Home Appliance Manager via IoT

Chukwudi Christian Okolo, Okwuchukwu Ogechukwu Chukwu, Vincent Chijindu, Juliet Olisa
Department of Electronic Engineering, University of Nigeria, Nsukka
Email: christianokolo14@gmail.com; okwuchukwu.chukwu@gmail.com; vincent.chijindu@unn.edu.ng; ewuziejuliet@gmail.com

Abstract- Energy and security are essential needs of every home. Saving energy cost is a function of appliance management and efficiency. However, home appliances are ineffectively managed in many homes due to human factors. Leveraging on the capability of devices to be integrated and unitary controlled from a platform, we proffer a solution to these challenges via the Internet of Things, IoT. The system is designed in three modules: The home environment, created for appliance signal collation and updating of the real-time database; the network communication layer, configured for sensor and control signals transmission; the remote environment, created for appliances integration, warning alert setting and receiving, and control signal generation. The achieved design is simple and responsive, with an average time lag of 4 sec. The real-time testing is a function of network coverage and signal strength at remote access location.

Keywords: Arduino Uno, Firebase, Java, Android App, Home Automation

1 INTRODUCTION

Internet of Things (IoT) is a world, where real, virtual, and digital environments combine to create a smart environment, which makes life easy. Due to the advancement in computer and communication technology, the trend is more towards the automation of most of the activities, which are needed, in a day-to-day activity with very less human intervention. The enrichment of IoT technology is revolutionizing enormous sectors such as energy efficiency, healthcare, automation of home and industry, financial services, nanotechnologies and so on [1]. Rapid change in the environment has resulted to a huge increase in electricity demand. This enormous demand seems overwhelming for the traditional grid, which makes it seem unreliable, unsustainable, and inefficient. Moreover, 65% of produced energy is wasted during production, transmission, and distribution in a conventional home [2]. To this end, energy efficiency is becoming highly important in our industries and in residential sectors. Monitoring and controlling the increasing number of sensors and actuators we integrate into our environment will help us manage energy efficiently. To solve the issue, the concept of home appliance manager via IOT is proposed. Monitoring energy usage in our homes can be daunting but with automation you can achieve the "smart home" you desire, which arises when you connect the home appliances, you wish to monitor automatically to the internet.

2.1 RELATED WORKS

2.1.1 HOME APPLIANCES POWER MANAGEMENT SYSTEM

This work proposed a system that consists of different modules that are coordinated by the microcontroller. It provides the user with the ability to set different parameters to protect and regulate voltage and power level [3]. However, users have limited control over their appliances as the devices can only be regulated physically and not remotely.

2.1.2 POWER MONITORING AND CONTROL FOR ELECTRIC HOME APPLIANCES BASED ON POWER LINE COMMUNICATION

This work proposed a system that controls and monitors home appliances through domestic power lines. They described a PPCOM (PLC Power- Controlled Outlet Module) which

integrates the multiple AC power sockets, the power measuring module, the PLC module, and a microcontroller into a power outlet to switch the power sockets on/off and to measure the power of plugged-in electric home appliances [4]. Though scalable, this system is expensive to implement.

2.1.3 REAL TIME ENERGY MONITORING AND CONTROLLING SYSTEM BASED ON ZIGBEE SENSOR NETWORK.

This work proposed a system that consists of a wireless sensor network and an intelligent home gateway. Wireless sensors are used for sensing and transmitting electricity data and remote monitoring and control of home appliances are provided to users through the intelligent home gateway. It continually senses and updates electricity data to provide real-time electricity consumption information to users. Users can remotely monitor and control household appliances to save energy [5].

2.2 PROPOSED SYSTEM FEATURE

The proposed system will implement a low cost, novel and reliable Arduino based home controlling and monitoring system using Wi-Fi and android smart phone. The architecture is divided into three layers: Home Environment, Network Communication and Remote Environment. Remote Environment represents users who can access the system on their Smart phone app using Wi-Fi. Home Environment consists of Home Network and the devices. The primary function of the Home Network is to communicate between the user and devices. The main component of the Home Network is Arduino and Wi-Fi. The main task of the Arduino is to manage, control and monitor system components that enable hardware interface modules to successfully execute their assigned task. Hardware interface modules are directly interfaced with sensors. It controls energy management systems like lights and fans. For monitoring Home Environment, the system supports sensors such as temperature sensors. The Network Communication layer serves as the interface between the Home Environment and the Remote Network. Its main function is to query the database with the data received from other layers.

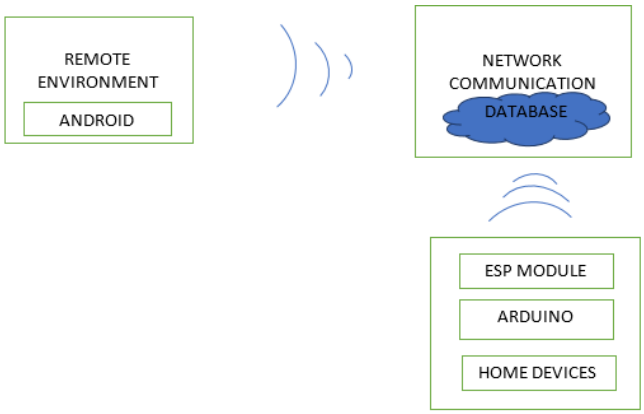

Fig 1: Block diagram of the proposed system

3.0 METHODOLOGY

The methodology adopted in the design of this work is the top-down design method. This process involves the designing of the various subsystems and integrating them to perform the desired function. This project is carefully segmented into three modules: The Home Environment, The Remote Environment and The Network Communication.

3.1 HOME ENVIRONMENT

This is the hardware specification, which consists of the relays, transformers, transistors and resistors. The system's hardware is designed to effectively contol the switching of the home devices. The system is expected to switch ON the devices when the arduino receives a high signal and also switch OFF the devices when the arduino receives a LOW.

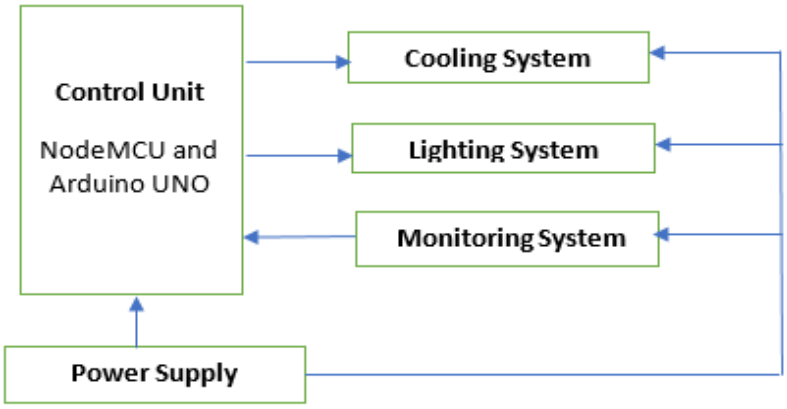

Figure 2: Block diagram of the hardware system

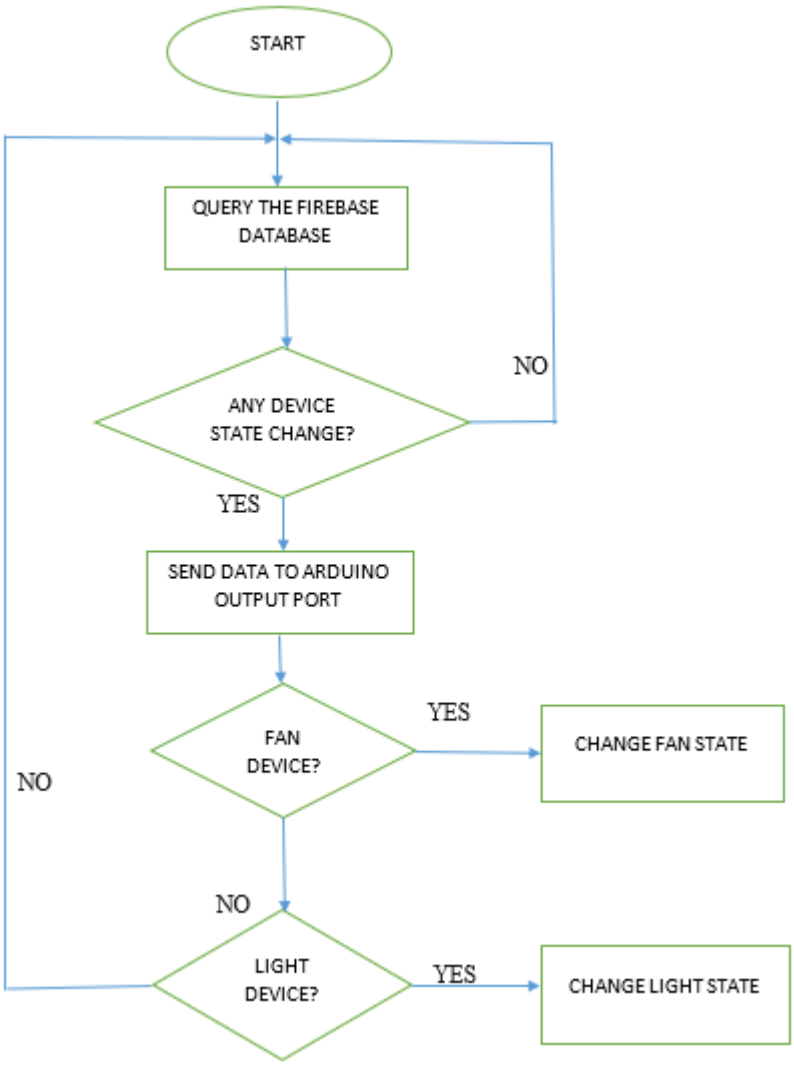

Fig 3: Hardware control system flow chart

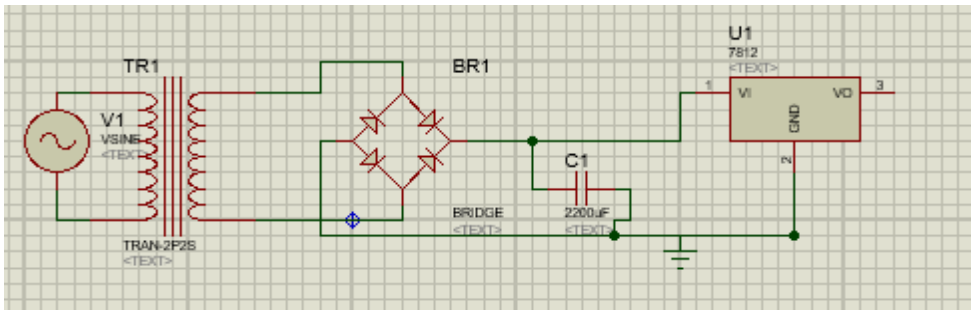

Fig 4: Power supply unit

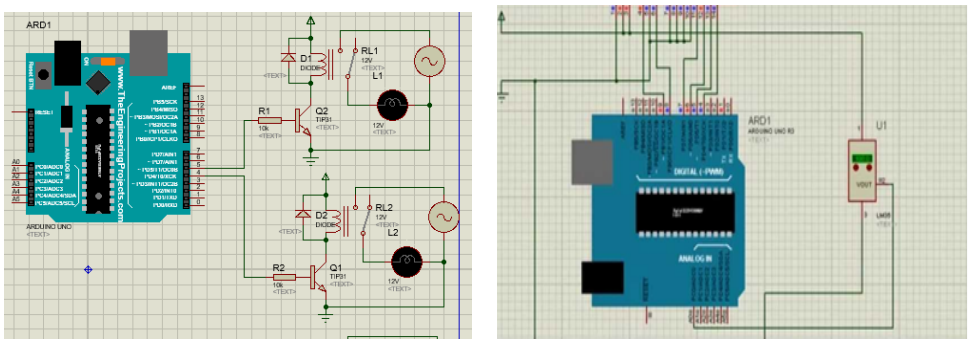

Figure 5: Switching subsystem circuit and sensing unit diagrams

3.2 NETWORK COMMUNICATION AND REMOTE ENVIRONMENT

This was designed to conveniently control the network environment. It is the android app and firebase cloud database, which gives the homeowner the ability to control his hardware devices remotely.

4 CONCLUSION

Considering all the systems analyzed, this paper presents the features for an ideal home appliance manager via Internet of Things. This energy management system gives the user capacity to control her home appliances (light bulb and electric fan) from any remote location through the android app. The home appliances are connected to the central controller (Arduino microcontroller) via wired method.

Further scope for the system involves interfacing the system with more sensors. This will increase the number of devices monitored in the home, which in turn increases the amount of energy saved. This system can also be extended to offices and bigger institutions.

Figure 6: Software block diagram

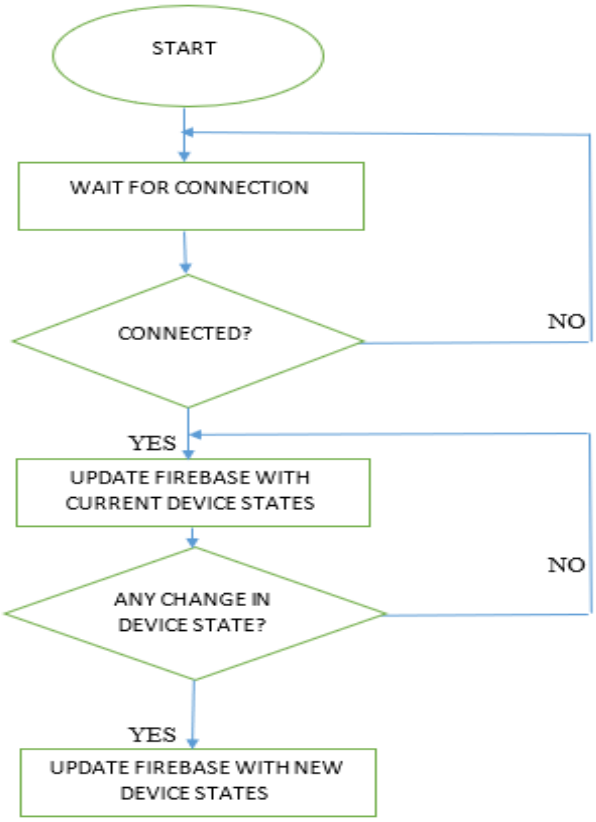

Fig 7: The software flow diagram

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