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Model of Smart Home Using Broadlink IOT Devices and Google Assistant

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Abstract
This article presents a smart home model that uses IOT Broadlink devices and is associated with Google Home, Google Assistant to control devices by smartphone or voice. By installing a Wi-Fi switch or RF switch for existing electrical and electronic equipment, and using the Broadlink central controller in conjunction with Google Assistant, it allows switching from ordinary homes to Smart home, with a relatively low investment, but still to satisfy the safety and comfort standards of smart home.

Keywords: Smart Home, IOT Broadlink, Google Home, Google Assistant

1. Introduction

In recent years, as the world is gradually entering the era of internet of things, smart home has become a technology trend and a standard of modern housing. Today, the number of electrical and electronic equipment in a house is constantly increasing, the need to improve the quality of life is also more and more, the control of electrical and electronic devices to serve the needs of people is becoming more and more complex. While the combined and synchronous control of these devices still has many shortcomings, the control of these devices is automatic, or contextual, or according to specific circumstances suitable for people or remote control in an environment with many obstacles meet much more difficulties. Therefore, it is necessary to research, propose, and apply a smart home model with a minimal cost, which can be widely used, in order to solve the problem.

A smart home is a house or apartment equipped with an advanced technology system to automatically manage, control and monitor the house, in order to serve a comfortable, safe and resource-saving life. Initially, when it was first formed, smart homes were only used to control systems such as lighting and heating, but today, smart technology has developed to the point where it can control most devices in the house [2]. A model of smart home based on Wi-Fi network to control home appliances by smartphone combined with display screen and wall panel using Raspberry Pi board has been proposed in [1, 5]. While smart homes with many factors have been studied in [3] such as: smart home connection technology, smart devices for the disabled. A smart-home information management model has been built to improve device interoperability [4]. Many other fields such as security, privacy, energy saving, networking, controller, smart kitchen are also proposed [6]. Smart home system architecture based on Web Service technology applying facial recognition for security authentication is discussed in [7]. FANE firewall applied to smart-home IoT devices is studied in [13].

The smart home model using sensors on the Web Service platform is also focused on research [9]. The model uses radio frequency (RF), low energy, high gain, omnidirectional signal transceiver and energy saving for smart home is introduction in [12]. Consumption and consumption management, energy saving measures are proposed for smart home [11]. Analysis of characteristics, technology, system architecture, power grid, communication and network model for smart home are discussed in [17].

Advanced smart-home model is capable of learning, suggesting suggestions, interacting and making decisions; security and privacy; energy saving [8, 15]. CASAS smart-home model, the smart home in a box, is compact, easy to design, easy to install and full of features [10]. Smart-home model using Arduino Uno microcontroller, body temperature detector, GSM sim 900 module is used to communicate with mobile network [14, 16].

The above studies have proposed many technology models and systems of smart home, but have not paid attention to the investment costs, the level of friendliness, ease of use and suitability for households with low and middle income. This paper proposes a model of Broadlink smart home combined with Google Assistant, with minimal investment and widely application.

2. Model of Smart Home

2.1 Block diagram model

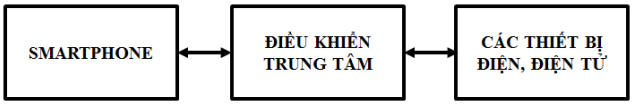


Fig 1: Model of smart home

- Smartphone block is a smart handheld device, this block is used to set up, control, manage and monitor the status of devices in the house.
- The central control block is a block of central devices, capable of connecting to Wi-Fi, learning commands and issuing IR or RF control signals.
- The electrical and electronic equipment block is the basic block of equipment in the house, capable of receiving and executing command signals from the central controller.

2.2 Model of connecting devices in smart home

The model of connecting devices in a smart home is described as shown in Fig 2. The model includes: Smartphone, Wi-Fi transmitter, central control Broadlink RM Pro Plus, infrared control center Broadlink RM4, environment control center Broadlink A1, security control center Broadlink S1C, Wi-Fi switch, Broadlink Wi-Fi socket, Broadlink RF touch switch.

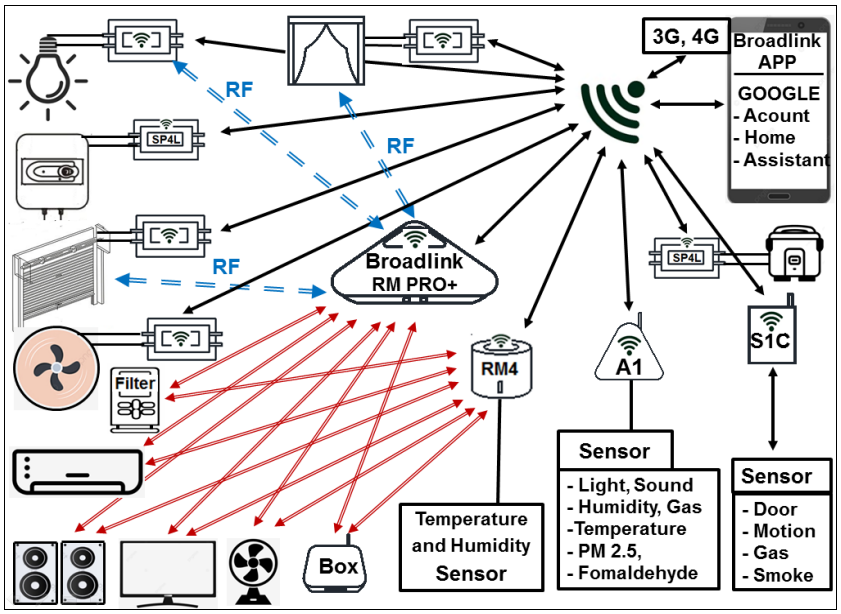
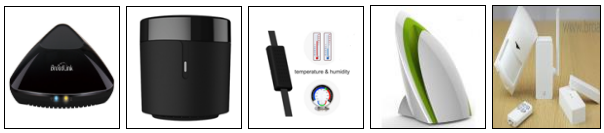


Fig 2: Model of connecting devices in a smart home

Broadlink RM Pro plus (Fig 3a) is a smart-home control center capable of learning commands and broadcasting omnidirectional IR and RF control signals.



a b c d e

Fig 3: Broadlink IOT devices

Broadlink RM4 (Fig 3b) is an infrared control center which is capable of learning commands, transmitting IR signals and wired connection to temperature and with humidity sensors.

Broadlink A1 (Fig 3d) is an environment control center, with smart sensor technology, allowing to control the living environment through 16 sensors.

Broadlink SmartONE S1C (Fig 3e) is a home security control center through motion sensors, door openings, smoke, gas...

Broadlink Wi-Fi switch, Wi-Fi socket (Fig 4a, b, c, d) is a switch that connects directly to Wi-Fi to control and respond to the status of devices in the house.

a b c d e

Fig 4: Broadlink Wi-Fi switch and socket

The Broadlink RF Touch Switch (Fig 4e) is a wall switch that replaces common mechanical switches. This switch can be controlled via GPS.

2.3 Broadlink linked Google Assistant model of smart home

The house usually includes basic function rooms such as living room, bedroom, kitchen, and bathroom. In addition, there may be other function rooms...

With the desire to build a smart home model at a basic level, universally applicable to the majority of households, therefore, the smart home model below (Fig 5) is proposed for a house with basic function rooms.

The principle of a basic smart home formation is that the house must be covered by Wi-Fi internet, each function room is equipped with an infrared control center, along with temperature, humidity sensors, Wi-Fi switches, and RF switch.

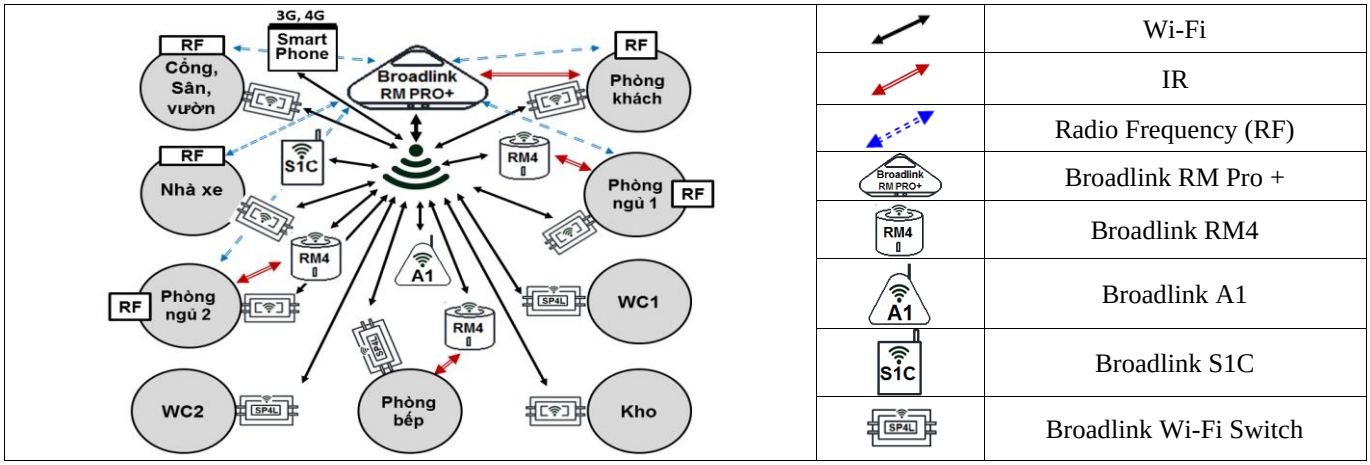


Fig 5: Broadlink linked Google Assistant model of smart home

In this model, the smartphone is installed with Google Home and Broadlink app. After installation, users need to use their Gmail account to register and authenticate their Broadlink account.

2.4 Experiment

Experiment model of the smart home (Fig 7) is implemented in a house with an area of 96.5m^2, including 2 bedrooms, 1 living room, 1 kitchen, 1 toilet and 1 parking space. IoT devices include: 1 Broadlink RM Pro Plus, 3 Broadlink RM4, 1 Broadlink A1, 1 Broadlink S1C, 5 Wi-Fi and RF switches, 3 temperature and humidity sensors.

Fig 7: Experiment of smart-home model

The total cost for the IoT Broadlink devices is quite low (about 4.6 million VND or 200 USD). Thus, Broadlink smart home has a cheaper cost of 20-100 times compared to other smart-home solutions on the market. This cost is also suitable for most households with average and low income.

2.5 Results

Experiments have confirmed that the Broadlink smart-home model is associated with Google Assistant meets the basic features of the smart home such as: water heater turning on or off, lighting lights, irrigation plants pumping from a long distance by voice, by schedule, or by context. Automatically turn off, turn on the TV in context, such as turning on the TV correctly, at 6:00 am, with the desired volume and turning off the TV at 6:55. Automatically turn on the light, when the landlord is coming home at a distance of 10m - 50m through GPS. Turn on the heater when the room temperature is below 18^{0}C and turn off the heater when the temperature is over 23^{0}C, the mist spray is humid when the humidity is below 60% and turn off the mist when the moisture content is over 70%. Turn on the air filter, turn on the ventilation fan when detecting fine dust, toxic gas and turning off the device when reaching the required index. Automatically pull curtains when it is bright. Automatically reduce volume when detecting excessive sound. Automatically warn by sound, lighting and notification on smartphones when people enter the house, when detecting gas. Automatically warn when the doors are opened. In particular, the temperature of the air conditioner is automatically control according to the desired time, for example: the temperature is set at 25^{0}C at the bedding time (22h), and at 26^{0}C after 24h, after 2 am the temperature is 27^{0}C, and turn off the air conditioner at 4h30 am. With this model, users can set up and control a lot of different devices in the house according to schedule, context, according to specific circumstances, programming or voice depending on creativity.

*** Limitations of the Broadlink linked Google Assistant smart-home model**

- There is no integrated camera.
- Only basic intelligence level is reached; the user's habits cannot be learnt.
- There is no Wi-Fi switch suitable for the stair circuit.
- The aesthetic level of devices is not high.
- Low energy saving due to the use of Wi-Fi connection.

3. Conclusion

The Broadlink linked to Google Assistant smart home model is a smart home model, basic level, handy, low price, easy to install and use. This model is feasible for households with average and low income. In particular, it is very convenient for the weak, children, people with disabilities or people who have difficulty in physical condition. With this model, users can completely control electrical and electronic devices in the family with Broadlink IoT devices and Vietnamese voice through Google Assistant virtual assistant or by automatic control programming or by context.

4. Acknowledgment

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