Improving the IT Competence of Vocational High School Teachers with Internet of Things Training Based on ESP 8266

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Abstract. This training aims to improve participants' understanding and skills of SMK Muhammadiyah 3 Yogyakarta Teachers in developing IoT applications using the ESP8266 module. The employed training techniques encompass both theoretical and practical modules, as well as interactive group discussions. Trainees are interested in technology and want to expand their knowledge of IoT. During the training, participants were given an understanding of the basic concepts of IoT, an introduction to the ESP8266 module, and how to use the Arduino IDE for microcontroller programming. The results of this dedication show a significant increase in participants' understanding and skills after attending the training. Participants can understand the basic principles of wireless communication, install, and configure the ESP8266 module, and develop simple IoT applications. Evaluation of the participants showed high satisfaction with this training. The training was deemed highly beneficial and applicable to the participants' everyday routines. Participants also feel more confident in facing challenges in developing IoT applications. The training program is expected to yield enduring advantages, foster indigenous ingenuity, and enhance community engagement with the Internet of Things (IoT) technology.

Keywords: Internet of Things, ESP 8266, Training, Microcontroller programming

1 Introduction

Education and teachers have an important role in shaping the future of a country. Education is one of the key factors in the development of a country. Because through education, human resources can develop and make a better contribution to society and the country (Haryoko et al., 2021). The role of the teacher in education is also very important. Teachers not only provide knowledge to students but also help them develop positive character, skills, and attitudes. The teacher also has a role as a liaison between students and the community so that they can help students understand their role in society (Finawan, 2021). Education in the current digital era demands changes in learning methods and increasing teacher competency to face increasingly developing technological challenges (Yulastri et al., 2019).

One of the technologies that is currently developing and has great potential in the industrial world is the Internet of Things (IoT). IoT is a concept that allows electronic devices to be connected and communicate with each other through the internet network (Hirzan et al., 2021). This concept allows electronic devices such as cars, household appliances, sensors,
and so on to connect and share information automatically. In the educational context, IoT has great potential to increase efficiency and effectiveness in the learning process (Istiadi & Faqih, 2020). For example, by using sensors connected to the IoT network, we can collect data on student performance in real-time and provide more accurate and timely feedback (Budioko & Harnaningrum, 2022). In addition, IoT also has the potential to develop more interactive and innovative learning methods. For example, the use of technology such as Augmented Reality (AR) and Virtual Reality (VR) connected to the IoT network can help students understand difficult concepts more interestingly and interactively (Hardani et al., 2021; Wardana et al., 2022). Overall, IoT has great potential for increasing efficiency and effectiveness in the learning process (Irwanto, 2022).

One of Muhammadiyah's charities in the field of vocational education is SMK Muhammadiyah 3 Yogyakarta. This school is located at Jalan Pramuka No. 62, Giwangan Village, Umbulharjo District, Yogyakarta City, Yogyakarta Special Region Province. SMK Muhammadiyah 3 Yogyakarta is currently accredited by A and has eight expertise programs, including light vehicle engineering, mechanical engineering, electronics engineering, electrical engineering, computer and network engineering, modeling and building information design, and pharmaceutical technology. To carry out these eight skills, equipment support is needed that can facilitate the practice process and increase the competence of teachers and students. One of the items needed is a trainer kit for the Internet of Things. However, until now, the trainer kit for the Internet of Things is not yet available in SMK because the available learning media are still small. Hence, training on the Internet of Things is held to provide basic knowledge and skills about the Internet of Things as well as trainer module facilities.

2 Methodology

Community service activities are carried out in two stages, namely the development of a training kit and training modules. Training kit design for the Internet of Things is presented in Figure 1.

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Figure 1. Trainer Kit Design Internet of Things ESP 8266-based
The training was carried out with partners at SMK Muhammadiyah 3 Yogyakarta for the use of a trainer kit for one day with 10 participating teachers from various majors, including electronics engineering, computer and network engineering, mechanical engineering, electrical engineering, and light vehicle engineering. The training was carried out in four stages: pretest, delivery of theory, practice, and posttest. The pre-test and post-test questions consisted of 15 items that were classified into three categories: the basic understanding of IoT, IoT applications, and IoT components and programming languages. Results from the pre-test and post-test will be compared to measure knowledge abilities and hard skills taught before and after the training.

### 3 Results and Discussion
The results of this community service activity are in the form of a trainer kit for the Internet of Things. Module trainer for the Internet of Things made by the community service team resulting from the trainer module "Internet of Things" is shown in Figure 2. This trainer can be used as a learning medium and a smart control mini-project using the ESP8266. After going through the trial phase, the trainer was handed over to SMK Muhammadiyah 3 Yogyakarta. Then we held socialization and training on the use of basic IoT trainers. This event was attended by school principals, deputy principals, and teachers of SMK Muhammadiyah 3 Yogyakarta. The training process was carried out through four stages: pretest, delivery of materials, practice, and posttest.
Before the training session started, participants were required to do a pretest. The pretest was carried out online using a hyperlink (link). The assessment consisted of fifteen questions, which were categorized into three main sections. This section included an understanding of the basic terminology associated with the Internet of Things, a company's Internet of Things, and applications of the Internet of Things. Furthermore, participants were given access to the Internet of Things module that has been made. Once able to access the module, participants are given a theoretical overview of the introduction of the Internet of Things. In addition, examples of application cases were provided for the Internet of Things, which was often found in the industry. This fundamental theory covers several important topics in the Internet of Things, such as (a) working principles and basic programming languages; (b) trainer kit components in the Internet of Things; (c) basic programming language exercises; and (d) a simple smart control case study by the service team as shown in Figure 3.
simulation and ensure that the programming language that has been made is in accordance with what has been determined. After the simulation was successful, the participants installed the wiring harness on the IoT trainer kit hardware module and entered the programming language (coding) into the Arduino Integrated Development Environment (IDE) software. The practical stage of the service team is to provide assistance and discuss how to resolve the obstacles encountered by the training participants, as shown in Figure 4.

![Figure 4. Mentoring and Discussion at the Practice Stage](image)

The training evaluation process involves a comparison of results pre-test and post-test for all participants, represented via a bar chart. A value comparison for the pre-test and post-test for 10 participants is depicted in Figure 5. Based on the data presented in Figure 5, the value of the trainees increases. The average values of the pre-test and post-test for ten participants were 43.5 and 84.5, respectively. This value has increased by 94.25%. This shows that the training provided to participants can increase their knowledge.
4 Conclusion

The training on the Internet of Things (IoT) by utilizing the ESP 8266 platform has been carried out. The material presented is related to technology, systems, and applications. With the Internet of Things (IoT), electronic devices can interconnect and communicate with each other via the Internet. IoT training has proven to be quite effective and communicative. This is due to the involvement of participants who were actively involved in discussions and the knowledge of participants can increase related to the Internet of Things.

References


