UNIVERSITI TEKNOLOGI MARA

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NODEMCU IOT STARTER LEARNING KIT

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ABSTRACT

The Internet of Things, or IoT, is a term used to describe the fast development of low-cost, widely available communication devices that are integrated into all new and current physical items. Using IoT devices in educational activities can improve the teaching and learning process with fresh ideas to motivate students much quicker and more efficiently. NodeMCU IoT Starter Learning Kit is an innovative solution to the problem of overly complex teaching materials that must match the learning objectives. Most kits available on the market are pricey and less ideal for users to master the fundamentals of IoT introduction. Some low-cost items must be reassembled or have a do-it-yourself concept. However, some modules need to be fixed due to improper installation, and it also requires an instruction booklet that occasionally needs to be clarified for users. Users need a reference point to determine whether their installation is accurate or if there are mistakes in troubleshooting. This kit allows users to grasp the whole IoT system and can assist users in developing other relevant applications. The structure of the kit is simple to understand, and it is well constructed. According to the post-test results, this learning kit improved 90% of students' knowledge and skills in building IoT applications.

Keywords: *Teaching and learning kit, Training kit.*

1. INTRODUCTION

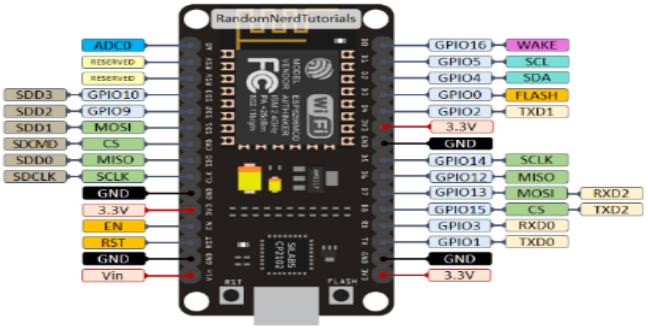
In the industrial 4.0 and digitalization era, teachers' and students' grasp of microcontrollers and the Internet of Things (IoT) needs to be increased regarding knowledge, attitudes, and skills. Microcontroller material is taught in the curriculum at the University, Polytechnic, course centre, and vocational high school (VHS), particularly in electrical engineering education. Expanding the advantages of constantly connected internet access is the goal of the Internet of Things (IoT) concept. The internet allows us to share data, remote controls, and other items. To put it simply, the Internet of Things is a fundamental idea that links any devices together. Another device that can be utilized to create learning media through trainers includes refrigerators, TVs, washing machines, lamps, cell phones, vehicles, and even IoT. Hamid et al. (2020), Lee et al. (2019), and Khaing et al. (2018) did research and innovation about the development of training kits for education purposes. While Somantri et al. (2019), Lyzhin et al. (2019), and Kusmin and Laanpere (2018) studied the development and implementation of IoT training. Given the numerous benefits and potentials of IoT technology research in the form of a learning trainer, the researcher takes the initiative to create one of the learning media resources in the design of an IoT learning trainer module with a prototype using NodeMCU, which is expected to provide changes for students in understanding and utilizing computers and microcontrollers in a broader application.

2. METHODOLOGY

Internet of Things (IoT) trainer kit is an all-in-one prototyping platform with open-source microcontroller and microprocessor development boards, packed with software applications starting from getting started with the kit to Internet of Things applications. This NodeMCU IoT Starter Learning Kit is designed to provide a flexible IoT training kit.

2.1 Hardware Development

The development boards used in this trainer kit are ESP8266 and NodeMCU. It consists of only two actuators: a relay and LED as a basic trainer kit for students understanding the concept of IoT. This kit also includes a sensor and OLED display. The schematic circuit and the PCB layout were designed by EasyEDA Online Software and fabricated through PCBWay Assembly Service. The components are mounted on the PCB and preserved as a hardware t



NO	MCU PIN	INPUT PIN
1	ADC0	
2	RESERVED	
3	RESERVED	
4	GPIO 10	
5	GPIO 9	
6	MOSI	
7	CS	
8	MISO	
9	SCLK	
10	GND	
11	3.3V	
12	EN	
13	RST	
14	GND	
15	Vin	

NO	MCU PIN	INPUT PIN	OUTPUT PIN
16	GPIO 16	D0	D1 PIN
17	GPIO 5	D1	OLED
18	GPIO 4	D2	OLED
19	GPIO 0	D3	LED 3
20	GPIO 2	D4	LED 4
21	3.3V		
22	GND		
23	GPIO14	D5	LED 5
24	GPIO 12	D6	
25	GPIO 13	D7	BASE Q1
26	GPIO 15	D8	BASE Q2
27	GPIO 3	RX	
28	GPIO 1	TX	
29	GND		EMMITER Q1 @ Q2
30	3.3V		

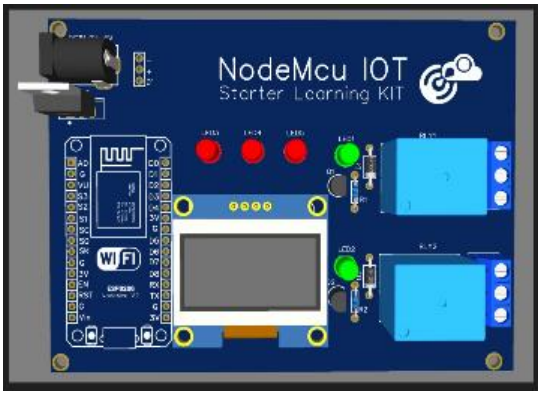


Figure 1 NodeMCU IoT Starter Learning Kit

2.2 Software Development

This kit uses the Arduino IDE and Blynk application as a program codes. Manuals on installing and using the apps are provided. The manuals contain:

i. Introduction of Arduino: explains how to connect the trainer to a WiFi network.
ii. Controlling LED, relay and buzzer using Arduino: Practice how to control the LED lights, starting from one, then increasing to four.
iii. Using Arduino on client-server configuration: Demonstrate how the Arduino board will function as a server. On the board, also installed an OLED panel to see its server log.

In the last experiment, the control of the LED and relay was tested to demonstrate the Arduino's ability to control more than one output.

3. FINDINGS

Based on hardware design, software, input-output testing, and remote testing experiments, the trainer works properly to support the practical work related to IoT topics. It satisfied the design specification that users could use this trainer as a learning platform to understand IoT applications. In a survey of 40 users, 98% said they were happy with the trainer's appearance and usability. A pre-test and post-test were also completed for students using this trainer for practical practice. As a result of using the trainer, 90% increased their knowledge of IoT applications. This outcome accomplishes the goal of this development trainer kit.

4. CONCLUSIONS

This NodeMCU IoT Starter Learning Kit is an innovative solution to the problem of overly complex teaching materials, improving the teaching and learning process.

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