Transformasi: Jurnal Pengabdian Masyarakat, 19(2), 2023: 399-407
p-ISSN 1858-3571 | e-ISSN 2580-9628

UTILIZING A THOUSAND-EYE SMART STOVE TO ENHANCE PRODUCTION OUTCOMES AT PODO MORO UMKM

Lutfi Hakim[1]*, Vivien Arief Wardhany[1], Subono[1]
[1]Politeknik Negeri Banyuwangi, Banyuwangi, Indonesia
*lutfi@poliwangi.ac.id

Abstrak: UMKM Podomoro adalah jenis home industri yang bergerak dibidang produksi makanan ringan di Desa Benelan Lor Kecamatan Kabat. Berdasarkan hasil survey yang telah dilakukan, alat yang digunakan mitra dalam proses produksi masih sederhana, kurang efisien dari segi pemanfaatan energi gas, termasuk penggunaan kompor gas yang tidak aman, sehingga berpotensi besar terhadap resiko bahaya kebakaran. Solusi yang ditawarkan adalah penerapan perangkat kompor gas yang aman dan efisien yaitu teknologi "Smart Kompor Seribu Mata Berbasis Mikrokontroller". Tujuan dari kegiatan ini adalah untuk meningkatkan kecepatan dan kualitas hasil produksi melalui infrastruktur industri berupa teknologi kompor cerdas dengan peralatan yang ramah lingkungan, minim resiko meledak. Metode pelaksanaan kegiatan ini menggunakan metode pengembangan prototyping dengan pendekatan metode kuantitatif dimana langkah-langkah disesuaikan dengan kebutuhan kegiatan. Hasil dari program pengabdian kepada Masyarakat ini berjalan dengan lancar, semua kegiatan dilaksanakan dengan baik mulai dari awal hingga evaluasi, teknologi yang diterapkan dapat diimplementasikan dengan baik dengan disertai tahapan pelatihan dan pendampingan dalam penggunaannya. Hal ini dibuktikan dengan adanya penerapan alat smart kompor seribu mata dapat mempercepat proses produksi 2-3 menit, tingkat pemerataan panas meninngkat 25, meningkatkan keamanan dengan adanya fitur pendeteksian kebocoran gas sehingga kompor dapat mati secara otomatis melalui solenoid valve sebagai pembuka dan penutup katup kompor, dan adanya pelindung kompor sehingga dapat meminimalisir terpaan angin pada api. Selain itu, hasil pengisian survey kepuasan mitra juga menunjukkan hasil yang sangat bagus dimana mitra menyatakan 95,23% merasa puas dengan semua kegiatan pada program pengabdian kepada Masyarakat ini.

Kata Kunci: teknologi kompor pintar; kompor berbasis mikrokontroller; peningkatan produksi usaha; peningkatan keamanan produksi

Abstract: Podomoro UMKM, specializing in snack food production in Benelan Lor Village, Kabat District, faces challenges with simple and inefficient production tools, particularly unsafe gas stoves posing fire hazards. The solution introduced a safe and efficient gas stove technology to address this: the "Microcontroller Based Thousand Eyes Smart Stove." This initiative aimed to enhance production speed and quality by incorporating environmentally friendly, explosion-minimizing equipment. Implementing a prototyping development method alongside a quantitative approach ensured tailored steps for this activity. The community service program unfolded seamlessly, encompassing comprehensive training and support, evident in the successful application of the thousand-eye smart stove tool. This tool improved production speed by 2-3 minutes, increased heat distribution by 25%, and enhanced safety via gas leak detection, automatic stove shut-off, and a protective shield against wind exposure. The partner satisfaction survey highlighted a 95.23% satisfaction rate with all aspects of this community service program.

Keywords: smart stove technology; microcontroller-based stove; increasing production business; increasing production safety

Introduction

Podo Moro UMKM, a small enterprise located in Benelan Lor Village, specifically in Krajan Hamlet, Kabat District, Banyuwangi Regency, East Java Province, specializes in producing and

selling various types of snacks. Established in the early 2000s, this business focuses on snacks like cassava chips, salted bananas, banana chips, taro chips, sweet potato chips, breadfruit chips, and tempeh chips (as indicated in Table 1). Utilizing locally sourced ingredients obtained from the community's harvest, this initiative aims to uplift the value of produce previously undervalued and underutilized in the area, thereby supporting the absorption of local products in Benelan Lor Village.

Table 1. The Production of UMKM Podo Moro

Raw Material	Product	Production Yield/Day
Cassava	Cassava Chip	1 Kwintal
Banana	Sale Pisang dan Keripik Pisang	100 Pieces
Talas	Talas Chip	75 kg
Sweet Potatoes	Sweet Potatoes Chip	1 – 1,5 Kwintal
Sukun	Sukun chip	Depend on the season
Tempeh	Tempeh chip	25 Kg

Source: Results of the service team's survey data

Figure 1. The Overview of Production Locations and Product Marketing Techniques

After conducting partner interviews and engaging with the community service team, the primary issue identified for resolution within a year revolves around the raw material production process. The consensus emerged due to the reliance on basic equipment, particularly standard stoves with minimal safety features, posing risks. Additionally, safety concerns arise due to the absence of standardized safety protocols for the stove devices utilized in production, especially considering the proximity of the production site to residential and marketing areas, illustrated in Figure 1.

Numerous research endeavors have addressed the aforementioned issues, focusing on the development of a smart gas stove integrated with an Arduino microcontroller to tackle gas leak detection (Alamsyah & Nurlaela Safitri, 2023; Andriawan et al., 2022; Hermawan et al., 2019; Inggi & Pangala, 2021; Istiyanto et al., 2022; Khakim et al., 2022; Kurniawan & Rochmadhona, 2021; Nugraha et al., 2022; Zulfani et al., 2022). Previous studies introduced tools designed to mitigate fire risks by employing various sensors like the MQ-2 sensor (Hermawan et al., 2019; Inggi & Pangala, 2021; Khakim et al., 2022; Nugraha et al., 2022), MQ-6 sensor (Kurniawan & Rochmadhona, 2021). These tools are interconnected with the ESP866 NodeMCU, enabling smartphone notifications through internet connectivity (Andriawan

et al., 2022). Additionally, research initiatives have created gas detection tools utilizing the MQ2 sensor and a fire sensor, linked to the internet through NodeMCU, sending notifications via platforms like telegram (Alamsyah & Nurlaela Safitri, 2023; Istiyanto et al., 2022). Similar studies have explored notification dissemination through WhatsApp (Hermawan et al., 2019), or custom applications rooted in the Internet of Things (Zulfani et al., 2022).

Hence, considering the aforementioned challenges and insights from prior research and community service initiatives, a microcontroller-based "thousand eye smart stove" technology was implemented in this program. This innovative stove, with multiple stove eyes compared to conventional ones, enhances production speed. Notably, it incorporates a gas leak detection system utilizing the MQ2 gas detection sensor coupled with a Selenoid Valve acting as an automatic gas flow shut-off, ensuring immediate stove deactivation upon detecting a gas leak. The central control unit for this smart stove is the Arduino Mega2560 module. Additionally, a protective feature has been integrated to safeguard against strong winds. The primary objective is to elevate production quality by implementing industrial infrastructure-specifically, environmentally friendly smart stove technology-minimizing explosion risks and fostering a safer operational environment.

Method

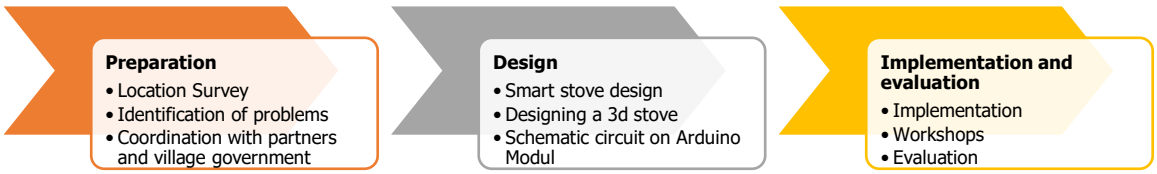

Figure 2. Problem Solving Framework

The approach taken to execute this community service program involves combining the prototyping development method with a qualitative approach. The prototyping development method, recognized among agile methodologies in product development (Camburn et al., 2017; Pressman & Maxim, 2020), is integrated with qualitative methods specifically during the preparatory phases, such as partner needs analysis (Snyder, 2019). This approach, detailed in Figure 2, encompasses distinct stages: preparation, design, implementation and evaluation of the program.

Preparation

This phase involves a series of three steps. Initially, a survey is conducted at the partner location to assess their current status and potential for development while identifying existing limitations. The aim of this survey is to pinpoint partners displaying promising potential yet facing constraints. Subsequently, partners with the greatest potential, specifically the Podomoro UMKM partners in Benelan Lor Village, are selected. The following step involves a meticulous identification of issues alongside prioritizing the most pressing problems for resolution. This includes coordinating with the village government to align partner issues with the village's

directives. Simultaneously, an agreement is established with Podo Moro UMKM partners to foster collaboration and enhance overall performance.

Design

In this phase, the service team develops a smart stove design capable of detecting gas leaks while tailoring the physical structure to suit the partner's requirements. The stove is configured with two burners, each encompassing a wind-protective cover and a space designated for depositing the fried chips, illustrated in Figure 3.

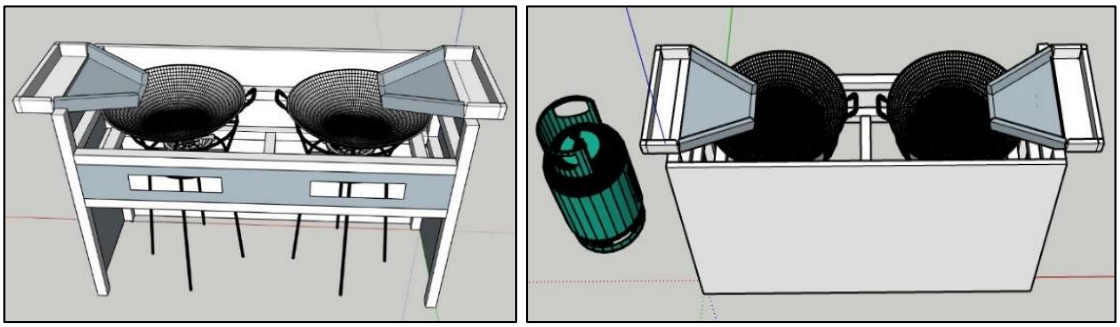

Figure 3. Smart Stove Design

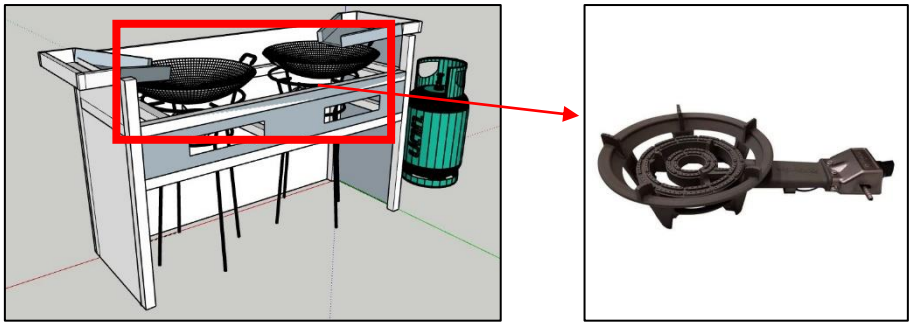

Figure 4. Placement of the Thousand Eyes Stove

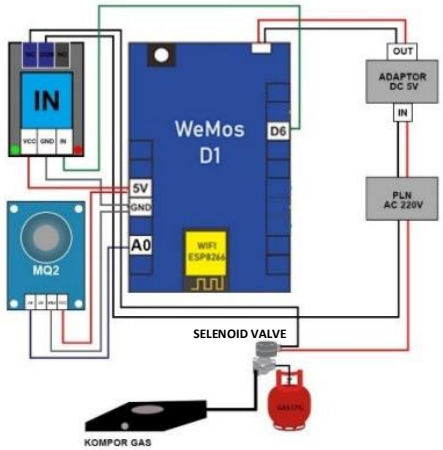

Figure 5. Schematic Circuit of a Gas Leak Detection System

The term "thousand eyes" signifies a stove with numerous stove eyes, generating more heat compared to a standard stove, as depicted in Figure 4. Utilizing a market-distributed

protective model with customized cross-sections based on the partner's needs (shown in figures 3 and 4), this high-pressure stove incorporates two burners accompanied by MQ2 gas detection sensors. These sensors serve the purpose of identifying gas leaks, supported by a Selenoid Valve that automatically shuts off gas flow upon detection for safety measures. Additionally, the smart stove's control center utilizes the Arduino Mega2560 module, as indicated in Figure 5.

Implementation and Evaluation

During this phase, the microcontroller-driven thousand-eye stove technology was integrated into the operations of Podomoro UMKM partners. The emphasis was also on setting up the equipment in a secure production environment to minimize risks. Furthermore, there was a focus on familiarizing and training Podomoro UMKM owners and staff on utilizing and maintaining the smart stove technology. This initiative aimed to effectively transfer knowledge, fostering sustainability and further development by the UMKM owners. Additionally, training sessions were conducted to familiarize the entire Podo Moro UMKM team with social media platforms like Instagram, empowering them to leverage these platforms for sales and tap into a broader market. The final step involved evaluating the conducted community service activities, ensuring their alignment with partners' needs and serving as a foundation for subsequent endeavors. Partner satisfaction surveys involve assessing service partners by presenting them with a set of questions listed in a Table 2 below, aiming to evaluate their level of satisfaction.

Table 2. The list questions of user satisfaction survey

Aspect	Questions
1	Planning for community service activities is discussed and communicated with partners
2	The planned community service activity schedule is in accordance with the realization in the field
3	The community service team involved in community service activities has a polite attitude; friendly and professional
4	The community service team has a responsive attitude to every complaint/question/problem raised by community service partners
5	The community service team provides good assistance in the use of Microcontroller-Based Thousand Eyes Smart Stove Technology
6	The method of delivering resource persons in community service activities that have been carried out can be understood well and clearly
7	Community service activities increase partners' knowledge or skills
8	The results or technology applied to community service are in accordance with the solutions expected by partners
9	The results or technology applied to community service activities can be utilized optimally and according to needs
10	Desire to continue cooperation in the following years

Results and Discussion

The planning stage highlighted two key issues addressed in this service initiative: firstly, production challenges stemming from the use of standard stoves, leading to suboptimal quality and uneven heat distribution; secondly, safety concerns due to minimal and risky equipment

usage in proximity to residential and marketing areas. To mitigate these problems, the proposed solution involved introducing microcontroller-based thousand-eye smart stove technology (Figure 6) as the primary intervention with partners. Additionally, support was extended to aid in the sustainable utilization and maintenance of the stove, aiming to address these issues comprehensively.

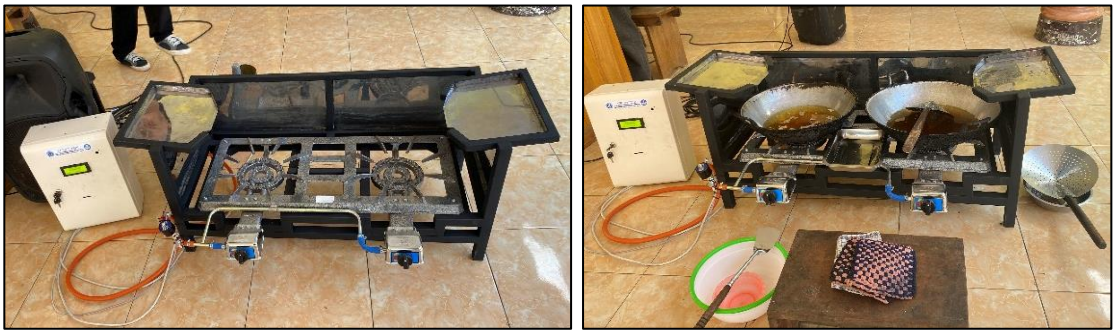

Figure 6. Thousand Eyes Smart Stove Technology

Figure 7. Workshop on Introduction, Use and Maintenance of Thousand Eyes Smart Stove Technology

The realization of the microcontroller-based thousand-eye smart stove technology is illustrated in Figure 4. This design aimed to solve two main issues: enhancing production by incorporating more stove tops than traditional ones to ensure optimal heat levels for an improved production process at Podo Moro UMKM, and addressing safety concerns. The safety aspect involves a stove protector made of hollow iron and aluminum, safeguarding against wind and reducing contact with flammable materials. Additionally, gas leak detection technology was integrated to prevent explosions, representing the "smart" aspect of the stove technology. This implementation involved a microcontroller-based circuit controlling a high-pressure stove with

two burners, equipped with MQ2 gas detection sensors and a Selenoid Valve to automatically cut gas flow upon detecting leaks, controlled by an Arduino Mega2560.

A workshop on the Microcontroller-Based Thousand Eyes Smart Stove Technology was attended by 15 individuals, including Podo Moro UMKM employees, Benelan Lor Village Government representatives, and Banyuwangi State Polytechnic students (Figure 7). The workshop aimed to introduce the tools' usage and functionality, conducting hands-on demonstrations to ensure participants' understanding. Participants received a guidebook to further aid their comprehension. This technology implementation strives to bring benefits to the community service partners, optimizing productivity at Podo Moro UMKM.

Table 3. Experiment data results from the Application of Appropriate Technology

Aspect	Before Implementation of smart stoves	After Implementation of smart stoves
Production Process Speed	±5-6 minutes	±2-3 minutes
Heat Equalization Rate	70%	95%
Security Standards	There is a gas leak, detected manually	A gas leak is detected by the MQ2 sensor and the stove turns off automatically
Security Standards	There is no stove protector yet	There is a stove protection from wind exposure

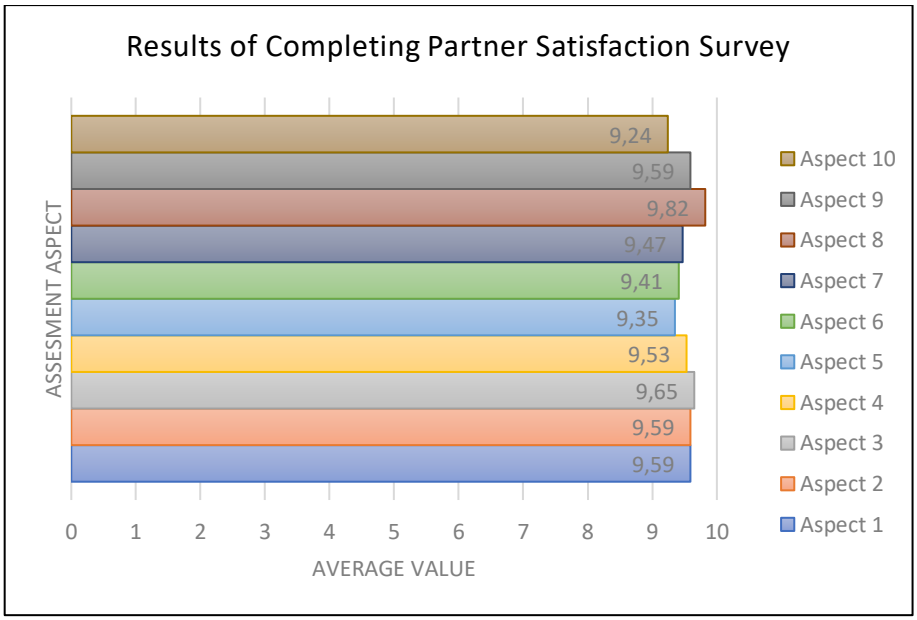

Figure 8. Results of Completing the Community Service Partner Satisfaction Survey

The testing of the microcontroller-based thousand-eye stove with PODOMORO UMKM partners yielded notable results, outlined in Table 3. The implemented technology (Thousand Eyes Smart Stove Technology) showcased a remarkable enhancement in production, reducing processing time by 2-3 minutes and improving heat distribution by 25%. Additionally, the integration of a gas leak detector sensor and Selenoid Valve significantly elevated safety measures, automatically shutting off the stove upon detecting gas leaks, while the stove protector mitigated wind-related fire risks. Moreover, results from a customer satisfaction survey

reflected highly positive responses from partners and related stakeholders (like village officials). Impressively, 96.31% of respondents expressed utmost satisfaction and highlighted the substantial benefits derived from the conducted community service activities, as depicted in Figure 8.

Conclussion

In summary, the executed community service program can be deemed highly successful, marked by its smooth and efficient implementation. The PODO MORO UMKM partners demonstrated adeptness in utilizing the thousand-eye smart stove technology and understanding its maintenance protocols. The outcomes derived from this community service initiative are promising: the TTG tool effectively reducing production time by 2-3 minutes and enhancing heat distribution by 25%. Moreover, the TTG tool's safety features, including gas leak detection leading to automatic stove shutdown via a solenoid valve, along with the stove protector minimizing fire exposure to wind, have significantly improved safety standards. Partner satisfaction survey results further validate this success, with 95.23% expressing contentment with all activities and acknowledging the benefits derived from this community service endeavor.

Acknowledgment

I want to extend my gratitude to Banyuwangi State Polytechnic's Center for Research and Community Service (PPPM Poliwangi) for their financial support, crucial for the seamless execution of this activity. I'd also like to express my appreciation to the Podo Moro UMKM partners and the Benelan Lor Village Government for their invaluable support and collaboration. Their contributions, along with the assistance provided by the Community Service Team from Banyuwangi State Polytechnic in gathering information about Podo Moro UMKM, have been immensely valuable.

Reference

Alamsyah, N., & Nurlaela Safitri. (2023). Sistem Pendeteksi Kebocoran Tabung Gas Elpiji (Lpg) Berbasis Nodemcu Dan Telegram. *Nuansa Informatika*, *17*(2), 94–100. https://doi.org/10.25134/ilkom.v17i2.19

Andriawan, R., Berliani, D., Sarigih, Y., & Latifa, U. (2022). Rancangan Bangun Sistem Pendeteksi Kebocoran Gas LPG Menggunakan Nodemcu ESP866 Berbasis Internet. *Science, and Physics Education Journal (SPEJ)*, *6*(1), 33–41. https://doi.org/10.31539/spej.v6i1.4394

Camburn, B., Viswanathan, V., Linsey, J., Anderson, D., Jensen, D., Crawford, R., Otto, K., & Wood, K. (2017). Design prototyping methods: state of the art in strategies, techniques, and guidelines. *Design Science*, *3*, e13. https://doi.org/10.1017/dsj.2017.10

Hermawan, D., Hendrawan, A. H., & Ritzkal. (2019). Sistem Deteksi Kebocoran Gas Rumah Tangga dengan menggunakan Peringatan Whatsapp. *Jurnal Teknik UMJ*, 1–8.

Inggi, R., & Pangala, J. (2021). Perancangan Alat Pendeteksi Kebocoran Gas LPG Menggunakan Sensor MQ-2 Berbasis Arduino. *Simkom*, *6*(1), 12–22. https://doi.org/10.51717/simkom.v6i1.51

Istiyanto, I., Solehudin, R., Nofarenzi, Y., & Setiyorini, T. (2022). Alat Pendeteksi Dini Kebocoran Gas LPG Dengan Sensor MQ2 Dan Sensor Api Berbasis IoT Menggununakan NodeMCU. *Jurnal Infortech*, *4*(1), 1–8. http://ejournal.bsi.ac.id/ejurnal/index.php/infortech

Khakim, L., Afriliana, I., Nurohim, N., & Rakhman, A. (2022). Proteksi Kebocoran Gas LPG Rumah Tangga Berbasis Mikrokontroler. *Komputika : Jurnal Sistem Komputer*, *11*(1), 40–47. https://doi.org/10.34010/komputika.v11i1.4977

Kurniawan, A. T., & Rochmadhona, I. A. (2021). Pembuatan Alat Pendeteksi Kebocoran Gas pada Penggunaan Tabung Liquefied Petroleum Gas (LPG) Menggunakan Sensor MQ6. *Journal of Innovation Research & Knowledge*, *1*(5), 799–806. https://www.bajangjournal.com/index.php/JIRK/article/view/621

Nugraha, I., Khairijal, K., & Sellyana, A. (2022). Alat Pendeteksi Kebocoran Gas Lpg Menggunakan Mikrokontroler Arduino Dengan Output Lcd, Led Dan Buzzer. *Jutekinf (Jurnal Teknologi Komputer Dan Informasi)*, *10*(1), 19–24. https://doi.org/10.52072/jutekinf.v10i1.355

Pressman, R. S., & Maxim, B. R. (2020). *Software Engineering: A Practitioner's Approach* (Ninth Edit). Mc-Graw Hill. https://doi.org/10.1049/ic:20040411

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, *104*, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Zulfani, Z., Qadriah, L., Achmady, S., & Salat, J. (2022). Aplikasi Pemantauan Kompor Gas Berbasis Internet of Things Menggunakan Android. *Jurnal Sains Riset*, *12*(3), 499–503. https://doi.org/10.47647/jsr.v12i3.859