Implementation of Home Automation with Thingspeak Cloud

Dalli Sai Suresh, Sivah Akash

Abstract— Internet of Things or IoT is a recent ongoing revolution in the world of Technology. It involves connecting physical devices to the Internet so that they can perform tasks and be controlled remotely. Most of these devices are connected wirelessly and have greatly reduced human effort. They have led to improved functionality for ordinary appliances and devices which either required repetitive human effort or continuous human control for the device. An extension of IoT is Home Automation, where these IoT devices are used to give smart functionality to certain elements in the home. The proposed system makes use of an Arduino Uno, that forms the basis of the home automation system and can sense the number of occupants in the room with the help of Passive Infrared (PIR) sensors and automatically switch the lights ON/OFF based on occupancy. It uses an ESP8266 module allows Arduino to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes commands. Further, the system also sends data to the ThingSpeak cloud for data analysis.

Index Terms— Arduino, ESP8266, Home Automation, Internet of Things, IoT, Passive Infrared sensors, Smart Homes, ThingSpeak

1 Introduction

Internet of Things(IoT) is a direct result of the ongoing digitization of the World. It is a network of smart devices embedded with sensors and other electronics to let them communicate with each other or more generally, with the Internet.

These devices are generally everyday objects like Thermostats, Door Bells and Traffic Signals, which give some extra functionality when connected to the Internet, thus making them accessible from anywhere. This provides convenience, cost savings and smartness to otherwise isolated devices as human effort is reduced. Some of them can also sense the environment and then influence them like Thermostats.

The trend of adopting IoT started with wired connections but with the increase in the use of wireless communication standards like Bluetooth and Wi-Fi, more devices are coming out integrated with wireless communication modems and batteries to totally isolate them.

With the advent of complicated AI and ML softwares and improvements in circuit and battery designs, IoT is expected to keep growing exponentially for the foreseeable future. Thus it's very clear that IoT will play a huge role in the future.

One particular application of IoT is exciting since it's been envisioned since Centuries-Home Automation! Home Automation allows people to control their home automatically or remotely. This field has only recently started maturing due to the widespread use of the Internet. Occupants can enjoy greater comfort, reduce their work and stress and also save time, money and effort due to automation of certain tasks in their home and instead focus on enjoying their time at home.

In particular, this paper deals with using IoT to achieve Home Automation to save energy and costs and also to improve the comfort of the occupants. Open source hardware and softwares are used to detect occupants in a room and turn on and off electronics accordingly.

The section 2 is an overview about home automation and descriptions of the components used in the project. The section 3 covers the design and implementation of the project. Section 4 concludes with the significance of the project and home automation in general.

2 Home Automation Overview

The project focuses on this particular aspect of IoT to achieve energy savings in a typical home without human intervention. An Arduino Uno forms the basis of the home automation system, which switches on the lights in a room when occupants enter the room and switches them off when everyone exits by keeping a count of the number of occupants entering and exiting the room.

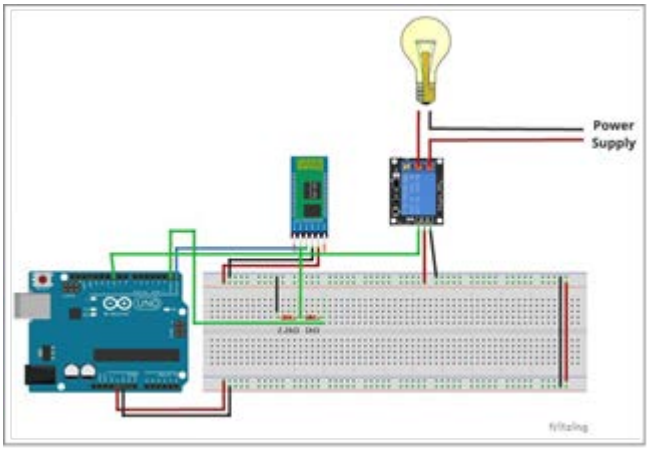

Fig. 1. Proposed System

The system uses an ESP8266 module to connect to a Wi-Fi

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network and accept simple TCP/IP connections using Hayes commands. Data is continuously shared with the ThinkSpeak cloud platform for data analysis.

2.2 Arduino

The Arduino Uno has 14 digital input/output pins (6 of them can be used as PWM outputs), 6 ana-log inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a re-set button. It is programmable with the Arduino IDE (Integrated Development Environment) via UART (Universal Asynchronous Receiver-Transmitter) cable. The Arduino UNO is generally con-sidered the most user-friendly and popular board because it is the well-documented board of the whole Arduino family.

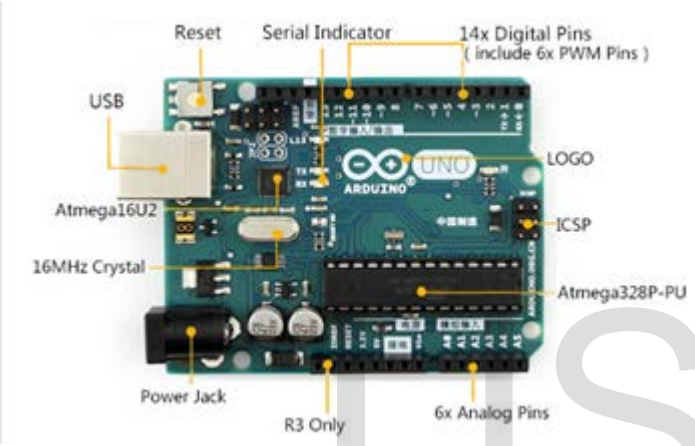

Fig. 2. Arduino Uno

2.3 ESP8266

The ESP8266 is a low-cost Wi-Fi microprocessor chip with full TCP/IP capability and this module allows Arduino to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes commands to query and change configurations of the WiFi module. This module has an MCU (Mi-cro Controller Unit) integrated which gives the possibility to control I/O digital pins via AT commands.

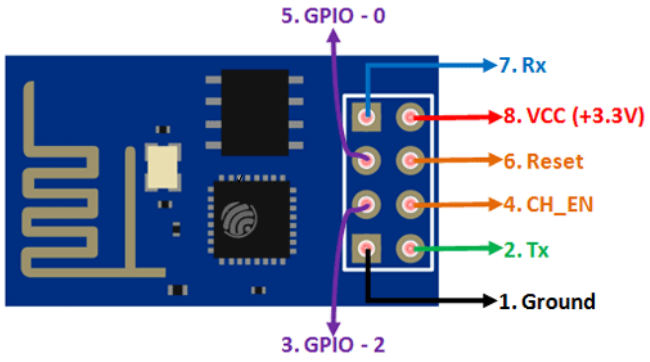

Fig. 3. ESP8266 Wi-Fi Module

2.4 PIR

A passive infrared sensor (PIR sensor) is a pyroelectric device that detects changes in the amount of infrared radiation impinging upon objects, which varies depending on the temperature and sur-face characteristics of the objects in front of the sensor. This sensor converts the resulting change in the incoming infrared radiation into the output voltage difference, and this triggers the detection. This sensor has Fresnel lenses or mirror segments, an effective range of about ten meters and a field of view less than 180 degrees.

2.4 Thingspeak

ThingSpeak is an open source Internet of Things (IoT) platform to collect and store data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak web service provides applications for real-time data collection, data analysis, data processing of the position in-formation, data visualization, message transmission in MATLAB® without requiring the purchase of a license from Mathworks.

3 Design And Implementation

An efficient smart home automation system is presented in the design. This system has two main modules: the hardware and the software. The hardware system consists of an Arduino Uno board, ESP8266 Wi-Fi module, Passive Infrared Sensor and relay module. This system uses an Arduino Uno board since it is an open-source electronics platform based on easy-to-use hardware and software. The open source development is a reliable means of designing and developing projects in this modern era.

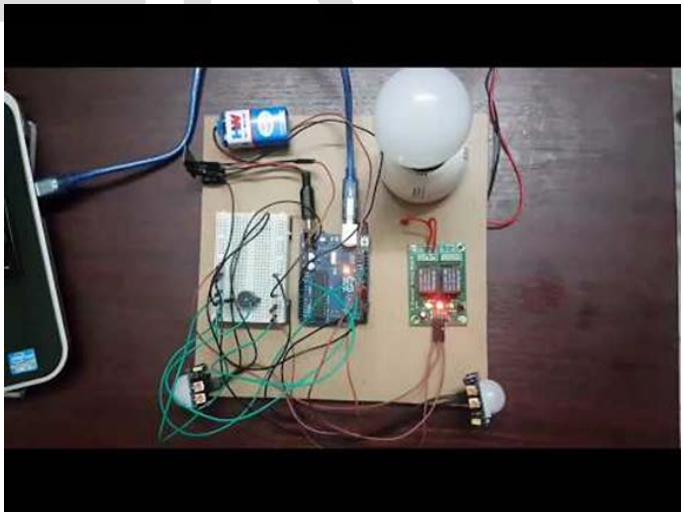

Fig. 4. Implemented System

Further, the Arduino board is integrated with Passive Infrared Sensor (PIR) to detect human movement in the home by detecting the change in temperature, this will trigger the PIR sensor and the trigger signal will be sent to the system. As an output, the system will automatically switch the appliances ON/ OFF based on occupancy. A relay switch is used to send

control signals from the microcontroller to the electronic device used to achieve the switching on and off action. This system uses an ESP8266 wifi module that connects Arduino to a Wi-Fi network and makes simple TCP/IP connections. Further, this module sends data from the system to the ThingSpeak cloud for data analysis. We will be able to analyze the usage of the room, the number of persons at various times of the day, the time for which appliances are ON and the power consumed. This implementa-tion provides an intelligent, comfortable and energy efficient home automation system.

4 Result

The proposed system is implemented; sensor data is be-ing monitored over the Thingspeak cloud channel. In this home automation, whenever there is no occupancy detected by the PIR sensors, all the appliances will turn off automatically, and if occupancy is detected at any section of the room then the appliances will get turned ON accordingly. The implemented system sends real-time sensor data at a regular sample interval to the Thingspeak cloud channel.

Fig. 5. Thingspeak Cloud

5 Conclusion

With the aim of transforming real-world appliances into smart devices and connect them through the internet, we have designed an IoT based electronic device using Arduino that forms the basis of home automation. The proposed system automates the home appliances and sends the data from such a system to the cloud for analysis to optimize the performance of cloud-based smart homes with community hierarchy.

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