



Microcontroller based food dehydrator for Rengginang crackers micro businesses in Prambontergayang Village, Tuban District

Eko Wahyu Abryandoko, Faisal Ashari, Nungki Dio Febriansa, Ary Angga Fachreza

Department of Industrial Engineering, Faculty of Science and Engineering, Bojonegoro University
Jl. Lettu Suyitno No. 2 Bojonegoro, 62119, Indonesia

ARTICLE INFO:

Received: 2023-12-28
Revised: 2024-01-09
Accepted: 2024-02-14
Published: 2024-02-29

Keywords:

Food dehydrator,
Micro-business,
Rengginang crackers

ABSTRACT

The micro-business of Rengginang crackers with the Urnika brand in Prambontergayang Village, Tuban District, is an industry in the food sector. The process of drying Rengginang crackers in partner's still uses conventional methods or under sunlight to carry out the drying process. Hence, it takes quite a long time to dry Rengginang, namely around 6-7 days. This community service program aims to develop and train the use of alternative technology for drying Rengginang crackers to Rengginang crackers micro-entrepreneurs in Prambontergayang Village, Tuban District. The method used for implementing PKM is a participatory approach (participatory action research/PAR). The results of the PKM carried out have had a positive impact on partners, namely more optimal and efficient drying. Drying using a microcontroller-based food dehydrator can speed up drying up to 120 minutes with a capacity of 5000 pcs of wet Rengginang. With this technology, partners can increase their production capacity for Rengginang crackers so that they can increase the expected number of sales.

©2024 Abdimas: Jurnal Pengabdian Masyarakat Universitas Merdeka Malang
This is an open access article distributed under the CC BY-SA 4.0 license
(<https://creativecommons.org/licenses/by-sa/4.0/>)

How to cite: Abryandoko, E. W., Ashari, F., Febriansa, N. D., & Fachreza, A. A. (2024). Microcontroller based food dehydrator for Rengginang crackers micro businesses in Prambontergayang Village, Tuban District. *Abdimas: Jurnal Pengabdian Masyarakat Universitas Merdeka Malang*, 9(1), 1-11. <https://doi.org/10.26905/abdimas.v9i1.12142>

1. INTRODUCTION

Microbusiness actors in Indonesia have an essential role in national economic development because they can absorb quite a significant workforce (Putra, 2016). According to BPS Statistic Indonesia (2011), job opportunities in Indonesia are getting narrower, so it can drive people to open businesses independently. Based on OECD (2018) the number of micro-business actors in Indonesia is 64.2 million or 99.99%. The workforce absorbed is 117 million workers, or 97%. Meanwhile, according to Kementerian Koordinator Bidang Perekonomian Republik Indonesia (2022) stated that GDP data on micro-business actors contributed 61.1% to the economy in Indonesia. This proves that more and more Indonesian people are choosing to do business in the micro-business sector.

Prambontergayang Village, Tuban Regency, is one of the villages with a micro business centre in producing Rengginang cracker snacks. Rengginang crackers are a traditional snack made from rice or sticky rice (Abryandoko et al., 2023). Rengginang cracker snacks have a savory, crunchy, and sweet

taste, so they have the potential to expand their market share. This taste image is produced according to the quality of the processed Rengginang cracker production. There are several stages in the cracker production process. First, the essential ingredients are formed using a mould; second, they are dried using solar heat; and third, the final process is frying (Sarianto et al., 2019). This program will provide community service in one of the Rengginang producing micro business units with the Urnika brand owned by Mr Suhadi. Based on primary information data from survey methods and direct field observation, Mr. Suhadi's Rengginang cracker production has been established since 2015 and received PIRT (home industry food) legality in 2018 with number 2153523010443-23. Figure 1 shows the production process of Pak Suhadi's Urnika Rengginang crackers.



Figure 1. Rengginang cracker production process: (1) Formation from essential ingredients of rice/glutinous rice; (2) Drying process; (3) Raw Urnika Rengginang packaging ready for sale

The marketing area for Mr Suhadi's Urnika Rengginang crackers is spread around Soko District, Widang District, Tuban Regency and partly in the Bojonegoro Regency area. The average production produced in a day reaches 130 kg of raw rengginan, which is ready to be sold. According to Fahmi et al., (2022), Rengginang cracker-type businesses in some parts of Indonesia are often used as village-owned businesses (BUMDES) because they have good market potential.

Rengginang crackers can be purchased in various traditional markets and minimarkets. The products vary; some are raw packaging, and some are ready-to-consume packaging. The quality of Rengginang crackers can be seen from the bloom level after the frying process (Azzaroh, 2022). According to Karyantina et al. (2023), Rengginang with an appropriate drying process makes it possible to improve the quality of the product so it doesn't break easily during the frying process. Initial observation results were collected through primary information and direct observation. Potential problems that occur to partners are identified in the drying process, which is the longest stage in the production of Rengginang crackers. Partners still use conventional methods to carry out the drying process, namely by drying raw Rengginang in the sun using woven bamboo. Figure 2 Shows documentation of the drying process at partner.

According to Suryana et al. (2020a), the drying process is considered vital because it affects the quality of the Rengginang results. The crispness of Rengginang is determined by the water content reduced due to the drying process. Drying using the conventional method, apart from requiring a long time (6-7 days), allows uneven drying of the Rengginang to occur (Firmansyah & Musyahar, 2020). Another condition that occurs in partners is the rainy season. This condition will decrease product quality due to the change in rengginan colour to blackish and less hygienic. If this condition is left without improvement, it will affect partner sales. The community service program that will be carried out is

the application of microcontroller-based Rengginang cracker food dehydrator technology innovation, which allows partner problems to be solved, including the quality and quantity of production results. The technology will also be ergonomically designed, mobile and portable, making it easier for partners to work safely and comfortably and not change the worker's body posture.



Figure 2. Rengginang drying process

The community service program (PKM) was carried out to provide training and mentoring on microcontroller-based Rengginang cracker food dehydrator technology innovation to the Rengginang-producing micro business unit with the Urnika brand owned by Mr. Suhadi located in Prambontergayang Village, Tuban Regency, with the main objective being that the microbusiness unit can optimize The drying process for Rengginang crackers, which initially took 6 to 7 days, was optimized to a few hours of drying. Training and mentoring at PKM allow the drying process to be carried out using innovative food dehydrator technology to improve the drying quality of partners' products optimally.

2. METHODS

The implementation method for PKM is carried out using two approaches, namely, through and mentoring. The training approach was carried out to inform operational standards for the use of microcontroller-based cracker-producing food dehydrator technology. Meanwhile, the mentoring approach was carried out to evaluate the sustainability of activities carried out by Rengginang Crackers microbusiness actors in Prambontergayang village, Tuban district. The types of data and information used consist of primary and secondary information. Figure 3 is a schematic diagram of the PKM assistance techniques that will be carried out.

The stages of PKM activities are explained in Figure 4, where the program implementation evaluation plan will be implemented for each activity that has been programmed and planned. Meanwhile, for program sustainability, monitoring will be carried out once a month after the program is completed by recording all obstacles and problems that occur with partners so that this program can be sustainable and meet the main target, namely the effectiveness of drying and production of Rengginang.

Implementation of activities is determined based on planning in the PKM activity stages in Figure 4. Time allocation. Implementation of activities is carried out using a scheduled mechanism through activity guidelines prepared jointly between the implementers of PKM activities, namely the Bojonegoro University academic community, and partners, namely the owners of the Rengginang cracker snack business unit. Table 1 is a schedule of PKM activities agreed upon jointly between implementers from the Bojonegoro University academic community and partners.

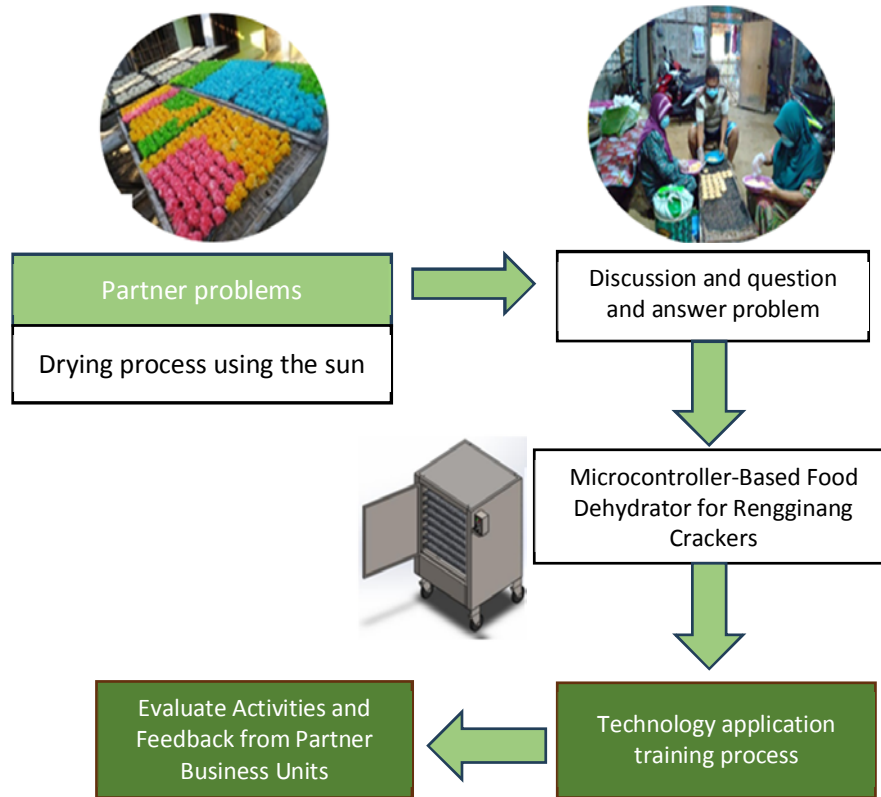


Figure 3. PKM mentoring techniques

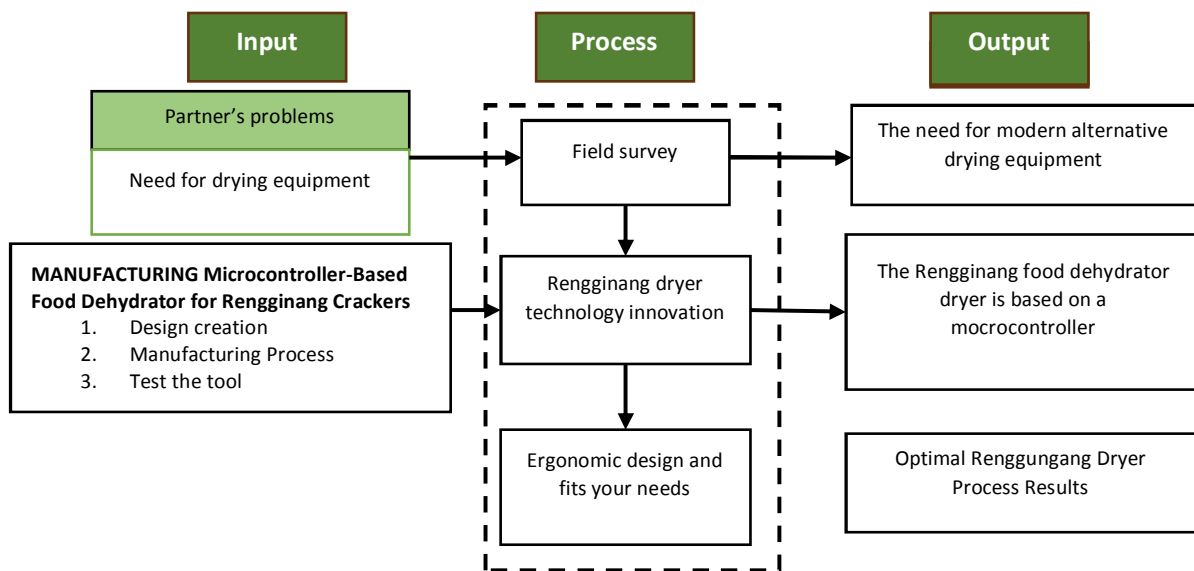


Figure 4. Stages of PKM activities

Table 1. PKM activity schedule

Activity Date	Type of Activity	Parties Involved
7 up 8 Oktober 2023	Initial survey and identification of partner problems	PKM implementation team and Business Unit owners
15 up 22 Oktober 2023	Making a Microcontroller Based Food Dehydrator for Rengginang Crackers	PKM implementation team
16 up 29 Oktober 2023	Testing of a Microcontroller Based Food Dehydrator for Rengginang Crackers	PKM implementation team involving Business Unit owners
4 up 5 November 2023	The training process involves forming a forum with materials: 1. Providing materials for using tools 2. Practice using tools 3. Evaluate the use of tools	PKM implementation team and all Business Unit employees

Strategy Used

The strategy used in assisting partners is explained in Figure 4, a diagram of the plan for achieving solutions to overcome the problems partners' face, namely the Urnika business unit managed by Mr. Suhadi, Prambontergayang Village, Tuban Regency. In this activity, partners will actively participate as participants in all activities that will be planned in the PKM.

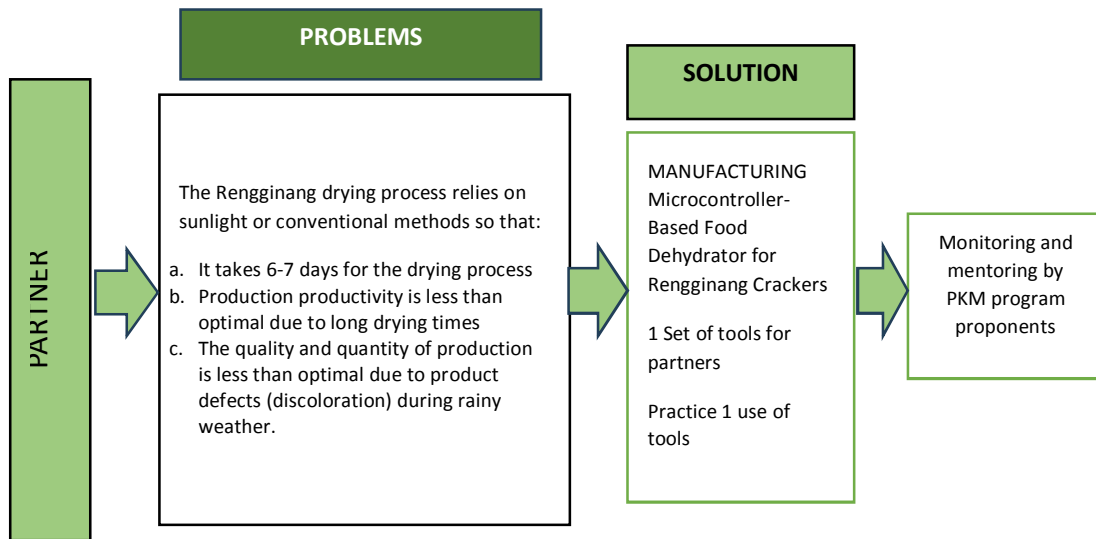


Figure 4. Strategy diagram for achieving solutions to overcome partner problems

The strategy used to assist partners begins with observations collected through primary information using a direct observation approach. After the primary data was obtained, the second stage involved the creation and testing of a microcontroller-based Rengginang cracker food dehydrator technology innovation based on the needs of microentrepreneurs. The third stage is training carried out through community learning activities by forming formal forums. The training activities carried out involved the owner and employees of Mr. Suhadi's Urnika Rengginang cracker micro business. The involvement of Rengginang Cracker microentrepreneurs enables the sustainability of the program. The

training and mentoring carried out involved the PKM team from the Bojonegoro University academic community. The practice of the Rengginang drying process was carried out jointly with guidance from a team of presenters from Bojonegoro University using materials from wet Rengginang produced by partner business units.

3. RESULTS AND DISCUSSION

Implementation of the microcontroller-based food dehydrator for Rengginang crackers training activity is one of the community service programs that aims to optimize the drying process for Rengginang Crackers for partners, which initially took 6 to 7 days and was optimized to a few hours of drying. Training and mentoring at PKM allows the drying process to be carried out using innovative food dehydrator technology to optimally improve the drying quality of partners' products. The microcontroller-based food dehydrator for Rengginang crackers is considered capable of having a positive impact on microbusinesses because it is able to speed up the drying process (Lesmanah et al., 2021). The manufacture of the microcontroller-based food dehydrator for Rengginang crackers was adapted to the needs of partners, namely the Urnika business unit managed by Mr. Suhadi, Prambontergayang Village, Tuban Regency. The application of appropriate technology makes it possible to be an alternative and cost-effective solution compared to conventional drying (Firmansyah & Musyahar, 2020; Rizqiati et al., 2021).

Priority Issues

PKM activities began with a survey to identify problems among partners, namely Rengginang crackers micro business actors in Prambontergayang Village, Tuban District. The initial survey found priority partner issues that were priorities for finding solutions. Table 2 justifies the proposed activities based on several priority issues for partners.

Table 2. Justification of activities to be proposed

Aspect	Problems	Solutions Offered
Technology	The Rengginang drying process relies on sunlight or conventional methods so that: 1. The drying process takes 6-7 days. 2. Production productivity is less than optimal due to long drying times. 3. The quality and quantity of production could be better due to product defects (discolouration) during rainy weather.	Making a microcontroller-based food dehydrator for Rengginang crackers. Training on the use of microcontroller-based food dehydrator equipment for partners.

The justification for the activities proposed in PKM is the technological aspect. PKM activities with technological aspects were chosen because solutions to problems faced by partners can be overcome with several technological approaches. Some of the problems faced by partners are in the drying process, which takes 6 to 7 days, so productivity in the production process is less than optimal. Apart from that, the quality and quantity produced are less than optimal due to product defects (discoloration) during rainy weather. Several discussions between partners and PKM implementers resulted in a solution for solving the problems faced, namely making a microcontroller-based Rengginang drying dehydrator and training partners on its use.

Implementation of PKM Tool-Making Activities

Tool-making activities in PKM activities are carried out in the product planning and design laboratory of the Industrial Engineering study program at Bojonegoro University by adapting to partner needs and testing by taking samples as Rengginang crackers from partners. The first stage is to design and plan the tool; the next step is to make the tool according to what was previously planned by paying attention to accuracy and using predetermined standards to produce the best tool. Figure 6 is the implementation of making a Microcontroller Based Food Dehydrator for Rengginang Crackers.



Figure 6. Implementation of the microcontroller-based food dehydrator for rengginang crackers

The results of making the Microcontroller-Based Food Dehydrator for Rengginang Crackers tool were then tested to ensure that the tool's performance could function as expected. The parameters used to test the quality of Rengginang are water content as a response, thickness of Rengginang, drying temperature, and drying time (Handoko et al., 2022; Suryana et al., 2020b). Testing was carried out to determine the level of efficiency of the microcontroller-based food dehydrator for Rengginang crackers. Testing activities were carried out in the product planning and design laboratory at Bojonegoro University by taking samples in the form of processed Rengginang from partners. The use of a microcontroller-based food dehydrator tool is needed to handle problems that exist among PKM partners. Identification of tool use shows the performance of the Food Dehydrator Microcontroller tool design, which is described in Figure 7.

Testing analysis in using the tool was carried out using a black box system. The performance of the microcontroller-based food dehydrator tool works well; with an input capacity of 5000 pcs, it can produce good product drying.

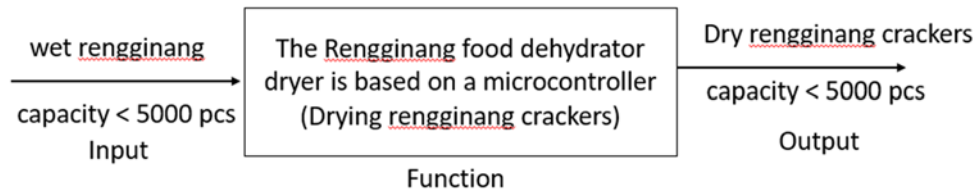


Figure 7. Transparent box for microcontroller-based food dehydrator tool

Implementation of PKM Tool Training Activities

Training on the operation of the Microcontroller Based Food Dehydrator for Rengginang Crackers for Rengginang cracker micro-entrepreneurs in Prambontergayang village, Tuban district, was carried out in several stages, starting with observing the potential of partners, collecting information and material through articles in relevant research journals. The activities we have carried out are as follows: (1) Observation of the Rengginang crackers micro business in Prambontergayang village, Soko sub-district, Tuban regency; (2) Collection of training materials; (3) Making training materials.

The training material was delivered by conveying the use of the microcontroller food dehydrator for Rengginang crackers as a tool that can make work easier, with the main function being too dry Rengginang with the help of measurable technology. Using a microcontroller food dehydrator for Rengginang crackers, the temperature and drying time can be adjusted according to predetermined criteria, namely using a temperature of 75 degrees, which can dry Rengginang for 120 minutes. We also explain using the Microcontroller Food Dehydrator tool to make the work process more efficient, which originally took seven days of drying to 120 minutes of drying perfectly.



Figure 8. Training on operating the microcontroller-based food dehydrator

After explaining the operation of the microcontroller food dehydrator tool, we then explain how the drying process is carried out properly according to the parameters that have been determined so that the drying can work more effectively. From the type of activity, we carry out direct practice for Rengginang cracker micro-entrepreneurs so that they can directly demonstrate the specified parameters. We also offer to try with other parameters by considering temperature and drying time. The main objective of making a Microcontroller Based Food Dehydrator tool is that drying can be carried out optimally with better quality results for Rengginang crackers.

The microcontroller-based food dehydrator tool shortens the drying process time. The microcontroller food dehydrator is made automatically using a heating lamp as a heat source for the machine, aluminium as a heat insulator, and a timer to set the drying time. Using a drying machine can shorten time and increase production capacity. Using a microcontroller-based Food dehydrator is important to optimize the drying process. Optimization resulting from the use of machines can reduce drying time from 2-3 days to 6-12 hours with production capacity from 300-600 per 3 days to 600-1200 per day. The influence of temperature and time is a benchmark for optimal drying results.

Evaluation of Training on Operation of Microcontroller-Based Food Dehydrator Equipment

The use of microcontroller-based food dehydrators has been put into practice. The use process has resulted in complaints from users about adding several components, such as Stavolt, to stabilize the electricity so that the device is safe when the electricity is unstable. Apart from that, several technical obstacles are insignificant but can be resolved directly in the field. As a follow-up to the results of the PKM that has been carried out to partners, it will be evaluated once a month until the Rengginang cracker micro-enterprise in Prambontergayang village, Tuban Regency, applies the technology provided consistently as a sustainable step in the use of Microcontroller Based Food Dehydrator Equipment, so that partners can easily dry Rengginang. Easily and quickly to increase partner productivity.

4. CONCLUSION AND RECOMMENDATIONS

This community service program aims to develop and train Rengginang crackers and Rengginang cracker micro-entrepreneurs in Prambontergayang village, Tuban district, using alternative technology for drying Rengginang crackers. The main target of this community service program is for participants to know and use alternative technology in the form of a microcontroller-based food dehydrator to dry Rengginang properly in a relatively faster time. PKM activities began with a survey to identify problems among partners, namely Rengginang crackers micro business actors in Prambontergayang village, Tuban district. The initial survey found priority issues for partners whose priority solutions were sought. Namely, the Rengginang drying process relies on sunlight or conventional methods so that the drying process takes 6-7 days, production productivity is less than optimal due to long drying times, and the quality and quantity of production are less optimally caused by product defects (discolouration) during rainy weather. The results achieved are the partner's ability to apply alternative technology by using a Microcontroller Based Food Dehydrator to dry Rengginang to increase the productivity of the partner's business.

Based on the community service that has been carried out, suggestions and input that must be considered for program sustainability are as follows: (1) In the future, partners will try to vary the temperature to determine a faster drying time so that we can record developments in the application of the technology that we have provided to partners; (2) The need for ongoing assistance to ensure the adoption of technological innovations presented during training can be developed; (3) Community service programs can be continued by providing the latest technology to support production to partners, such as dough molding equipment and digital financial management.

ACKNOWLEDGEMENTS

Bojonegoro University's research and community service institute has funded all the PKM activities we have carried out.

REFERENCES

- Abryandoko, E. W., & Ashari, F. (2023). Pelatihan pengoprasian aplikasi keuangan berbasis VBA Macro Excel pada IKM rengginang di Desa Prambontergayang Kecamatan Soko Kabupaten Tuban. *Aplikasia: Jurnal Aplikasi Ilmu-ilmu Agama*, 23(1), 1-8. <https://doi.org/10.14421/aplikasia.v23i1.3048>
- Azzaroh, F. (2022). Inovasi kerupuk rengginang sebagai upaya peningkatan potensi usaha mikro kecil menengah di Desa Cidokom. *PRAXIS: Jurnal Pengabdian Kepada Masyarakat*, 1(2), 118–125. <https://doi.org/10.47776/praxis.v1i2.581>
- BPS Statistic Indonesia. (2011). *The informal sector and informal employment in Indonesia: country report 2010*. Asian Development Bank.
- Fahmi, M. H., Nafisa, A., Pradhana, C., Abidin, Z., Zamzami, M. R. A., Rahmawati, Z. N., & Yahya, A. N. (2022). Penerapan modifikasi mesin pencetak rengginang berbasis mikrokontroler pada usaha mikro di Desa Tangkilsari Kabupaten Malang. *I-Com: Indonesian Community Journal*, 2(3), 643-651. <https://doi.org/10.33379/icom.v2i3.1863>
- Firmansyah, G., & Musyaha, G. (2020). Prototipe alat pengering makanan ringan rengginang menggunakan sensor suhu LM35 studi kasus: UMKM Pimpinan Ranting Muhammadiyah Rogoselo. *Cahaya Bagaskara: Jurnal Ilmiah Teknik Elektronika*, 5(1), 1-8.
- Handoko, Y. P., Sari, R. U., Mokhtar, M. K., & Atmaja, R. D. (2022). Pengolahan dan karakteristik mutu rengginang dengan penambahan daging ikan cakalang (Katsuwonus pelamis). In *Prosiding Simposium Nasional Kelautan dan Perikanan*, 9, 153-160.
- Karyantina, M., Prabowo, J. T., & Widanti, Y. A. (2023). Karakteristik rengginang beras merah (*Oryza nivara*)-pati singkong (*Manihot esculenta*) dengan variasi lama penggorengan. *Jurnal Ilmu Pangan dan Hasil Pertanian*, 7(1), 93-112. <https://doi.org/10.26877/jiphp.v7i1.13197>
- Lesmanah, U., Afroni, M. J., & Wafi, A. (2021). Alat pengering kerupuk untuk meningkatkan Usaha Kecil Industri Rumah Tangga di Desa Mulyoagung, Kecamatan Dau, Kabupaten Malang. *JPP IPTEK (Jurnal Pengabdian dan Penerapan IPTEK)*, 5(2), 78-94. <https://doi.org/10.31284/j.jpp-iptek.2021.v5i2.2191>
- Organisation for Economic Co-operation and Development (OECD). (2018). *SME and entrepreneurship policy in Indonesia 2018*. OECD iLibrary. <https://doi.org/10.1787/9789264306264-en>
- Putra, A. H. (2016). Peran UMKM dalam pembangunan dan kesejahteraan masyarakat Kabupaten Blera. *Jurnal Analisa Sosiologi*, 5(2), 40-52. <https://doi.org/10.20961/jas.v5i2.18162>
- Rizqiati, H., Hintono, A., & Setyawan, A. (2022). Teknologi pengering rengginang sebagai upaya pengembangan UMKM aneka makanan ringan di Desa Papedan Kabupaten Pematang. *Inisiatif: Jurnal Pengabdian Kepada Masyarakat*, 1(1), 18-20.
- Sarianto, D., Ikhsan, S. A., & Djunaidi, D. (2019). Sebaran daerah penangkapan alat tangkap sondong di Selat Rupa Perairan Kota Dumai. *Jurnal Ilmu-Ilmu Perikanan dan Budidaya Perairan*, 14(1), 1-6. <https://doi.org/10.31851/jipbp.v14i1.3363>
- Kementerian Koordinator Bidang Perekonomian Republik Indonesia. (2022). *Perkembangan UMKM sebagai critical engine perekonomian nasional terus mendapatkan dukungan pemerintah*. Kementerian Koordinator Bidang Perekonomian Republik Indonesia Retrieved from: <https://>

Microcontroller based food dehydrator for Rengginang crackers micro businesses in Prambontergayang Village, Tuban District

Eko Wahyu Abryandoko, Faisal Ashari, Nungki Dio Febriansa, Ary Angga Fachreza

www.ekon.go.id/publikasi/detail/4593/perkembangan-umkm-sebagai-critical-engine-perekonomian-nasional-terus-mendapatkan-dukungan-pemerintah

Suryana, D., Utami, A. R., & Bangsawan, H. T. (2020a). Perencanaan proses pengeringan rengginang dengan menggunakan bahan bakar sabut kelapa dan gas elpiji. *Indonesian Journal of Industrial Research*, 31(2), 94-101.

Suryana, D., Utami, A. R., Sultoni, A. I., & Bangsawan, H. T. (2020b) Studi efisiensi proses pengeringan rengginang pada alat pengering yang memiliki delapan loyang. *JTPII (Jurnal Teknologi Proses dan Inovasi Industri)*, 5(1), 1-4.
