Research and Innovation in Technical and Vocational Education and Training Vol. 1 No. 2 (2021) 057-065

RITVET

Homepage: http://publisher.uthm.edu.my/periodicals/index.php/ritvet
e-ISSN : 2785-8138

Automatic Temperature Control System for Gray Oyster Mushroom Block Steamer

Farah Sakinah Ismail[1*], Alias Masek[1]

[1]Faculty of Technical and Vocational Education
Universiti Tun Hussein Onn Malaysia, Parit Raja, 86400, Batu Pahat MALAYSIA

*Corresponding Author Designation

DOI: https://doi.org/10.30880/ritvet.2021.01.02.007
Received 8 February 2021; Accepted 28 April 2021; Available online 28 September 2021

Abstract: The purpose of this project is to design and develop the Automatic Temperature Control System product for Gray Oyster Mushroom Block Steamer. This was due to problems that occurred in controlling the temperature and monitoring time in the steaming process of mushrooms. In addition, based on preliminary survey, the Automatic Temperature Control System for Gray Oyster Mushroom Block Steamer is yet to be in the market. Thus, the main objective of the project is to design an automatic temperature control system for the gray oyster mushroom steamers using Blynk applications consisting of DS18B20 temperature detectors as well as developing software using microcontrollers. The project was developed based on the Engineering Design Process model, which is the phase of asking, imagine phase, plane phase, create phase and improve phase. Overall, the project has successfully worked as planned. The automatic temperature control system for this gray oyster mushroom steamer works when the temperature exceeds the set level the Blynk application will receive notification and the mushroom operator can control the heating of the fire through the Blynk app as well. So here mushroom entrepreneurs can monitor through smartphones. Therefore, with the operations of this circuit the mushroom operator can avoid losses from damage of the mushrooms. In fact, it is also relevant to help entrepreneurs toward technological entrepreneurship.

Keywords: Gray Oyster Mushroom, Blynk, Temperature Control, DS18B20, Temperature Sensor

1. Introduction

The increasing demand scenario for mushroom cultivation is due to its advantage in the development of the pharmaceutical, nutraceutical, cosmeceutical, and potential industries in the development of other downstream industries (Rosmiza, 2020). To increase mushroom offering rates in the local market and the encouragement of agropreneur participation, the National Agromatic Policy (2011-2020) has set the mushroom industry as one of the country's high value industries.

**Corresponding author: DB170125@siswa.uthm.edu.my*

Gray mushroom is a type of fungus that grows on its soil or source of nutrients. Mushrooms contain proteins, vitamins and minerals such as calcium and phosphorus. These mushrooms can be eaten and have been heavily planted in Asia ever since. The history of mushroom plants is very unique. It is said to be discovered by the French countryside as a source of food and medicine in the past hundreds. It is grown in caves and this plant requires a humid and cold temperature (Megat Rahim,2013).

In making mushroom media bags, steaming is an important process. This method aims to remove all pollutants in the mushroom block, such as germs, fungi, bacteria and all forms of life (Anim Hosnan,2020). In this process, after being steamed at the required temperature and sufficient time all the impurities will be removed. Therefore, the steaming process must be performed thoroughly to avoid mushroom blocks from being destroyed by harmful impurities (Saiful Amri, 2020).

The problems encountered during the steaming process are difficulty controlling steam temperature and monitoring of steaming time. Therefore, the researcher proposed to develop an automatic temperature control system for grey oyster mushroom block steamer This product perhaps will help entrepreneurs to monitor and control their mushroom temperature automatically without hiring workers to handle it manually.

2. Methodology

This research was carried out using Model Engineering Design Process (2009) This research design is chosen because it is suitable for developing this project. This model has five phases namely ask, imagine, plan, create and improve. Figure 1 shows the model.

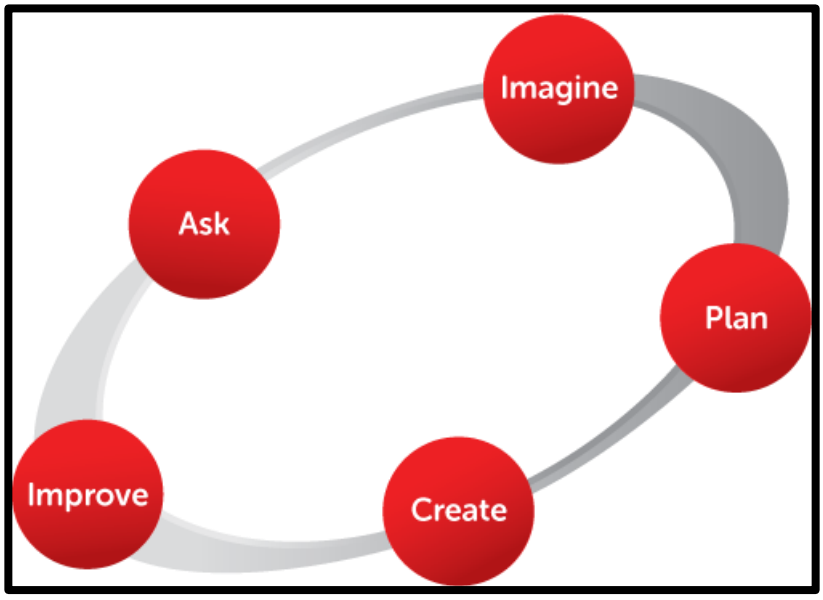


Figure 1: Model Engineering Design Process

These steps all contribute to success the development of product and may be described as follows:

i. Ask: Ask is the most important stage to identify the problem. During this phase, the researcher needs to clearly understand the problems faced by mushroom entrepreneurs. Researchers use the Kipling Method (5W1H) in Table 1 which is the who, what, where, when, why, and how method to identify problems that need to be improved (Bierman, 2010).

Table 1: Explanation of Kipling Method

Kipling Method	Explanation
Who	Researcher interviewed mushroom entrepreneur at Benut, Pontian to get relevant information
What	The problem is that the steamer temperature does not reach the optimum temperature. When this happens, it can cause damaged mushroom blocks. Also, time constraints on this steaming process because the temperature is always monitored manually.
Where	This problem occurs in the mushroom store.
When	Automatically monitor and control the temperature with a smartphone and save time.
Why	To achieve the objective of this project. in addition, can help and solve the problems faced.
How	The researcher will solve the problem with the product development.

ii. IMAGINE: The researcher will begin planning to make some sketches and choose the best drawing eventually. Researchers proposed a few design options to address the demand of entrepreneurs. Thus, the automatic temperature control system for gray oyster mushroom block steamer was developed to replace the manual control system. Researchers develop products using casing boxes in each component used.

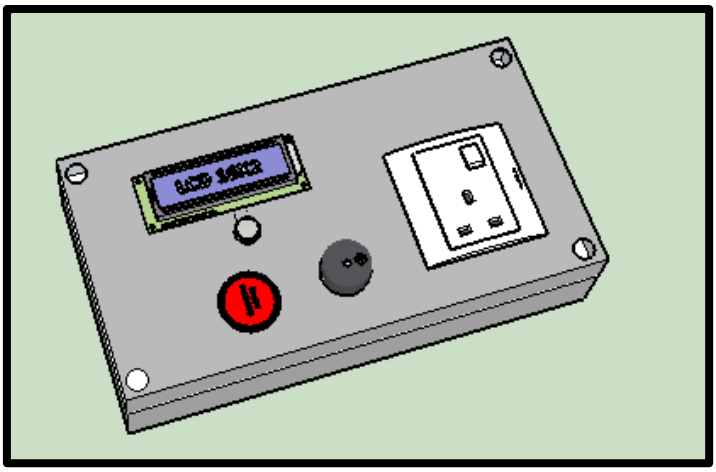


Figure 2: Proposed Design

iii. PLAN: This phase is an important phase to find solutions in the development of this product. In this phase the selection of components and hardware is made. Figure 3 shows a block diagram for product development consisting of input process and output. The input process is when the operator pushes the button. This will give a signal to Node MCU and at the same time the sensor of DS1820 will be activated. Next process is when the temperature exceeds the maximum level by NodeMCU ESP8266, the Blynk application will receive notification. When notifications appear, users can control fire heating using the Blynk app as well. Then the buzzer will sound

when steaming time finishes and the LCD displays the temperature and time set. Figure 3 demonstrates the operations which are Input, Process and Output.

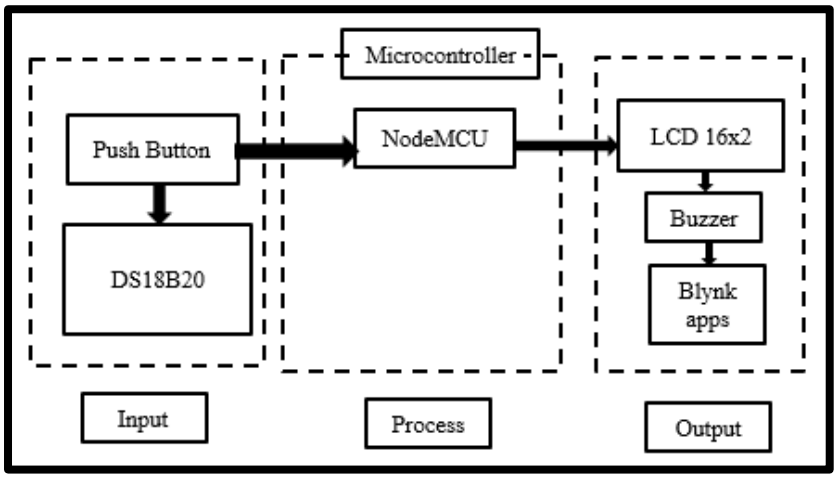


Figure 3: Block Diagram

Figure 4 shows the schematic circuit that can be implemented based on the block diagram that has been described above.

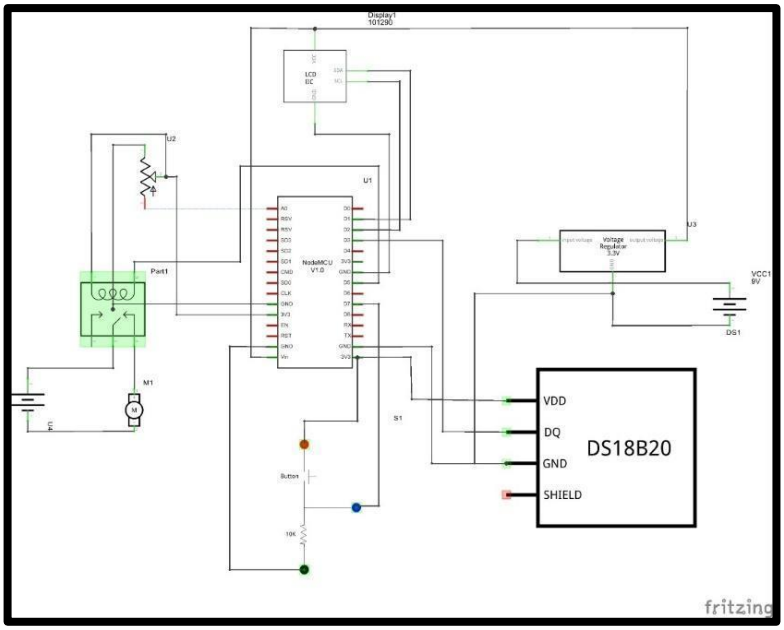


Figure 4: Schematic Circuit

The process of this study is illustrated in a flow chart. Figure 5 shows a flow chart of the operational process of the Automatic Temperature control system for Gray Oyster Mushroom Block Steamer.

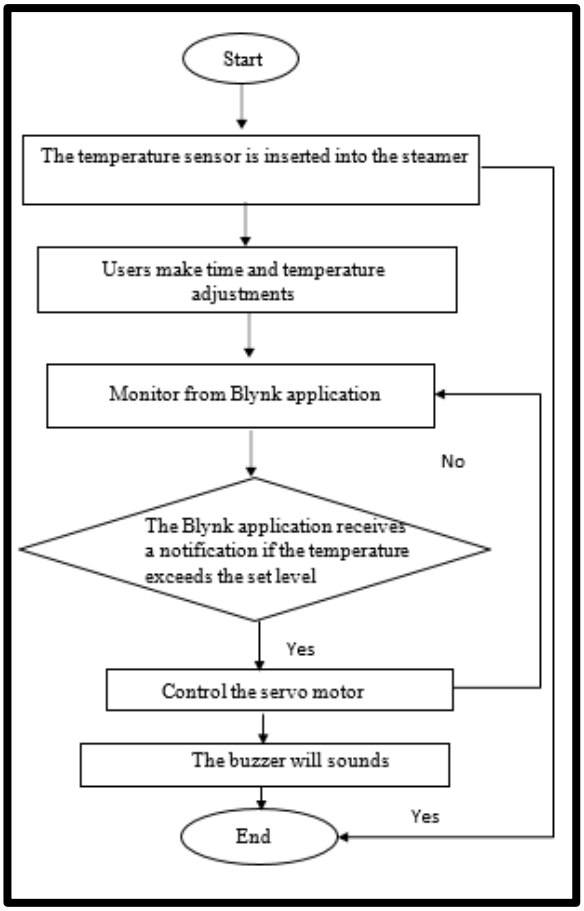


Figure 5: Flow Chart Process

iv. CREATE: This phase is the product development and testing phase. For the development phase is the arrangement of components in the casing as well as software development. This phase will also look at the functionality of the developed product, evaluated by experts.

Figure 6: Automatic Temperature Control System for Grey Oyster Mushroom Block Steamer

v. IMPROVE: Based on the evaluation result, improvements were made accordingly.

3. Results and Discussion

The results and discussion section presents data and analysis of the study.

3.1 Analysis of DS18B210 (Temperature sensor).

The temperature sensor is connected to the NodeMCU ESP8266 microcontroller. The data read by this temperature sensor will be displayed on the LCD and notification will be sent to the Blynk application. The user can monitor the temperature via smartphones with the availability of internet networks.

The operation starts when the temperature exceeds the setting level, automatically the user will receive notification such as “alert temperature high” and then the user is able to control the fire heating by using the Blynk application. Figure 2 shows the result of the setting temperature and the notification sent to the Blynk application.

Table 2: Temperature sensor process

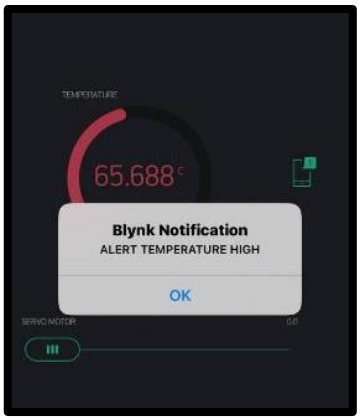
Data	Explanation
	The temperature is set at 50°C-60°C for 12 hours of squeeze. The start button presses the moving time, and the temperature also changes according to heat
	When the temperature sensor exceeds over 61°C, the Blynk application will receive a notification called "alert temperature high". So, the user will be able to control the temperature to the required temperature by using the Blynk application.

Table 3: Result of temperature sensor analysis

Temperature Optimum (°C)	Time (Hour)	Test Temperature (°C)	Blynk Notification
98-105	1	106	Accept
95-98	3	99	Accept
90-95	5	96	Accept
80-90	6	91	Accept
70-80	9	81	Accept
50-60	10	61	Accept

3.2 Instrument for Expert Evaluation

Questionnaire is used as an instrument to evaluate the system. A total of 5 experts were involved in the process. The questionnaire has 3 parts which are product design, product functionality and commercial potential. Also a suggestion section for experts to suggest improvement of the system. Each item in the questionnaire uses a nominal scale for this evaluation checklist which is yes and no.

3.3 Design Aspect of Product

There are 7 items to test the design aspect. The data is presented in the form of frequency and percentage values. Table 4 shows the frequency and percentage of each item.

Table 4: Evaluation of the Design Aspect by the Experts

No	Item	Frequency		Total (%)
		Yes	No	
1	Casing size appropriate to the circuit components used	4	0	100
2	Neat arrangement of components	4	0	100
3	User Friendly: i. Using temperature and time adjustments. ii. Using sensor temperature and LCD display iii. Using IoT systems and monitoring via smartphones iv. Using servo motors and IoT systems to control heating automatically.			100
4	Appropriate power source	4	0	100
5	The casing used is head resistant	4	0	100
6	The DS18B20 temperature sensor is suitable for use.	3	1	90
7	Notification issues are suitable for mushroom agropreneurs.	4	0	100

Table 4 shows that the experts agree with the design of the product in terms of circuit casing size, component arrangement, user friendly, appropriate power source, heat resistant casing and notification issue for mushroom agropreneurs. However, one expert does not agree with the use of the DS18B20 temperature sensor. Perhaps, researchers could use higher temperature sensors. On the whole, most experts agree with the design aspects of the system.

3.4 Expert evaluation of product functionality

There are 7 items to ensure the product functionality. Analytical data is presented in the form of frequency and percentage values. Table 5 shows the frequency and percentage of items against the product design.

Table 5: Evaluation of the Functionality Aspect by the Experts

No	Item	Frequency		Total (%)
		Yes	No	
1	LCD display temperature readings	4	0	100
2	The temperature is adjustable	4	0	100
3	The time is adjustable	4	0	100
4	Buzzer issue a notification sound to the user	4	0	100
5	Data is sent to the Blynk application according to set temperature and time range	4	0	100
6	Data from blynk application is sent to the microcontroller	4	0	100
7	The motor can function after receiving instructions from NodeMCU ESP8266	4	0	100

Based on the result presented in Table 5, all experts agreed on the functionality aspect of this product. Experts agree that the LCD can display the temperature and time reading. Also, adjustment of temperature, buzzer notification and sound issuance. Data is sent successfully to the Blynk app according to the set temperature and time range. For servo motor usage, the data from the Blynk application is sent to the microcontroller and the servo motor can function after receiving instructions from NodeMCU ESP8266.

3.5 Expert evaluation of the commercial potential of the product

Similarly, 7 items were constructed for analysis of the commercial potential of this product. Analytical data is presented in the form of frequency and percentage values. Table 6 shows the frequency and percentage of evaluation of the commercial potential aspects by the experts.

Table 6: Evaluation of the Commercial Potential Aspects by the Experts

No	ITEM	Frequency		Total (%)
		Yes	No	
1	Save on temperature monitoring time	4	0	100
2	Using the concept of steam and stay	4	0	100
3	Avoid losses	4	0	100
4	Improve production quality	4	0	100
5	Low development costs	4	0	100
6	Low maintenance costs	4	0	100
7	Easy to operate	4	0	100

As demonstrated in Table 6, 100% of experts agree on the commercial potential aspects of this product. Overall, experts agreed the product can be applied to the mushroom steamer to facilitate mushroom entrepreneurs in controlling temperature for the steamer of this grey oyster mushroom.

4. Conclusion

To realize the implementation of the 4.0 industrial revolution in the field of agriculture, some suggestions were given by experts for the improvement of this product. Among the recommendations are to use a better temperature sensor and a higher temperature value. Also, use suitable materials for

heat resistance. Finally, the addition of LED for the power indicator light and the trigger indicator light. In the future, the researcher hopes that with the cooperation of industry, The Automatic Temperature Control System of Grey Oyster Mushroom Block Steamer can be commercialized.

Acknowledgement

The authors would also like to thank the Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn Malaysia for its support. A special thanks to Dr. Alias bin Masek for his countless hours of supervising, reflecting, encouraging and most of all patience throughout the entire process of this research.

References

Anem, M. "Anim Agro Technology: TEKNOLOGI TANAM CENDAWAN KUKUR (Part 1)." Anim Agro Technology, 13 May 2020

Bierman, D. (2010). Consciousness-Induced Restoration of Time Symmetry (CIRTS). A Psychophysical Theoretical Perspective. Journal of Parapsychology, 24, 273–300.

Harress. "TEKNIK PENGUKUSAN BONGKAH CENDAWAN." MyAgri.Com.My, 3 Jan. 2017, https://myagri.com.my/2017/01/pengukusan-bongkah-cendawan/.

Ismail, F. S. (2020, Mac 14). Pengukus Bongkah Cendawan Tiram Kelabu. (N. A. Suloh, Interviewer)

Johan, Yaacob. Economic and Technology Management Review. www.academia.edu, https://www.academia.edu/11624963/Economic_and_Technology_Management Review. Accessed 18 June 2020.

Kakon, A.J. & Choudhury, Bazlul & Saha, Shusmita. (2019). Mushroom is an Ideal Food Supplement. Journal of Dhaka National Medical College & Hospital. 18. 58-62. 10.3329/jdnmch.v18i1.12243.

Serikul, Peerasak, et al. "Smart Farm Monitoring via the Blynk IoT Platform: Case Study: Humidity Monitoring and Data Recording." 2018 16th International Conference on ICT and Knowledge Engineering (ICT&KE), Nov. 2018, doi:10.1109/ictke.2018.8612441.

Sheth, Mitul, and Pinal Rupani. "Smart Gardening Automation Using IoT with BLYNK App." 2019 3rd International Conference on Trends in Electronics and Informatics (ICOEI), Apr. 2019, doi:10.1109/icoei.2019.8862591.

Sihombing, P., et al. "Microcontroller Based Automatic Temperature Control for Oyster Mushroom Plants." Journal of Physics: Conference Series, vol. 978, Mar. 2020, p. 012031, doi:10.1088/1742-6596/978/1/012031.