP8266 :This project show you how to monitor some data in your home precisely using Arduino Wi-Fi shield. Arduino Uno board and the system will form an autonomous solution to monitor one or more sensors in your home.
- The project RASPBERRY PI HOME AUTOMATION WITH WIRELESS SENSORS USING SMART PHONE presents a low cost home control and monitoring system. An embedded

microprocessor & microcontroller, with IP connectivity were used for accessing and controlling appliances using Smart phone app. This system doesn't require a server.

E. RF Based Home Automation:

- RF Remote Control Circuit for Home Appliances:-The proposed system controls the appliances using RF technology without using any microcontroller. RF434 MHz modules are used in this project to make wireless remote. Using this remote, we can control the appliances within the range of 100 meters.

F. Miscellaneous:

- Home automation project using Lab view:-This system discusses the approach of real-time home automation system development using the data acquisition tool of Lab VIEW. This approach is a combination of software and hardware technologies.
- The article Internet of Things Based Architecture of Web and Smart Home Interface Using GSM(Global System for Mobile) proposes architecture to enable the users to control and monitor smart devices through internet. It creates an interface between users and smart home by using GSM and internet technologies, or it simply creates GSM based wireless communication from the web server into the smart home.

IX. FUTURE

By 2012, in the United States, according to ABI Research, 1.5 million home automation systems were installed. As per research firm Statista more than 45 million smart home devices will be installed in U.S. homes by the end of the year 2018.Based on the findings of April 2017 by Zion Market Research, the Smart home market at the global market is expected to reach an enormous $53.45 billion by the year 2022 which will be quite stupendous and stunning. According to Cisco, connected home applications such as home automation, home security and video surveillance, connected white goods, and tracking applications, will represent 46%, or nearly half, of the total M2M connections by 2021.

X. CONCLUSION

AI-driven home automation system certainly offers peace of mind to homeowners as it takes care of convenience, home security, and energy efficiency. Thought to achieve a widespread acceptance, the system has to pass obstacles like the initial investment cost of such an intelligent system that comes with multiple devices. And most importantly, these systems should be highly secured as a single attempt of hacking into such a centralized system can lead to invade in privacy and loss of sensitive information.

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