Smart House (Remote light control)

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Abstract

As Internet of Things (IoT) has revolutionized the modern life, this project aims to build a simple prototype of the Smart House, which can be controlled and monitored by a WeChat mini program. The model implements remote control of the lights as well as monitor of the front door's status through Wi-Fi. The transmission time of the model is around 5 seconds while the success rate is approximately 100%. In terms of improvements, we plan to implement 5G technology to enhance the model's network and add security measures to address its current privacy issues.

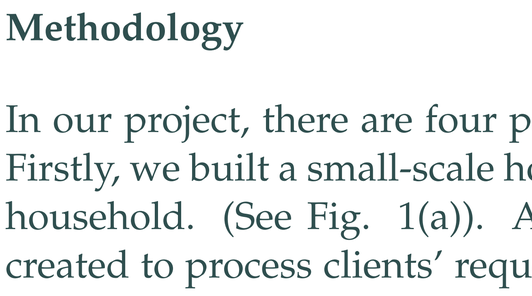
Introduction

In the modern world, the need for connectivity rises and the remote control of electronic devices has become one of the main objectives of great companies [1]. It has caused the rise of Internet of Things (IoT) and the concept of Smart house [2]. Smart House allows remote access to monitor and manage household appliances, which would be more time-efficient and convenient for users. Our group aims to build a small model of the Smart House which can be controlled by a WeChat mini-program.

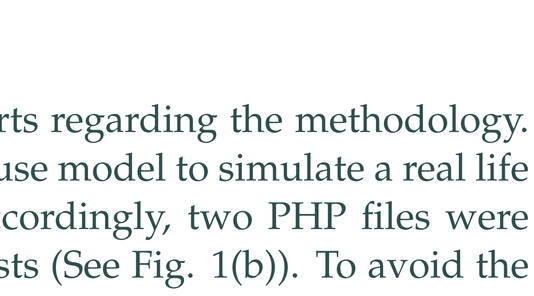
Methodology

In our project, there are four parts regarding the methodology. Firstly, we built a small-scale house model to simulate a real life household. (See Fig. 1(a)). Accordingly, two PHP files were created to process clients' requests (See Fig. 1(b)). To avoid the complicated connection between the ESP module and the basic UNO board, we applied an improved board, which is known as NodeMCU, instead. The complete hardware circuit is shown in Fig. 1(c). Regarding the software part of the Arduino design , we merely used two libraries:
ESP8266WiFi.h - connect to a given Wi-Fi network
ESP8266HTTPClient.h - send HTTP requests

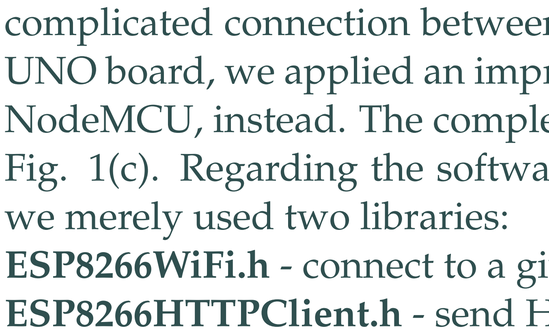
Consequently, our team designed a WeChat mini-program which can be run on various operating system (See Fig. 1(d)). This mini app allows the user to turn the lights on/off by using the corresponding buttons. Moreover, the status of devices would update automatically.



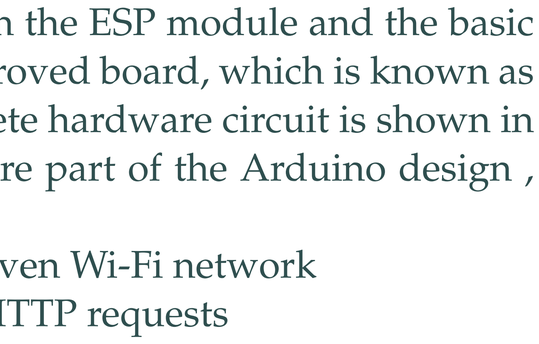
(a) House model



(b) Two PHP files



(c) The whole circuit



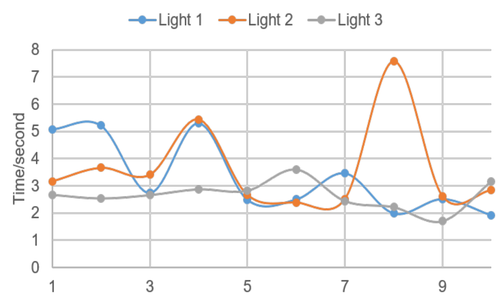
(d) User interface of WeChat mini-program

Figure 1: The four parts of the methodology

Results

I Testing reusult

The model was connected to power bank with 5.1V / 2.1A and a personal hotspot. After establishing the required power and connection for this prototype, we randomly tested and measured the transmission time of the LEDs and the door ten times (See Fig. 2).



(a) Three LEDs transmission time

(b) The door transmission time

Figure 2: Measurements of transmission time

The average transmission time is computed in Table 1.

Table 1: Testing results of transmission time

	Lights	**Door**
$\bar{t}(s)$	3	5.5
Accuracy	100 %	

II Discussion

Due to the I/O pin being highly sensitive to electrical noise, random fluctuations occur in I/O between the connection pins. This is phenomena is known as the floating pin. In order to resolve this issue, we inserted a pull-up 15kΩ resistor between I/O and GND pins (See Fig.1(c)).

Future works and Conclusions

In order to reduce the transmission delay, we plan to implement 5G to improve this project. Additionally, we would deploy the server in a local city due to the same reason. Moreover, our team plans to add owner authorization, user verification, and data encryption to the WeChat mini-program by applying Hash Codes. This would address the privacy and security issues that our current prototype has. In conclusion, our team was able to successfully build a properly functioning prototype of the Smart House, where the user can control and monitor the lights in the house as well as its front door.

References

[1] X. Shang, R. Zhang, and Y. Chen, "Internet of things iot service architecture and its application in e-commerce," *Journal of Electronic Commerce in Organizations*, vol. 10, no. 3, pp. 44–55, 2012.

[2] H. Yang, W. Lee, and H. Lee, "Iot smart home adoption: The importance of proper level automation," *Journal of Sensors*, vol. 2018, pp. 1–11, 2018.

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