



Home Automation System using Raspberry pi and Arduino board

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Abstract – In current scenario so many innovative gadgets are designed and developed which makes the human life easy. Home automation is also one kind of innovation through which one can control home appliances easily through smart phone. There are so many products available in the market that allow us to control the appliances automatically using board like raspberry pi or Arduino board. This paper represents the difference between raspberry pi and the Arduino board also the implementation of home automation system using these boards.

Keywords – Home automation, Raspberry pi, Arduino.

I. INTRODUCTION

Home automation is "The Internet of Things"...The way that all of our devices and appliances will be networked together to provide us with a seamless control over all aspects of our home and more. Home automation has been around from many decades in terms of lighting and simple appliance control, and only recently has technology caught up for the idea of the interconnected world, allowing full control of your home from anywhere, to become a reality. With home automation, you dictate how a device should react, when it should react, and why it should react. You set the schedule and the rest is automated and based off of your personal preferences thus providing convenience, control, money savings, and an overall smarter home. Home automation can also alert you to events that you might want to know about right-away while you are gone like water leaks and unexpected access to your home, or any part of it. At any time, you can grab your iPhone, Android device or other remote control and change the settings in your house as desired [1].

Home automation can include the scheduling and automatic operation of water sprinkling, heating and air conditioning, window coverings, security systems, lighting, and food preparation appliances. Home automation may also allow vital home functions to be controlled remotely from anywhere in the world using a computer connected to the Internet. Besides the functions already mentioned, remote control can be extended to telephones and answering machines, fax machines, amateur radios and other communications equipment, and home robot s such as automatic vacuum cleaners [2].

The fundamental components of a well-designed home automation system include a computer (or computers) with the appropriate programming, the various devices and systems to be controlled, interconnecting cables or wireless links, a high-speed Internet connection, and an emergency backup power source for the computer, its peripherals, and the essential home systems [2].

There are so many ways to implement the home automation system. But in this paper we are showing implementation of home automation system via two devices.

- A. Home automation system using Raspberry pi
- B. Home automation system using Arduino board

Let us first of all see the brief introduction about Raspberry pi and Arduino board.

II. Raspberry Pi vs Arduino

- A. *What is Raspberry pi*

The Raspberry Pi is a series of credit card-sized single-board computers developed in the United Kingdom by the Raspberry Pi Foundation with the intent to promote the teaching of basic computer science in schools and developing countries. The original Raspberry Pi and Raspberry Pi 2 are manufactured in several board configurations

through licensed manufacturing agreements with Newark element14 (Premier Farnell), RS Components and Egoman. The hardware is the same across all manufacturers. The firmware is closed-source [4].

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games [3].

The Raspberry Pi has the ability to interact with the outside world, and has been used in a wide array of digital maker projects, from music machines and parent detectors to weather stations and tweeting birdhouses with infra-red cameras [3].



Figure 1. Raspberry pi

Application of Raspberry pi

- Media streamer
- Arcade machine
- Tablet computer
- Home automation
- Internet radio
- Controlling robots
- Cosmic computer

B. What is Arduino

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE that runs on your computer, used to write and upload computer code to the physical board [5].

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package[5].



Figure 2. Arduino Uno [5]

The Uno is one of the more popular boards in the Arduino family and a great choice for beginners.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide [6].

III. IMPLEMENTATION

As we have discussed earlier home automation system can be implemented using various ways. But here we are going to explain it via using raspberry pi and using Arduino board.

A. Using Raspberry Pi

Monika Patel , Mehul Jajal, Dixita vatiliya have implemented home automation using Raspberry pi.

Figure 3 shows the basic block diagram of the system. With the help of this system we can monitored and controlled the various equipment that are connected to the relay circuit via the input from raspberry pi model as well as from the WEBIOPI. Whenever the system is turned on, the current lighting data of the home are read and written to the data base and then transferred to the user interface. So, one can easily know the current situation of rooms and change in the state of the lights [8].

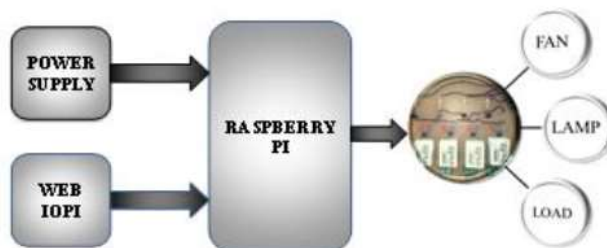


Figure 3. A block diagram of home automation using raspberry pi [8]

A Relay is electrically operated switches, which allow low power circuits to switch a relatively high voltage or current on/off. For a relay to operate a suitable pull in and holding current should be passed through its coil. Relay coils are designed to operate from a particular voltage often its 5V or 12V. The function of relay driver circuit is to provide the necessary current energize the relay coil, when a LOGIC 1 is written on the PORT PIN thus turning on the relay. The relay is turn off by writing LOGIC 0 on the port pin. In our system four relays are used for device control [8].

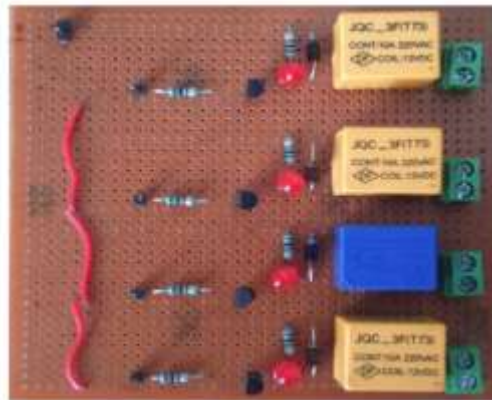


Figure 4. Relay circuit [8]

B. Using Arduino Uno

Bader M. O. Al-thobaiti, Iman I. M. Abosolaiman, Mahdi H. M. Alzahrani, Sami H. A. Almalki, Mohamed S. Soliman have implemented home automation system using Arduino uno board. The core of the home automation system consists of two main hardware components: the PC home server and the Arduino uno microcontroller board. The architecture of the system developed is shown in figure 5. A PC home server hosts the Matlab-GUI platform management and Arduino uno control algorithm that enables the user to access the home appliances through cellular phone using Wi-Fi communication. It communicates with the Arduino Uno microcontroller board through USB data transfer cable. A number of appliances and sensors are connected to ports of the microcontroller board. The home Appliances can be monitored and accessed remotely by user cellular phone [7].

In this proposal they have designed two operating modes. The first one is a manually–automated mode in which the appliance is monitored and accessed manually using the cellular phone. The proposed flow chart of this process is shown in figure 6. In this case, the appliances detection status is performed by the Arduino Uno. The user can select the required appliances using Matlab-GUI button. The selected appliances can be ON/OFF according to the suitable decision [7].

The other mode is a self-automated mode. In this case the microcontroller accesses the appliance automatically without returning back to the user decision. The user can monitor the action only. Figure 7 illustrates the process of temperature self-automated control system as an example of this operating mode [7].

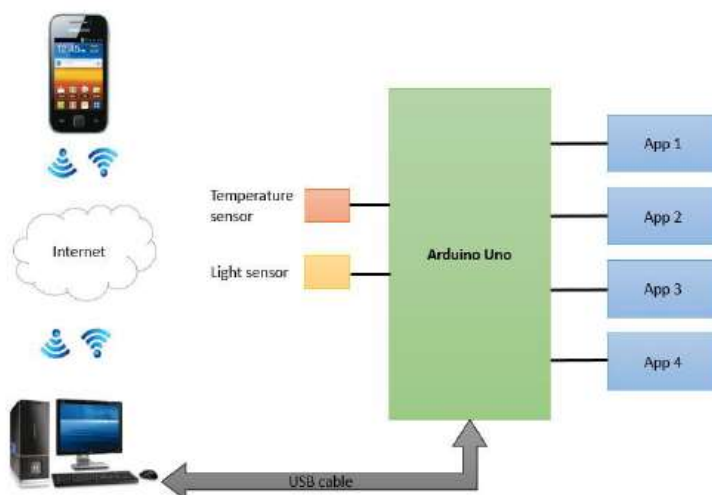


Figure 5. Home Automation Architecture proposed by Bader M. O. Al-thobaiti and team [7]

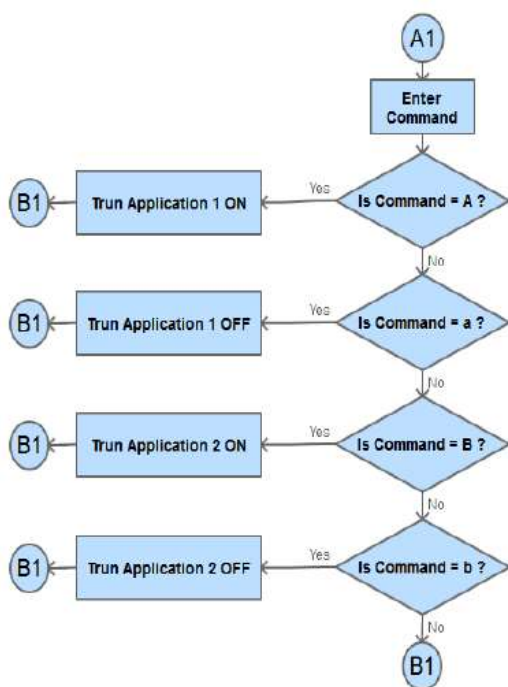


Figure 6. Home automation system process manually-automated mode [7]

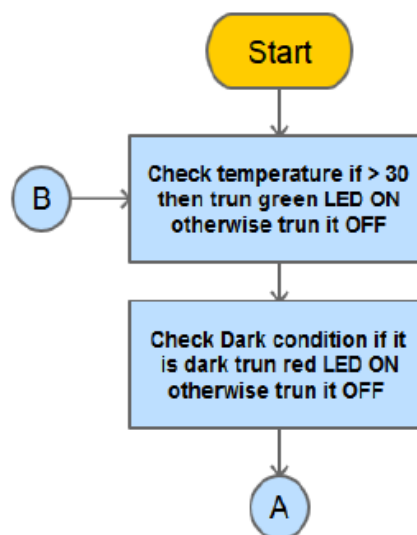


Figure 7. Home automation system process self-automated mode [7]

IV. CONCLUSION

In this paper clearly explain the actual fundamentals of raspberry pi and Arduino board. Also the difference between them. And how it can be used to make home automation system.

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