

SMART HOME AUTOMATION USING INTERNET OF THINGS (IOT)

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Abstract

If one discusses about a smart system using Internet, this type of control system is named Internet of Things (IoT). Internet of Things (IoT) is a concept that includes everyday objects. IoT is able to connect a large number of devices around the world. Different types of sensors are used to control smart systems. The inputs of the sensors are evaluated by a computer and outputs of the system act as actions to do something which will be benefit of humans.

For example, a security camera system can be used as a distance to monitor the home, and thanks to alerts created by sensors, moving objects around the home can be detected immediately. By creating an instant alarm via camera system, malicious aliens approaching home can be disturbed. Evidence can be generated by remote recording. Zooming in the camera allows a clear view of the moving subjects. You can define which areas in the view of camera need to detect moving objects.

IoT technology is used in real time to collect and detect human daily life data from different places.

The Internet of Things (IoT) is the future of technology that can make our lives more efficient.

This article is about a low-cost intelligent home automation system, all appliances, and electronic devices can be easily controlled through the mobile application. An experimental set was established to see how some devices can be controlled using Internet. For practice set an Arduino Mega 2560 board, various sensors and modules were used. In this paper, the parts of the set are explained and the control system is analyzed.

Keywords: Arduino Integrated Development Environment (IDE), home automation, Bluetooth, Android, internet of things (IoT).

1. Introduction

The Internet of Things (IoT) is a necessary platform used for controlling and monitoring physicals and electronics devices remotely. IoT are used in many applications such as home automation, health, security, and home appliances such as washer, oven, air conditioner, TV, freezer, lamp, etc. All devices are used remotely and are monitored in real time [1]. IoT Technology makes life easier and intelligent for humans. Smart home automation solutions make life easy for individuals and one can control IoT system using his or her personal smartphones Figure 1 [2].

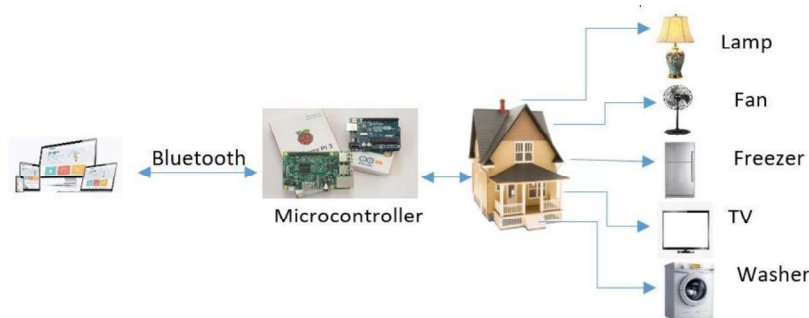


Fig. 1. Architecture of Smart Home Automation System

This system was previously used many additional devices to achieve its goals, but it made the cost unfeasible. Author Mahesh presented a GSM-based mobile application control system. In this system use of Microcontroller ATtiny2313 was not powerful and because of two relay modules it was not possible to add more than two appliances [3].

Thanks to Arduino the devices are connected to the Arduino Bluetooth board, and wireless communication is established between the mobile phone and the Arduino Bluetooth board [4]. A lot of research is done on home automation using Wi-Fi systems [5].

Blynk is an application that easily understands the steps of managing equipment online [6]. The proposed system with a convenient interface and a powerful Arduino Mega 2560 microcontroller and an 8-relay module can add more devices and can easily redesign the application from the inventor of the MIT app.

2. System Description

The system contains two sections, namely software and hardware components. A software has developed for controlling of electronic devices in mobile application [7, 8].

2.1. Software Requirements

- Arduino IDE:

It is an open source platform that uses code for Arduino Mega 2560 board, Arduino sensor and modules. In Figure 2, Integrated Development Environment Download main page is shown where you can download to necessary software (Arduino.cc) [9].

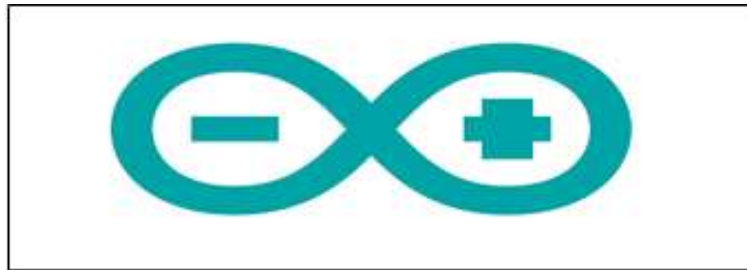


Fig. 2. Arduino IDE (Integrated Development Environment)

- MIT App Inventor:

App Inventor is an open source web application which creates Android apps for mobile phones (ai2.appinventor.mit.edu) as shown in Figure 3 [10].



Fig. 3. MIT App Inventor

2.2. Hardware Requirements

The proposed system is made up of multiple modules as shown in Fig 4.

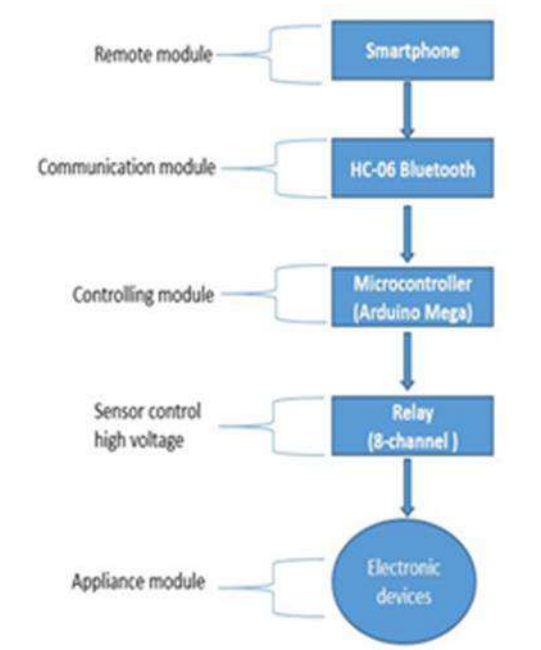


Fig. 4. System's modules

- Remote Module:

This module uses an Android system for the smartphone to interact with the proposed system.

- Communication Module:

This module makes a bridge with the Arduino Mega 2560 through the Bluetooth module, The Bluetooth ranges between 10 and 15 meters as shown Figure 5.



Fig. 5. HC-06 Bluetooth Module

- Controlling Module:

The Arduino Mega 2560 is a board based on the ATmega2560 microcontroller, Provides 54 digital pins that support either 0 (0Volts) or 1 (5Volts) I/O operations, 14 pins can be used as PWM outputs. 16 Analog pins that support input values only and the range between 0 (0Volts) and 1023 (5Volts) as shown in Figure 6.



Fig. 6. Microcontroller (Arduino Mega 2560)

• Sensor Module:

An 8-channel relay (5V) module is used for turning electronic devices ON/OFF, it is used to control high voltages with a low voltage by connecting it to an Arduino Mega 2560. Support control of 10 Amps 30 Volts DC and 10 Amps 250 Volts AC signal as shown in Figure 7.



Fig. 7. 8-channel relay (5V) module

• Appliances module:

Several electronic devices are used for experimental testing of the proposed system. For example, air conditioner, fan, TV, freezer, lamp, and washer to ensure the proper functioning of the system. User is able to control all devices easily and interactively (Figure 1).

2.3. Hardware Components Required

The hardware modules of the proposed system is shown in Figure 8.

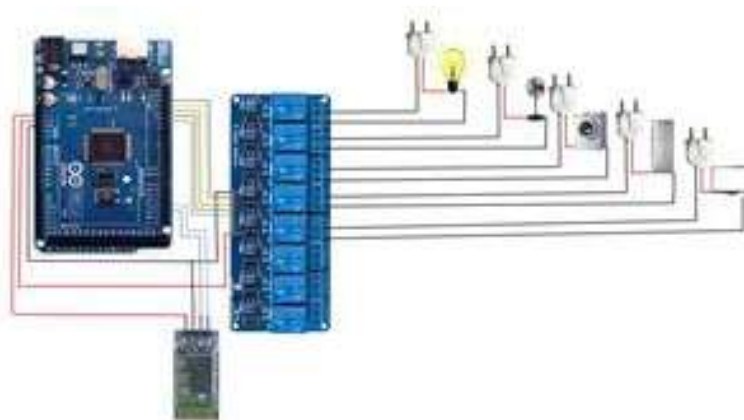


Fig. 8. Circuit Diagram

The proposed system can be easily installed in the home or in the institutions. Mega control devices that use a sequence compatible with Arduino and has 8 channels to control 8 devices

separately; Each channel passes up to 10A of current. Table 1 shows the Arduino Mega 2560 digital pins connected to the relay channels to control 8 devices.

The HC-6 Bluetooth module has 6 pins [11]. Before uploading the code to the Arduino Mega disconnects the HC-06 module as it shares the TX and RX pins and it will interfere with the load. Table 2 shows pin connection between Bluetooth and Arduino board.

Table 1. Pin connection between 8-channel relay and Arduino mega board

8-Channel relay	Arduino Mega 2560	Appliances
IN1	PIN(13)	lamp
IN2	PIN(12)	fan
IN3	PIN(11)	washer
IN4	PIN(10)	freezer
IN5	PIN(9)	TV
IN6	PIN(8)	For new device
IN7	PIN(7)	For new device
IN8	PIN(6)	For new device

Table 2. Pin connection between HC-06 Bluetooth and Arduino mega board

HC-06 Bluetooth	Arduino Mega 2560
STATE	-
RXD	TX0
TXD	RX0
GND	GND
VCC	5V
EN	-

In the first step, the application must be uploaded into the smartphone. Through Bluetooth the connection between mobile device and the system is done. It is possible to control all devices in the range of 10 to 15 meters by pressing the buttons on and off. Each time an application is started, the Arduino board connects to a smartphone via Bluetooth connectivity using serial communication protocol. If a user presses the power button, the lamp will turn on automatically; the status will change whether the ON or OFF data is sent, such as "A". The transmitted data will be taken by the Bluetooth module. Figure 10 below is a screenshot of a GUI application.



Fig. 10. Android Mobile application

3. Conclusion

In this study, a mobile Android application is developed using MIT App Inventor 2 to explain how a smart home automation system can be set and controlled. All connections are done via Bluetooth. Thanks to Arduino, a smart home automation system can be established cheaper and easily. This type of the automation system will especially help elderly people, disabled people, and people who have Parkinson's diseases, etc. On the other hand, the people will enjoy living in a home where smart automation systems are used.

4. References

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