

# *Device automation and control*

## *Using ESP8266*

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*Abstract*— In a world where technology is showcasing incessant development and advancements, people are trying to cope up with it. People are getting smart, and devices are getting smarter. The need of the hour is automation and Internet of Things (IoT) is a foundation stone for this. IoT can basically be defined as interconnectivity for various devices and gadgets. Thus, IoT is slowly becoming an indispensable part of our lives. This new wave of connectivity is going beyond laptops and smartphones, it's going towards connected cars, smart homes, connected wearables, smart cities and connected healthcare. So, in our project, we aim to establish automatic connectivity of all devices connected to the same network generated by the ESP8266 Wi-Fi module along with controlling the devices from the server. Further, the concept of 'smart' devices has been demonstrated and achieved by controlling it with voice commands given to Amazon's Alexa.

This project report starts with introducing our project need and objective. It covers the information about existing projects in this field. We later talk about all the technical terms and explain briefly about Arduino UNO, LM35, DC Motor along with the voice assistant Alexa. In the later part of the report, dataflow of the module is explained along with the database schema. The report then talks about the working of our project followed by results and conclusion.

DACE is an approach to minimize and reduce human effort and intervention that is, it gives an insight into Internet of Things (IoT) by automating and controlling the devices and things.

## I. INTRODUCTION

We believe that humans as of today are much more reliant to gadgets and technology as they are on each other. The time that an average person spends on their mobile phones is roughly over four hours a day. Almost every activity today can be controlled by smartphones thus it is paving the way for what can be called as Internet of Things. In a world where technology is showcasing incessant development and advancements, people are trying to cope up with it. People are getting smart, and devices are getting smarter. The need of the hour is automation and Internet of Things (IoT) is a foundation stone for this. IoT can basically be defined as interconnectivity for various devices and gadgets. Thus, IoT is slowly becoming an indispensable part of our lives.

This new wave of connectivity is going beyond laptops and smartphones, it's going towards connected cars, smart homes, connected wearables, smart cities and connected healthcare. So, in our project, we aim to establish automatic connectivity of all devices connected to the same network generated by the ESP8266 Wi-Fi module along with controlling the devices from the server. Further, the concept of 'smart' devices has been demonstrated and achieved by controlling it with voice commands given to Amazon's Alexa.

## II. TECHNOLOGIES USED

- *Arduino Genuino Uno*

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. [19] It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards. [19]

- *ESP8266*

The ESP8266 is a low-cost Wi-Fi chip with full TCP/IP stack and MCU (microcontroller unit) capability produced by Shanghai-based Chinese manufacturer, Espressif Systems. The chip first came to the attention of western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer, Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at the time there was almost no English-language documentation on the chip and the commands it accepted. [18] The very low price and the fact that there were very few external components on the module which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation. The ESP8285 is an ESP8266 with 1 MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi. [18]

- *PHP (Hypertext Preprocessor)*

**PHP** (PHP: Hypertext Pre-processor) is a scripting language that helps people make web pages more interactive by allowing them to do more things. [3] A website programmed with PHP can have pages that are password protected. A website with no programming cannot do this without other complex things. Standard PHP file extensions are .php .php3 or .phtml, but a web server can be set up to use any extension. Its structure was influenced by many languages like C, Perl, Java, C++, and even Python. It is considered to be free software by the Free Software Foundation. [20]

- *HTML (Hypertext Markup Language)*

HyperText Markup Language (HTML) is a mark-up language for creating webpages. Webpages are usually viewed in a web browser. They can include writing, links, pictures, and even sound and video. HTML is used to mark and describe each of these kinds of content so the web browser can show them correctly. HTML can also be used to add meta information to a webpage. Meta information is information about the web page. For example, the name of the person who made it. Meta information is not usually shown by web browsers. Cascading

Style Sheets (CSS) and JavaScript can be included in HTML code. CSS is used to change how a webpage looks. JavaScript is used to add features to webpages and make them more interactive.

HTML was made by the World Wide Web Consortium (W3C). There are many versions of HTML. The current standard is HTML 4.01. So, it is the version the W3C recommends. A newer version, called HTML5, will become standard within the next few years. The W3C also develops XHTML. This is another mark-up language which is very similar to HTML, but stricter.

- *JavaScript*

JavaScript is a scripting language for computers. It is often run in web browser applications to create dynamic content like a popup message or a live clock. It is not related to the programming language Java.

- *jQuery*

jQuery is a lightweight, "write less, do more", JavaScript library. The purpose of jQuery is to make it much easier to use JavaScript on your website. jQuery takes a lot of common tasks that require many lines of JavaScript code to accomplish, and wraps them into methods that you can call with a single line of code.

jQuery also simplifies a lot of the complicated things from JavaScript, like AJAX calls and DOM manipulation. The jQuery library contains features such as HTML/DOM manipulation, CSS manipulation, HTML event methods, effects and animation, AJAX, Utilities.

- *WAMP*

WAMP Server refers to a software stack for the Microsoft Windows operating system, created by Romain Bourdon and consisting of the Apache web server, OpenSSL for SSL support, MySQL database and PHP programming language. [20]

## III. APPLICATIONS

- *Easily Accessible Data*

The temperature data that is hosted on a local server can be accessed from anywhere around the world since it is also available on an open IOT Platform i.e. [www.thingspeak.com](http://www.thingspeak.com).

- *Efficient Data Management*

The temperature data can be easily accessed and controlled anytime, anywhere.

- *Control System*

The devices connected in the module can also be controlled locally through a server which in this case is the speed of a DC Motor.

- *Hands Free Control*

Devices are connected to Amazon's ALEXA which is Amazon's voice assistant and the light bulb that is connected can be controlled just by a simple voice command.

- **Authorized Connection**

The sensor data and all the analytics are secured behind a login ID and Password thus restricting any unauthorized user, access to your private home data.

#### IV.IMPLEMENTATION:

- **Basic Idea**

The idea here is to provide remote accessibility and operability to various devices from a local host or a specially hosted website. This allows to decrement in the effort quotient of people and makes life a lot easier. In this particular model, a temperature sensor i.e. the LM35 sensor reads the temperature of the surrounding and records it on a database created by using the WAMP server. The temperature monitoring and regulation is a real-time process and happens within a span of seconds. The module used to provide internet connectivity to the complete project is the ESP8266 (also known as NodeMCU). Using this we are able to control the devices present in the same network as that of the ESP8266. There are two different modes in which the Wi-Fi module can act. These are namely (i) Sender Mode (Transmitter Mode) (ii) Receiver Mode. The ESP8266 can either act in sender mode or in the receiver mode, but it cannot act in both the modes simultaneously. In order to achieve the above stated functionality, two ESP8266 will be required.

- **ESP8266 in Sender Mode**

In this the temperature sensor LM35 which is situated on the application board collects the data from the surroundings and sends it to the database created by using the WAMP server. This monitoring and analysis of data is real time and happens within a gap of seconds.

- **ESP8266 in Receiver Mode**

After 3 temperature readings have been calculated and stored, the Serial monitor prompts a message asking the user whether he wants to configure the ESP8266 in ESP Mode. Once replied with a 'Y', the ESP8266 gets configured in the receiver mode. It would mean that the user can send instructions to control a particular appliance via the internet, In this case, a DC motor is controlled by the localhost. The speed of the motor can be varied between "HIGH", "LOW" and "STOP".

- **ALEXA Functionality**

Alexa is an intelligent personal assistant developed by Amazon, first used in the Amazon Echo and the Amazon Echo Dot devices developed by Amazon Lab126. From the day of its release 3 years ago in November 2014, work on Alexa and Alexa driven projects have gripped the market. Our project aims at inculcating 'Smart' features to common conventional devices making it affordable to the common man itself reducing the cost of accessing and maintaining it to a bear minimum. In the prototype created by us, a conventional light bulb can be controlled simply by voice.

It can prove to be very beneficial to the physically healthy and handicapped people alike thereby increasing its use and popularity.

#### V. MODULES:

- **Sign Up/Login**

This is the first module through which a user can create a unique account to access to his data. To create account, one must enter his first name, last name, channel id and field id. The account will be created successfully only if the user has entered a unique channel id. After creation of user account, he can log in from anywhere and anytime over internet.

- **Welcome**

After logging in, the user is redirected to a welcome page where he is given several options like profile settings, view statistics, control motor and many more.

- **Temperature Analysis**

Here, the user can view the chart generated after analysis of temperature readings. This module updates the chart in real time. It takes values from database. This is the page from where the user can monitor the statistics over the internet and control motor accordingly.

- **Motor Control**

In this module the user is given several options to control motor at different speeds. On a single click, he can switch on, switch off, and control the speed of motor (in this case, DC motor of fan) as per his choice.

- **Profile Settings**

Using this module, the user can view his current profile details and also update his profile. To do so, he just needs to enter his new details and click on the save button. This leads him to the log in page from where he can log in again using his new details.

- **About Device**

In this module, the user can view detailed information about his device. It also gives an introduction to the internal structure and features of the device.

- **Help/Contact**

Help module helps the user if he is unable to create account or log in. it provides a set of instructions to the user using which he can solve his problem and move further. If he still cannot solve his problem, he can contact us. In the contact us space, we have provided an email id.

- **Alexa**

Alexa is a voice based assistant by Amazon. In our project, we have given the characteristics of a smart bulb to a conventional bulb by giving it voice commands and operating the bulb i.e. turning it on and off. Thus, it can be useful for blind and physically handicapped people as well.

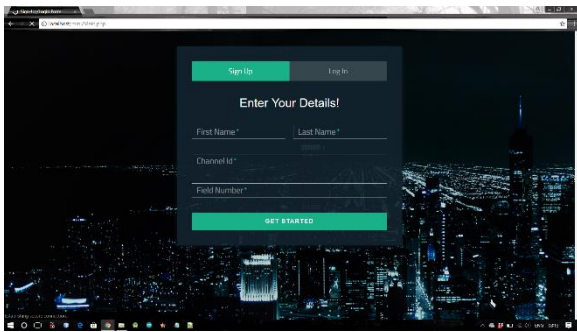


Figure 1: Sign Up Page

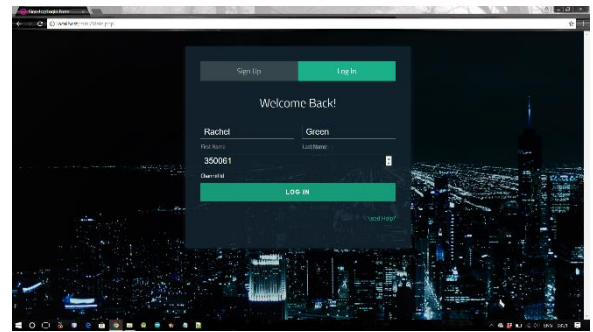


Figure 5: Enter Details (For Log In)

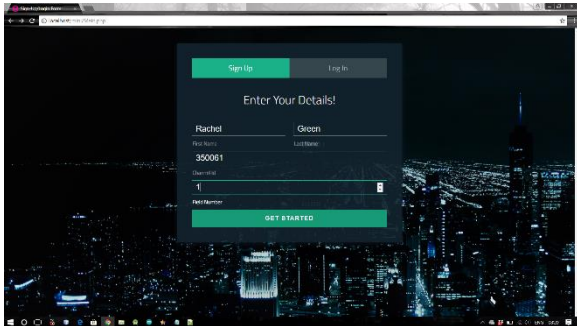


Figure 2: Enter Details (For Sign Up)

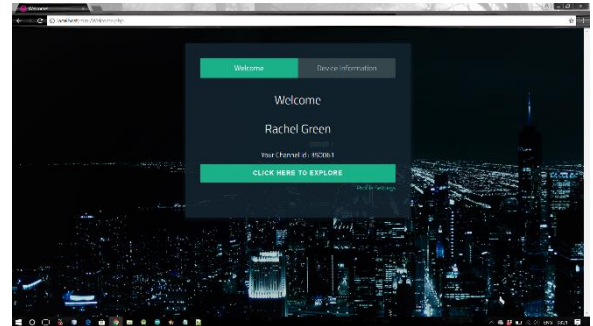


Figure 6: Successful Log In

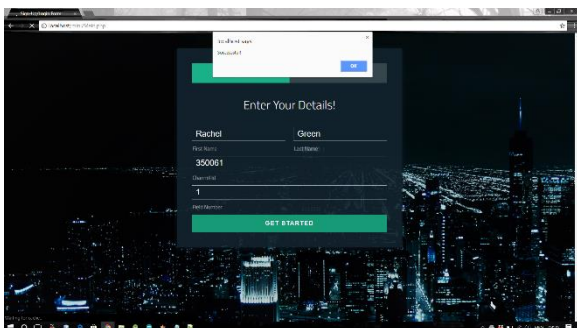


Figure 3: Successful Sign Up

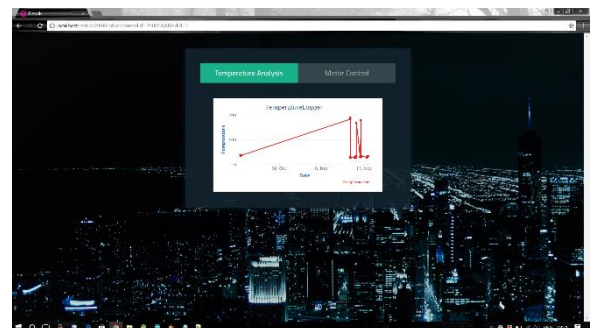


Figure 7: Temperature Analysis

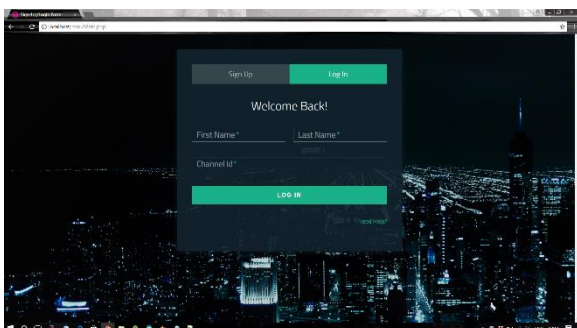


Figure 4: Log In Page

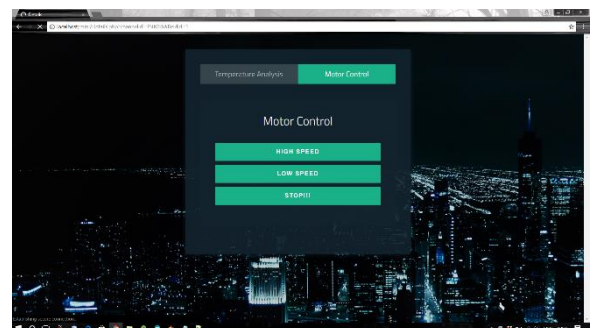


Figure 8: Motor Speed Control

## CONCLUSION

In this way, we have created a “Device Automation and Connection System using ESP8266 (DACE)” from where a user can control his/her home devices from a remote location through a website by just creating their account on it and they can also control their home appliances through their voice. Our project gives the most cost effective way to automate the simple low-cost unautomated devices. Thus, it is an economic and a financially feasible solution.

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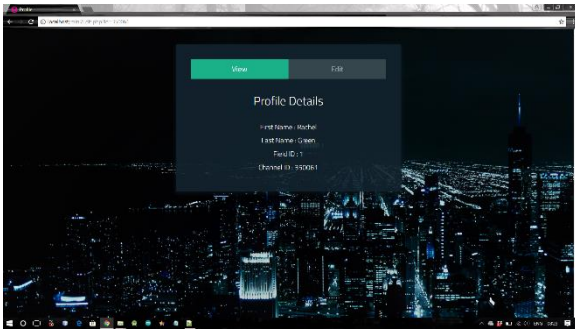


Figure 9: Profile Details

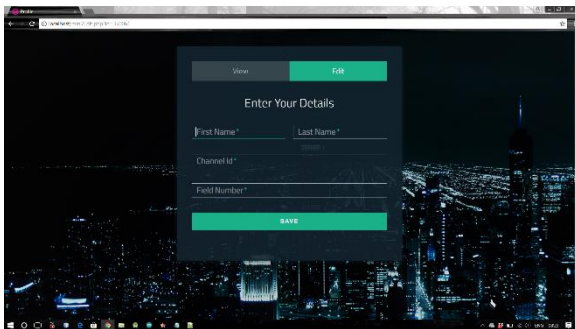


Figure 10: Edit Profile

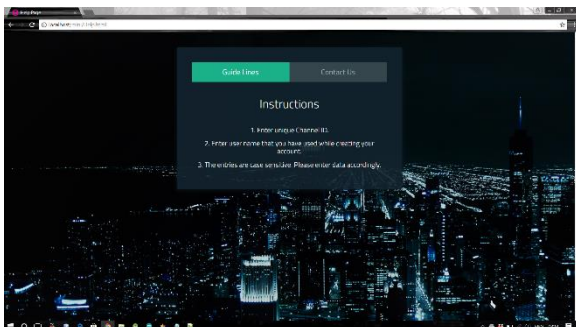


Figure 11: Instructions Page