IOT Base Household Equipment Control Using Arduino and Smartphone

Ramli Ahmad\textsuperscript{1,2}, Baiq Andriska Candra P\textsuperscript{2}
\textsuperscript{1,2}Universitas Hamzanwadi, Lombok, Indonesia

*email: iosram81@gmail.com

Abstract. Due to the rapid development of mobile technology, especially android smartphones as a communication device and smart phone has improved a lot of developments, such as remote control that can control electronic devices. Indirectly, the use of a remote control can reduce the user's task in handling electronic equipment. This research aims to build a control system that can control electronic devices using Arduino ESP and Android based on Internet of Things (IOT). The construction of this system is expected to make it is easier for users to control electronic devices remotely. Users only provide voice commands via Google Assistant on Android, which was built to make commands to turn on or turn off electronic devices by utilizing an internet connection. The tests on the system have been done and the result show that the system can work well to turn on and turn off electronic devices. The system has a delay of (3 seconds) for each command sent by the user via an Android smartphone.

Keywords: Smartphone, Android, Internet of Things (IOT).

1. Introduction

Smart Home is technology to make a house to become intelligent and automated. Usually, that technology has automation systems for lighting, temperature control, security and many other functions \cite{1}. The Internet of Things (IoT) has been in the spotlight for the past decade. It is regarded as one of the disruptive technologies of this century\cite{2}. The basic concept of an IoT (Internet Of Things) is to IoT is rapidly growing network of heterogeneous devices and objects, which are uniquely addressable within the network and capable of identifying and sharing information with or without human interaction\cite{3}. IoT become more relevant to the practical world largely because of the growth of mobile devices, embedded and ubiquitous communication, cloud computing and data analytics \cite{4}. Considering the rapidly increasing energy costs, reduced energy consumption has economic benefits but it also pays on amacrosopic level, where national and international environmental goals and laws have to be fulfilled. Realizing \cite{5}. Devices in such IoT networks will typically operate based on battery power sources, and hence, energy efficiency is naturally of utmost importance in device management \cite{6}.

In general, users do manual control of household electronic devices such as lights, fans and other electronic equipment. However, if the number of electronic equipment such as lamps, fans and other electronic equipment in large quantities will certainly not be effective to turn on or turn off the equipment especially when the user is not at home. Therefore it is necessary to have a controller such as a smartphone that has an Android operating system to control electronic equipment at home easily from a distance. By implementing an IOT (Internet of Things) system at home, household electronic
equipment will be monitored and controlled by users remotely from a communication channel that is through the internet network with an android smartphone[7]. The concept of IoT (Internet of Things) was built on household equipment so that home users feel comfortable in controlling and monitoring electronic equipment at home when the user or homeowner is not at home. The Gardener research report forecast that the IoT contrivances will be incremented by a maximum of 24 billion IoT-enabled devices, and Industrial Development Corporation (IDC) project will grow by $1.7 trillion in economical IoT market [8]

2. Method
The method used in this research is an experiment (trial), the purpose is to create a device that can control household electronic equipment in a house, so that it can be controlled using a smartphone from a distance. This experiment was carried out on system design, both in hardware design and software design. IoT home gateway as the media path that connects multiple wireless devices wirelessly and provides automatic addressing to devices connected to the home gateway, where all devices connect to the smartphone as an interface medium for controlling and monitoring electronic devices [9]

The Materials are used in this research are as follows on Table 1:

| No | Material       | Quantity | Function                                                                 |
|----|----------------|----------|--------------------------------------------------------------------------|
| 1  | ESP8266 Arduino | 1        | The main components of the control system                                |
| 2  | Relay 4 channel | 1        | Switch ON/OFF                                                            |
| 3  | LED lamp       | 1        | As a notification whether ESP is connected to the internet or not         |
| 4  | PCB board      | 1        | Tools design                                                             |
| 5  | USB cable      | 1        | To link ESP arduino to DC source                                         |
| 6  | Resistor       | 3        | Inhibiting electric current                                              |
| 7  | Buzzer         | 1        | Voice Notification                                                       |

2.1 Work Steps
There are several steps taken to complete this research so the results obtained are in line with expectations:

2.1.1 Literature Study
Literature Study is conducted to study various sources of references or theories related to the research “IOT Base Household Equipment Control Using Arduino and Smartphone”

2.1.2 Tool Design
The IOT (Internet of Things) is adjusted to the requirements criteria such as software features which include how many electronic devices will be controlled via a Smartphone.

2.1.3 Software Feature Design
This section is about how many devices will be controlled, whether only one device or even more.

2.1.4 Analysis
This test is done to ensure that the equipment that has been built meets the criteria as expected.

Flow diagram from that steps above also shown on Figure 1:
Figure 1. Flow Diagram Of Working Steps

The program algorithms in the software that will be embedded in Arduino ESP, is shown in the following flowchart

Figure 2. Arduino algorithm
3. Result and Discussion

The final stage of the application process on the system that has been build, at this stage the system is ready to operate and can be said as an embodiment of the system that has been designed. Beside hardware, in building this system also uses the main program applications namely IO Adafruit as a webserver, and IDE Arduino as a tool for programming and configuration of the ESP8266 Arduino as microcontroller.[10]

3.1 Controller Display on Android

In this section is a display or user interface control system of electronic devices that have been installed on an Android smartphone. can be seen in figure 3:

![Figure 3. Controller Display](image)

3.2 Testing Result

Here are the results of commands that have been carried out through Google Assistant where light 1 is on and indicator light relayed 2 which is red lights up as seen on Figure 4:

![Figure 4. First Lamp is On](image)
Testing has been carried out on the application has been running as expected, the following is the measurement of the delay time for each data inputted by the user, as shown on Table 2:

| No. | Electronic Equipment | Initial condition | Condition by control | Information  |
|-----|----------------------|-------------------|-----------------------|--------------|
| 1.  | Lamp                 | The lamp is off   | The light can be controlled remotely and light up | Success      |
| 2.  | Fan                  | The fan is off    | The fan can be controlled remotely and it’s on | Success      |
| 3.  | Blander              | The blander is off| The blander can be controlled remotely and it’s on | Success      |
| 4.  | An Iron              | The iron is off   | The iron can be controlled remotely and it’s on | Success      |
| 5.  | Water machine        | The water machine is off | The water machine can be controlled remotely and it’s on | Success      |
| 7.  | Magic com            | The Magic com is off | The magic com can be controlled remotely and it’s on | Success      |

4. Conclusion
With the construction of a remote control system for household electronic devices using Android and an esp arduino as microcontroller based on IOT, it can make it easier for homeowners or user to control electronic devices at homes using Android smartphones that have been connected to the internet. This electronic device control will not work if there is no internet connection and WiFi module. Internet connection and signal strength at the closest access point greatly affect the control of lights in this application. The control delay for each data send is about 3 seconds.

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