Internet of Things based Home Automation System

United International University

Computer Networks Lab Project

Final Report

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Introduction

The Internet of Things (IOT) is a network of interconnected computing devices, machines, or items that have unique IDs and the ability to transfer data via a network or the Internet without the need for human interaction. Today, the Internet of Things (IoT) has a plethora of applications that make life easier. A smart home (SH) is an Internet of Things (IoT) application that allows users to remotely control and monitor home appliances. Making an IoT product entails connecting any physical thing to the Internet or a local network in order to gather and share data and conduct some physical action based on that data. A user interface, hardware elements such as actuators and processors, backend software, and connectivity make up an IoT prototype. The user interface could be a smartphone app or a web frontend. In IoT systems, the processor unit is usually a microcontroller (NodeMCU), which is in charge of processing data and running software stacks that are connected to a wireless device. The user interface is connected to the backend via connection, and the backend is connected to the hardware via connectivity. The business logic and data storage are handled by backend software. The microcontroller is the most important component of an IoT-based home automation system. The main microcontroller in this project is a node microcontroller unit (NodeMCU) Wi-Fi-based controller board, which is an open-source platform for IoT applications. NodeMCU is primarily used to collect data from sensors and transfer it to an IoT server. Furthermore, this microcontroller gets commands to do specified tasks from users via smartphones/laptops. NodeMCU is made out of a physical programmable circuit board that works similarly to an Arduino or Raspberry Pi. The Arduino software, which is an integrated development environment (IDE) for writing and uploading instruction codes to the microcontroller, can be used to program the NodeMCU. The use of gadgets to access and control all home appliances and sensors is an advanced kind of SH automation system. The most often used devices are designed as mobile apps for smartphones running Android/iOS operating systems or as web-based dashboards coupled with open-source IoT platforms. When data from sensors is uploaded to IoT cloud computing servers, it is collected and processed to provide valuable information for solving specific requirements. All of the data can be utilized to illustrate reading patterns as graphs, highlight potential problems, and make recommendations or alert the user. IoT has the potential to generate new innovation

concepts that can be used to design SHs that give intelligence, comfort, safety, and a higher quality of life.

Related Works

Misbahuddin, J. A. Zubairi, A. Saggaf, J. Basuni, S. A-Wadany and A. Al-Sofi proposes an IoT based traffic management solutions for smart cities where traffic flow can be dynamically controlled by onsite traffic officers through their smartphones or can be centrally monitored or controlled through Internet. They have used the example of the holy city of Makkah Saudi Arabia, where the traffic behavior changes dynamically due to the continuous visitation of the pilgrims throughout the year. Therefore, Makkah city requires special traffic controlling algorithms other than the prevailing traffic control systems.

S. Kumar and S. R. Lee propose a low-cost Smart Living System, which uses Android based User Interface for control of home appliances. Connection to the smart living system can be made from the designed app via Bluetooth or internet connection. They also integrate home security and alert systems.

A. Mohammed, A. Seeam, X. Bellekens, K. Nieradzinska and V. Ramsurrun proposed a smart wireless wristband. The potential of innovative gesture based interactivity with connected lighting solutions is reviewed. The solution is intended to offer numerous benefits, in terms of ease of use, and enhanced dynamic interactive functionality. A comparative analysis will be carried out between this work and existing solutions. The evolution of lighting and gesture controls will be discussed and an overview of alternative applications will be provided, as part of the critical analysis.

E. Ronen and A. Shamir propose a new taxonomy of attacks, which classifies them into four broad categories. The most interesting category (which we call functionality extension attacks) uses the designed functionality of the IoT device to achieve a totally different effect. To demonstrate this type of attack, they consider the case of smart lights (whose original functionality is just to control the color and intensity of the lights in a particular room) and show how to use them to achieve unrelated effects.

Problem Statement

To successfully design, develop, and simulate an IoT-based Home Automation System (HAS) utilizing NodeMCU, an open source IoT platform, allowing full management of all system loads from anywhere in the globe via a public web application with an internet connection. Home Automation allows us to operate devices in our houses from anywhere using a mobile device. Home automation is more correctly linked with homes in which practically everything is connected to a remotely controllable network, from lighting, fans, and electrical outlets to heating, cooling, and ventilation systems. This may also include any alarm systems, all doors, windows, locks, smoke sensors, security cameras, and any other sensor that may be related to it from a home safety standpoint**.** We will build a project in which we will control the light and fan over the internet. In other words, we'll use smart devices to turn lights and fans ON and OFF remotely.

Possible Outcome

We will be able to manipulate light from far in this project. Android phones, laptops, and other smart gadgets are examples. Let's pretend that someone neglected to turn off the light in his room. However, the individual is no longer present in the room. In this situation, the individual will be able to turn on or off the light using the Wi-Fi network as needed.

Proposed system and architecture

The system's core principle is to control home over internet. The database will be stored in a server along with the process. The system can be divided into its hardware and software components. The hardware components consist of a Relay Module, ESP8266 connected with lights, fans, electrical devices and power supply and a server which will wirelessly connect with the ESP8266 and paired smartphones to send and receive data. The block diagram illustrates the connections among the physical components**.**

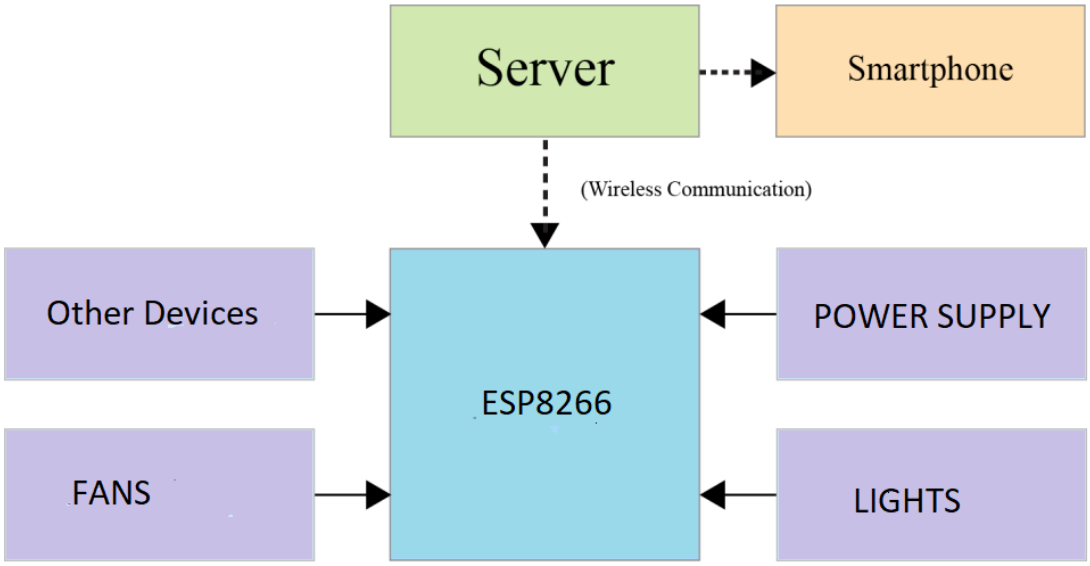

Fig 1: Block diagram of system

The software components consist of the logic used in the Relay Module and ESP8266 to take input and show the output specifically controlling the devices.

Experimental Setup and Results

For the experimental setup we have used the CISCO Packet Tracer to implement the prototype system. Here we used the home gateway, Appliance, Speaker, Fan, Light and AC components to configure the prototype.

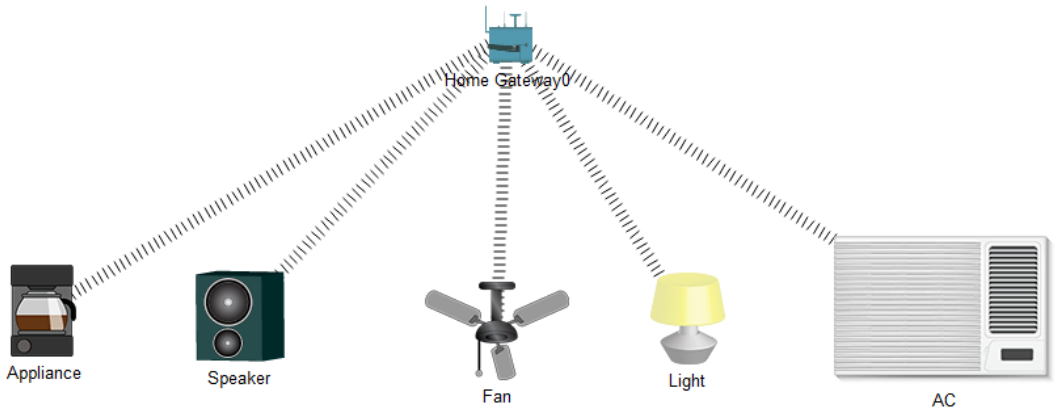

Fig 2: Prototype System in Cisco Packet Tracer

We have used similar logic described in the proposed architecture to develop and test the prototype. The home gateway acts as the server in this prototype and sends the outcome to the door. All the sending and receiving of the data is done wirelessly through the home gateway.

The outcome of this is like this in the following figure (3), while switch is active, we see that the specific LED is on.

Fig 3: Outcome showing led on from app signal

Conclusion and Future Work

This paper is unique in that it achieves a successful yet simple simulation of a complete HAS utilizing commercially accessible components and raw materials at low prices, as well as design and implementation techniques from Electrical and Electronics Engineering. The system automates four distinct devices/loads via a phone app that can be viewed via an internet connection from anywhere in the world. IoT has brought about a set of new technical advancements in our daily lives, allowing us to simplify and improve our lives. These devices can be made more cost-effective by utilizing NodeMCU and the IoT platform. Furthermore, it will give considerable user ease by allowing users to control devices from a distance. The system has been made platform neutral by using a web page or an application.

For future work we plan to build a system for the user which can monitor his electricity usage as well as the status of his device and receive notifications as needed. As home automation advances, fully automated smart homes will undoubtedly become a reality in the coming years. Smart homes are appealing to a wide spectrum of individuals all around the world due to its user ease. Devices can connect with each other as automation and IoT become more prevalent. This will aid in the development of new and smarter cities. Cities that is free of pollution, traffic accidents, and other issues. Agriculture can also benefit from the proposed system. The various equipment used in the field can be controlled by a device from any remote location.

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