DINAMIKA REKAYASA
http://dinarek.unsoed.ac.id

Volume 22 Nomor 1 (2026) Hal. 63-72
e-ISSN 2527-6131
http://jurnaldinarek.id

PEMBANGUNAN *PROTOTYPE* JEMURAN PAKAIAN PINTAR BERBASIS ESP8266 MENGGUNAKAN METODE ANALISIS DIMENSI KUALITAS PRODUK

DEVELOPMENT OF SMART CLOTHESLINE PROTOTYPE BASED ON ESP8266 USING DIMENSION OF QUALITY FOR GOODS ANALYSIS METHOD

Sulistiyasni[1*], Lia Fitriatun Agustin[2], Muhammad Akbar Setiawan[3], Nur Alfi Ekowati[4]

*Email: sulistiyasnipwt@swu.ac.id

[1,2,3] Teknik Informatika, STMIK Widya Utama, Purwokerto, Indonesia
[4]Informatika, Universitas Jenderal Soedirman, Purwokerto, Indonesia

Abstrak

Pemanasan global seringkali menyebabkan cuaca menjadi lebih sulit diprediksi. Terutama di Indonesia, saat ini musim kemarau dan musim hujan sering datang secara tiba-tiba. Cuaca yang tidak dapat diprediksi juga dapat mengganggu pekerjaan rumah tangga, misalnya, menjemur pakaian. Sistem kontrol jemuran otomatis diusulkan sebagai solusi untuk masalah ini. Penelitian ini bertujuan untuk membangun prototipe jemuran pintar berbasis ESP8266 menggunakan metode pengembangan sistem prototipe dan menganalisis kualitasnya menggunakan metode pengujian produk dengan atribut dimensi kualitas produk. Perangkat keras yang digunakan dalam pengembangan meliputi Arduino Uno, NodeMCU ESP8266, sensor hujan, sensor inframerah, sensor LDR, dan motor servo. Sementara itu, perangkat lunak yang digunakan adalah Blynk. Atribut yang dinilai dalam pengujian meliputi kinerja, daya tahan, kesesuaian dengan spesifikasi, fitur, keandalan, estetika, kualitas yang dirasakan, dan kemudahan perawatan. Dalam penelitian serupa lainnya, penggunaan pengujian produk seperti ini belum pernah dilakukan. Hasil penelitian menunjukkan bahwa prototipe jemuran pintar yang dibangun telah lulus uji produk dengan nilai uji produk sebesar 90.10.

Keywords: dimensi kualitas produk, ESP8266, IoT, jemuran pakaian, prototipe

Abstract

Global warming often causes the weather to become more unpredictable. Especially in Indonesia, currently the dry and rainy seasons often come unexpectedly. Unpredictable weather can also interfere with household chores, for example, drying clothes. An automatic clothesline control system is proposed as a solution to this problem. This research aims to build a prototype of a smart clothesline based on ESP8266 using the prototyping system development method and analyze its quality using the product testing method with product quality dimension attributes. The hardware used in the development includes Arduino Uno, NodeMCU ESP8266, rain sensor, infrared sensor, LDR sensor, and servo motor. Meanwhile, the software used is Blynk. The attributes assessed in the test include performance, durability, conformance to specifications, features, reliability, aesthetics, perceived quality, and serviceability. In other similar studies, the use of such product testing has never been done. The results of the study show that the smart clothesline prototype that was built has passed the product test with a product test value of 90.10.

Keywords: clothesline, dimension of quality for goods, ESP8266, IoT, prototype

I. INTRODUCTION

Technology is currently developing at a very rapid pace. Many daily human activities can now be carried out using technology to simplify and accelerate work processes. However, technological development can also produce negative effects, one of which is global warming, which often leads to unpredictable weather conditions. In Indonesia, for example, the dry and rainy seasons frequently occur outside of forecasts. Unpredictable weather conditions can disrupt household chores, particularly the activity of drying clothes. An automatic clothesline control system is therefore introduced as a solution to this problem. This technology optimally utilizes sunlight to reduce the time and physical effort required by humans.

Previous research on automatic clotheslines has been conducted, such as the study described in [1], which developed a prototype of an Arduino Uno–based automatic clothes dryer. The prototype was designed to prevent clothes from getting wet when rain falls. That study employed the prototyping system development method. In the prototyping model, users are enabled to understand the stages of the system being developed so that the system can operate effectively [2].

Other similar studies have added rain sensors and Light Dependent Resistor (LDR) sensors [3]. Another study developed a smart automatic clothesline called S.M.A.R.T, equipped with innovative rain sensor modules that allow individual clotheslines to retract when the system detects changes in surrounding weather conditions [4].

In addition to the studies mentioned above, various other related works have been conducted, as reported in references [5]–[13]. These studies adopt technologies based on the Internet of Things (IoT) concept, which is designed to optimize the use of continuously connected internet networks [14].

Among the many existing studies, none have linked automatic clothesline development with product quality dimension analysis. Such dimension-based analysis is generally applied in economic research, for example, studies examining the effect of product quality dimensions on consumer satisfaction in fashion retail stores [15]. Therefore, this research aims to develop an ESP8266-based smart clothesline prototype using the prototyping development method and to analyze its quality using product quality dimension attributes. This IoT-based smart clothesline system integrates hardware and software in the form of an Android application that can automatically control the clothes drying process.

II. LITERATURE REVIEW

The literature review of this research is described in the following explanation.

A. Clothesline

A clothesline is a tool used to dry clothes [16]. An automatic clothesline is a device that operates independently without human intervention. It moves automatically in and out based on readings from installed light and humidity sensors. Thus, clothes are automatically moved according to sensor readings [3].

B. Prototype

The prototyping model has several advantages and disadvantages [17]. One of its main advantages is that developers can more easily identify user requirements, and system implementation becomes simpler because users have a clearer understanding of their expectations and needs.

C. IoT (Internet of Things)

The Internet of Things (IoT) is a concept that enables devices to be connected to the internet and share information with one another. This concept has been widely applied across various activities and fields [18].

D. NodeMCU ESP8266

The NodeMCU ESP8266 functions to connect a microcontroller to a programmed Wi-Fi network. This device uses a programming language compatible with the Arduino platform [18].

E. Rain Sensor

A rain sensor is a device used to detect rainfall and can be applied in various applications. Commercially, rain sensors are available as modules that are easy to integrate with microcontrollers or Arduino boards using jumper cables [19]. These sensors are equipped with a comparator IC that produces high or low logic output signals and can generate both analog and digital signals [20].

F. LDR Sensor

An LDR (Light Dependent Resistor) sensor is used in electronic circuits to convert light intensity into electrical signals. This sensor is a type of resistor whose resistance varies according to light intensity [20].

G. Infrared Sensor

An infrared sensor operates by utilizing infrared waves, which act as a communication medium between devices. This sensor is commonly used in remote control systems, security systems, and automation. In remote controls, the sensor responds to button presses that convert signals into inputs for electronic devices [8].

H. Servo Motor

A servo motor is a type of motor used in closed-loop control systems, where the rotor position is precisely controlled. The system continuously checks and ensures that the rotor position matches the desired position; if not, a control signal is sent to adjust it. A servo motor consists of a motor, gears, a potentiometer, and a control circuit. The potentiometer determines the rotation angle limits. Servo motors generally move only within a specific angle range and do not rotate continuously [21].

III. METHODOLOGY

This section describes the system development method and the product quality analysis method used in this research.

A. System Development Method

The system development method used in this research is the prototyping method. Figure 1 illustrates the stages and processes of system development using the prototyping model [22], which include the following steps:

1) Communication

Communication is conducted to identify user needs and system requirements. At this stage, observations are also necessary, as needed. Once user needs have been identified, the system development requirements for resolving them can also be identified. This step is carried out on existing problems to identify a solution approach, supported by the collected data.

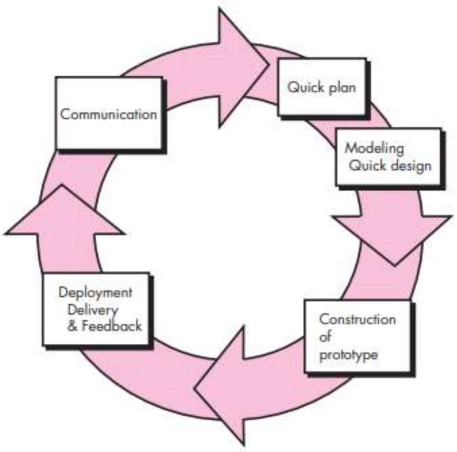


Figure 1. *Prototyping* Model [23]

2) Quick Plan

At this stage, brief planning and preparation are conducted to ensure that the prototyping-based system development process proceeds in a structured and directed manner.

3) Modeling Quick Design

This stage involves designing diagrams to describe the main functions of the system based on user requirements.

4) Construction of Prototype

In this stage, the system prototype is developed. All identified features and functional requirements are implemented based on the quick plan and quick design models.

5) Deployment, Delivery, and Feedback

In the final stage, the developed system is tested to measure its functionality and validate its conformity with user requirements. Testing is conducted by users, who also provide feedback on the designed system [24].

B. Product Quality Analysis Method

The quality of a product, whether goods or services, is determined by various dimensions [25]. Therefore, product quality analysis was conducted by evaluating the developed prototype using the following product quality dimension attributes: performance, durability, conformance to specifications, features, reliability, aesthetics, perceived quality, and serviceability [26].

IV. RESULTS AND DISCUSSION

The development of the ESP8266-based smart clothesline prototype using the prototyping method involved several stages as follows.

A. Communication

This stage involved analyzing and identifying hardware and software requirements through communication with prospective users. The required hardware included a laptop or notebook, Arduino Uno, NodeMCU ESP8266, rain sensor, LDR sensor, infrared sensor, servo motor, smartphone, jumper cables, and other supporting cables. The primary software used to develop the smart clothesline application was Blynk.

B. Quick Plan

The working principle of the system involves the use of light, rain, and infrared sensors. These sensors send signals when weather changes are detected. The light and rain sensors detect weather conditions, while the infrared sensor monitors the servo motor movement to ensure that the clothesline has moved into a covered area. Sensor data are transmitted to the Blynk application.

C. Modeling Quick Design

This stage is carried out by designing a diagram to illustrate the main functions of the automatic clothesline system based on user needs. Figure 2 illustrates the ability of users can turn the clothesline system on and off to control or monitor the clothesline [27]. This activity is supported by sensor metadata obtained from LDR sensor detection activities and rain sensor detection. In addition, users can also see notifications in response to activities they have carried out through the system. Therefore, it can be said that monitoring is performed through the Blynk application.

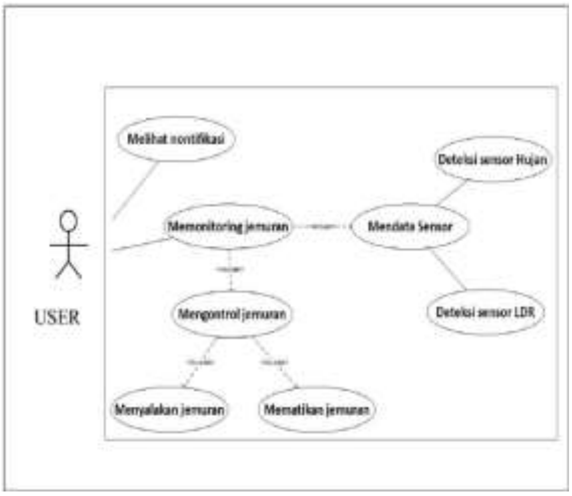


Figure 2. Use Case Diagram of Automatic Clothes Drying System Referring to Reference [28]

D. Develop Initial Prototype

The prototype was developed based on the principles described in the quick plan and quick design stages. The ESP8266-based smart clothesline system integrates hardware and Android-based software to control and monitor the clothes drying process.

1) Software Development

The Android application was built using Blynk. The application's format is shown in Figure 3. It is used to monitor clotheslines. If the clothesline is outside, the application's status will be 0.

Meanwhile, the status will change to 1 if the clothesline is indoors or in a roofed area. This status is facilitated by the NodeMCU ESP8266's notification of changes in weather conditions.

Figure 3. Android Application for Monitoring the Smart Clothesline

2) Hardware Development

The steps for building the hardware for the smart clothesline prototype are as follows.

a. Arduino Uno Installation

The Arduino Uno is installed to serve as the main controller for the system's circuit. The Arduino Uno installation is shown in Figure 4.

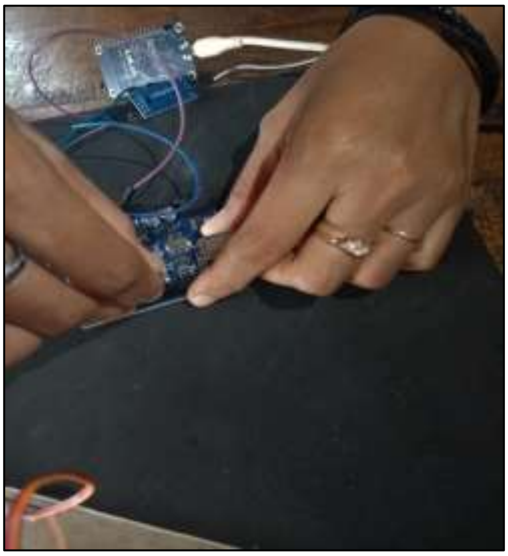


Figure 4. Arduino Uno Installation

b. NodeMCU ESP8266 Installation

The NodeMCU ESP8266 acts as a bridge for transmitting sensor data from the Arduino Uno to the Blynk application. The installation of these components is shown in Figure 5.

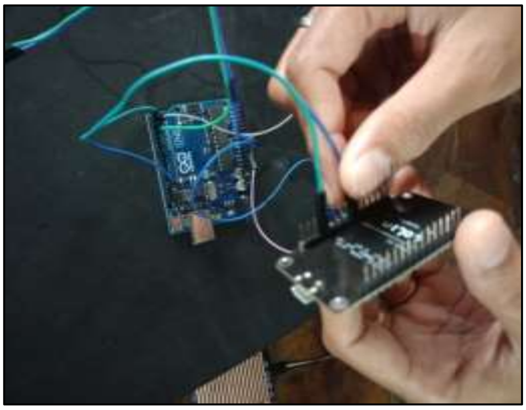


Figure 5. NodeMCU ESP8266 Installation

Installing the NodeMCU requires writing several lines of source code for the NodeMCU microcontroller to ensure the component runs properly.

A screenshot of the source code is shown in Figure 6. The first line of the source code, #include <Servo.h>, is a C++ preprocessor that informs the compiler that the Servo.h file is included in the program. Meanwhile, const int declares an integer variable whose value cannot be changed after initialization. In this case, two constant variables are defined. In addition, there are four non-constant integer variables: rain, light, close, and open.

Figure 6. Source Code Screenshot

c. Rain Sensor Installation

The rain sensor on the smart clothesline functions as a water or rain detector. The intended rain sensor installation is shown in Figure 7.

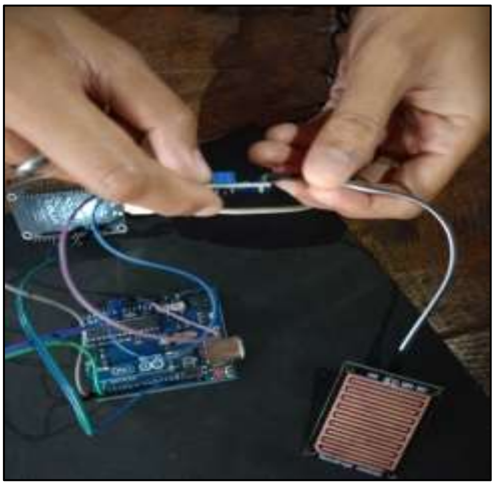


Figure 7. Rain Sensor Installation

d. Light Sensor Installation

The light sensor is installed as shown in Figure 8. This sensor functions as a detector of light or dark (cloudy) weather.

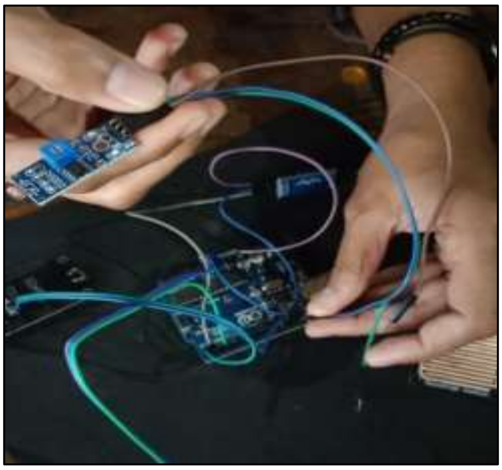


Figure 8. Light Sensor Installation

e. Servo Motor Installation

A servo motor is used to drive the clothesline. The servo motor installation diagram is shown in Figure 9.

Figure 9. Servo Motor Installation

f. Assembly Results

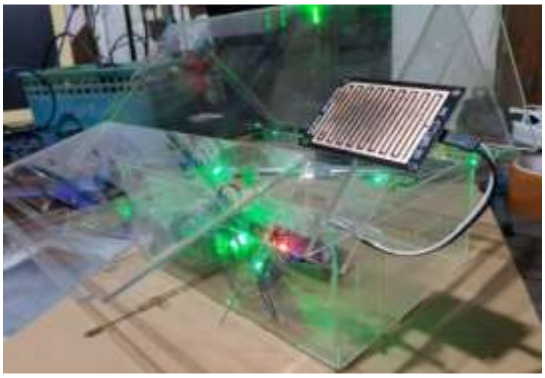


Figure 10. Smart Clothesline Prototype Appearance

After all components were installed, the assembly of the ESP8266-based smart clothesline prototype was successful. The prototype's appearance is shown in Figure 10. This prototype can be implemented as a life-size smart clothesline.

E. Deployment, Delivery, and Feedback

The prototype was evaluated by prospective users to ensure that it met their needs. Revisions were made if the prototype did not meet expectations.

1) Respondents and Product Test Attributes

This research used product testing to analyze product quality based on the product quality dimension assessment attributes. The testing was conducted with 20 respondents with knowledge of hardware systems.

a. *Performance*

Performance is the ease and convenience of using this smart clothesline prototype. In this case, the servo motor should operate as expected.

b. *Durability*

Durability describes a clothes dryer that can be used repeatedly and still provides results that match the conditions at the time of testing.

c. *Conformance to Specifications*

This attribute means that the ESP8266-based smart clothesline prototype should be able to be used according to the specifications.

d. *Features*

Features refer to the availability of attractive and user-friendly functions.

e. *Reliability*

Reliability shows that the ESP8266-based smart clothesline prototype can be used to dry clothes repeatedly.

f. *Aesthetics*

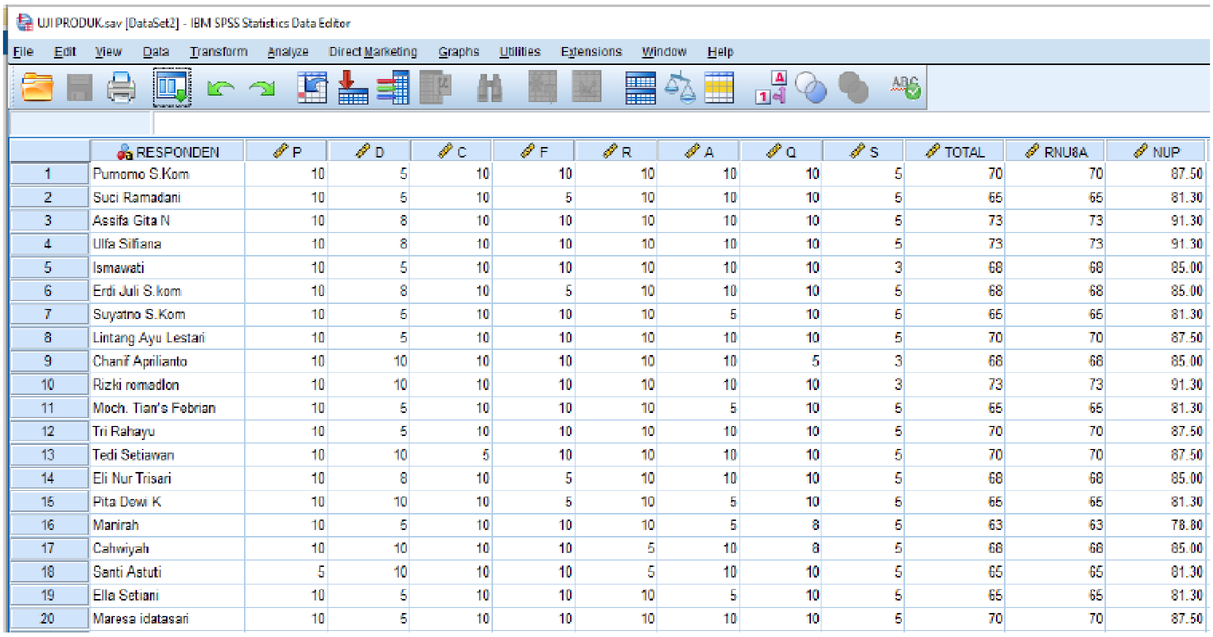
This aspect means that the ESP8266-based smart clothesline prototype should have an attractive design.

g. *Perceived Quality*

The implementation of IoT in the form of a smart clothesline prototype based on ESP8266 should have good and adequate quality.

h. *Serviceability*

The ESP8266-based smart clothesline prototype should be repairable if damaged.



UJI PRODUK.sav [DataSet2] - IBM SPSS Statistics Data Editor

	RESPONDEN	P	D	C	F	R	A	Q	S	TOTAL	RNU8A	NUP
1	Pumomo S.Kom	10	5	10	10	10	10	10	5	70	70	87.50
2	Suci Ramadani	10	5	10	5	10	10	10	5	65	65	81.30
3	Assifa Gita N	10	8	10	10	10	10	10	5	73	73	91.30
4	Ulfa Silfiana	10	8	10	10	10	10	10	5	73	73	91.30
5	Ismawati	10	5	10	10	10	10	10	3	68	68	85.00
6	Erdi Juli S.kom	10	8	10	5	10	10	10	5	68	68	85.00
7	Suyatno S.Kom	10	5	10	10	10	5	10	5	65	65	81.30
8	Lintang Ayu Lestari	10	5	10	10	10	10	10	5	70	70	87.50
9	Chanif Aprilianto	10	10	10	10	10	10	5	3	68	68	85.00
10	Rizki romadlon	10	10	10	10	10	10	10	3	73	73	91.30
11	Moch. Tian's Febrian	10	5	10	10	10	5	10	5	65	65	81.30
12	Tri Rahayu	10	5	10	10	10	10	10	5	70	70	87.50
13	Tedi Setiawan	10	10	5	10	10	10	10	5	70	70	87.50
14	Eli Nur Trisari	10	8	10	5	10	10	10	5	68	68	85.00
15	Pita Dewi K	10	10	10	5	10	5	10	5	65	65	81.30
16	Manirah	10	5	10	10	10	5	8	5	63	63	78.80
17	Cahwiyah	10	10	10	10	5	10	8	5	68	68	85.00
18	Santi Astuti	5	10	10	10	5	10	10	5	65	65	81.30
19	Ella Setiani	10	5	10	10	10	5	10	5	65	65	81.30
20	Maresa idatasari	10	5	10	10	10	10	10	5	70	70	87.50

Figure 11. Screenshot of Questionnaire Response Score Recapitulation

2) Product Testing Results

A number of respondents were given 20 questionnaire questions to answer. The list of questions is as attached in Table 1. The results of the product test based on aspects and a number of respondents' answers are tabulated in a table that can be seen in Figure 11. RNU8A in the table is the product test value of 8 attributes (P, D, C, F, R, A, Q, S), while NUP is the product test value. The mean of the total value and RNU8A is 68.10 respectively, while the mean of NUP is 85.15.

The product test value has a limit of 75. If the value is ≥75, the product is declared successful, but if the product value is <75, the product is declared a failure. Based on the data in the table, the following results were obtained:

a. Average attribute value in product testing = 68.10

b. Product test value $= \frac{\text{RNU8A}}{\text{N Max 8A}} \text{ X } 100$

$$= \frac{68{,}10}{75} \text{ X } 100 = 90.10 \qquad (1)$$

Table 1. Product Testing Assessment Form

Number	**Performance Attribute Assessment Indicators**	**Y (5)**	**N (0)**
1	Can the smart clothesline operate automatically?		
2	Can a smart clothes dryer last long when turned on?		
Total score = score 1 + score 2			
Number	**Durability Attribute Assessment Indicators**	**Y (2,5)**	**N (0)**
1	Can the smart clothesline be used once without error?		
2	Can the smart clothesline be used twice without error?		
3	Can the smart clothesline be used three times without error?		
4	Can the smart clothesline be used four times without error?		
Total score = score 1 + score 2 + score 3 + score 4			
Number	**Conformance Attribute Assessment Indicators**	**Y (5)**	**N (0)**
1	Can the smart clothesline prototype operate automatically?		
2	Does the smart clothesline prototype follow the instructions in the microcontroller program?		
Total score = score 1 + score 2			
Number	**Features Attribute Assessment Indicators**	**Y (5)**	**N (0)**
1	Does the smart clothing prototype have easy-to-understand features?		
2	Does the smart clothing prototype have switches?		
Total score = score 1 + score 2			

Number	Reliability Attribute Assessment Indicators	Y (5)	N (0)
1	Can the smart clothesline be used for 1 hour without error?		
2	Can the smart clothesline be used for more than 2 hours without error?		
	Total score = score 1 + score 2		
Number	**Aesthetic Attribute Assessment Indicators**	**Y (5)**	**N (0)**
1	Does the smart clothesline prototype package look attractive?		
2	Are the connectors and cables neatly arranged?		
	Total score = score 1 + score 2		
Number	**Quality Attribute Assessment Indicators**	**Y (2,5)**	**N (0)**
1	Is the quality of the components of the smart clothesline prototype good?		
2	Do the stepper motor movements follow the path?		
3	Are the microcontroller components good?		
4	Are the circuit components shock-resistant?		
	Total score = score 1 + score 2 + score 3 + score 4		
Number	**Serviceability Attribute Assessment Indicators**	**Y 2,5**	**T 0**
1	Can the microcontroller provide an error warning?		
2	Is it easy to repair if an error occurs in the smart clothesline prototype?		
	Total score = score 1 + score 2		

The results of the 20 questions in the product test questionnaire showed a score above 75, namely 90.10. It can be stated that the product test on the prototype that has been built has passed.

F. Discussion

The development of a smart clothesline was carried out using the prototyping system development method. Several previous studies [5]-[13] also employed the same method. However, all of these studies had different testing methods than this research.

Study [5] did not list the name or type of testing method, but only stated that the testing was conducted on the LDR sensor and rain sensor components. Similarly, study [6] tested the performance of its sensor components, such as the rain sensor, LDR sensor, DHT-22 sensor, and also tested the L298n motor driver and relay. Study [7] developed a clothesline control system using fuzzy logic and the black box testing method.

Research [8] tested each component one by one, including the light sensor/LDR, temperature and humidity sensor/DHT1, rain sensor, servo motor, and 12 volt DC fan. In addition, testing of the software was also carried out, especially on the functions of the home page, automatic control mode, manual control mode, instructions page, and page about the application. Testing [9] conducted tests on hardware, software, and also time. Research [10] explained the tests which included testing the tools (hardware) and testing the software. Meanwhile, research [13] conducted tool testing without any explanation of software testing.

This research differs significantly in its testing method, which utilizes dimension analysis of product quality (dimension of quality for goods). Tests conducted with 20 respondents and 20 questions revealed that the prototype smart clothesline that was built passed product testing.

V. CONCLUSION

Unpredictable weather can disrupt household chores, such as drying clothes. An automatic clothesline control system offers a solution to this problem. This technology can optimally utilize available sunlight and save time and effort. This research has developed a smart clothesline using a prototyping system development method and a product testing method with attributes of the product quality dimension (dimension of quality for goods). Application software development was carried out using Blynk. Meanwhile, hardware development was carried out by installing an Arduino Uno, NodeMCU ESP8266, rain sensor, light sensor, and servo motor.

Attributes in the product quality dimension analysis include performance, durability, conformance to specifications, features, reliability, aesthetics, perceived quality, and serviceability. Based on the discussion of the research results and referring to the dimension of quality for goods, the product test score obtained was 90.10. Therefore, it can be concluded that the smart clothesline prototype has passed product testing. Future research should further enhance the smart clothesline prototype by adding additional parameters and features, such as a camera, GPS module, and automatic heating system for unfavorable weather conditions.

REFERENCES

[1] A. D. Darusman, M. Dahlan, and F. S. Hilyana, "Rancang Bangun Prototype Alat Penjemur Pakaian Otomatis Berbasis Arduino Uno," *Simetris: Jurnal*

Teknik Mesin, Elektro dan Ilmu Komputer, vol. 9, no. 1, 2018, doi: 10.24176/simet.v9i1.2077.

[2] E. W. Fridayanthie, H. Haryanto, and T. Tsabitah, "Penerapan Metode Prototype Pada Perancangan Sistem Informasi Penggajian Karyawan (Persis Gawan) Berbasis Web," *Paradigma - Jurnal Komputer dan Informatika*, vol. 23, no. 2, 2021, doi: 10.31294/p.v23i2.10998.

[3] D. Haryanto and W. S. Fatimah, "Jemuran Pakaian Otomatis Bergerak dengan Indikator Kondisi Cuaca Menggunakan Arduino," *Jumantaka Jurnal Manajemen dan Teknik Informatika*, vol. 03, no. 01, 2019.

[4] M. Nasrulddin, A. Latif, A. Abd Aziz, M. R. Ramdan, and H. Othman, "Design and Development of Smart Automated Clothesline," *Malaysian Journal of Industrial Technology*, vol. 6, no. 1, 2021.

[5] M. Syarmuji, Sumpena, and R. M. Sultoni, "Sistem Jemuran Otomatis Berbasis Arduino," *Jurnal Teknologi Industri*, vol. 11, no. 1, 2022.

[6] A. Dhanial, A. A. Nugroho, and M. Rifan, "Prototipe Sistem Kendali Otomatis Atap Jemuran Berbasis Internet of Things," *Autocracy: Jurnal Otomasi, Kendali, dan Aplikasi Industri*, vol. 7, no. 1, 2021, doi: 10.21009/autocracy.071.1.

[7] S. Hidayatulloh and J. Aryanto, "Sistem Pengendalian Jemuran Otomatis Berbasis IoT dengan Logika Fuzzy untuk Pengkondisian Cuaca," *Edumatic: Jurnal Pendidikan Informatika*, vol. 7, no. 2, 2023, doi: 10.29408/edumatic.v7i2.21515.

[8] R. P. Milandika, W. B. Nugroho, T. R. Yudantoro, W. Sulistiyo, and W. Wiktasari, "Rancang Bangun Sistem Monitoring dan Kontrol Jemuran Pakaian Berbasis IoT," *Jurnal Review Pendidikan dan Pengajaran*, vol. 4, no. 2, 2021, doi: 10.31004/jrpp.v4i2.2965.

[9] A. Syam and A. M. Asmidin, "Alat Jemuran Otomatis Menggunakan Rain Sensor dan Internet of Things (IoT)," *Jurnal MediaTIK*, vol. 6, no. 1, 2023, doi: 10.26858/jmtik.v6i1.45022.

[10] A. M. Asmiddin, L. A. La Atina, and W. A. Anjani, "Rancang Bangun Jemuran Pakaian Otomatis Berbasis Internet of Things," *JURNAL INFORMATIKA*, vol. 12, no. 1, 2023, doi: 10.55340/jiu.v12i1.1309.

[11] P. Purwa Wiyoga, R. Maulana, and A. S. Budi, "Implementasi Metode K-Nearest Neighbor pada Purwarupa Jemuran Otomatis Berdasarkan Sensor Hujan dan Intensitas Cahaya," 2022.

[12] A. D. Harianto, A. Sudaryanto, A. Kridoyono, and M. Sidqon, "Rancang Bangun Alat Pelindung Jemuran Berbasis Arduino dengan Sensor Hujan dan Sensor Cahaya," *Informatics, Electrical and Electronics Engineering (Infotron)*, vol. 2, no. 1, 2022, doi: 10.33474/infotron.v2i1.14696.

[13] E. Rismawan, S. R. Sulistiyanti, and A. Trisanto, "Rancang Bangun Prototype Penjemur Pakaian Otomatis Berbasis Mikrokontroler ATMEGA8535," *Jurnal Informatika dan Teknik Elektro Terapan*, vol. 1, no. 1, 2012, doi: 10.23960/jitet.v1i1.22.

[14] Abdul Kadir, "Pengenalan Sistem Informasi Edisi Revisi," 2014.

[15] D. R. Octavia, M. I. P. Nasution, and Nurbaiti, "Pengaruh Dimensi Kualitas Produk Terhadap Kepuasan Konsumen pada Toko Fashion Grosir Muslim," *Ad-Deenar: Jurnal Ekonomi dan Bisnis Islam*, vol. 7, Sep. 2023.

[16] Tim KBBI Daring (Online), "Kamus Besar Bahasa Indonesia (KBBI)." Accessed: Feb. 10, 2025. [Online]. Available: https://kbbi.web.id/jemur

[17] R. S. Pressman, *Software Quality Engineering: A Practitioner's Approach 7th*. 2010.

[18] A. Sanaris and I. Suharjo, "Prototype Alat Kendali Otomatis Penjemur Pakaian Menggunakan NodeMCU ESP32 dan Telegram Bot Berbasis Internet of Things (IoT)," *Jurnal Prodi Sistem Informasi*, no. 84, 2020.

[19] A. Perapat, Syaechurodji, and F. Surya, "Rekayasa Perangkat Lunak Alat Kendali Jemuran Otomatis Menggunakan Arduino dan Sensor Hujan/Air, Kelembaban DHT11 dan Cahaya LDR," *Saintek (Jurnal Sains dan Teknologi)*, vol. 4, pp. 19–26, 2020.

[20] Syaefudhin, "Sistem Monitoring Jemuran Otomatis Berbasis Industrial Internet of Things dengan NodeMCU 8266 dan Telegram," Surabaya, 2018.

[21] R. Ramdan, L. Lasmadi, and P. Setiawan, "Sistem Pengendali On-Off Lampu dan Motor Servo sebagai Penggerak Gerendel Pintu Berbasis Internet Of Things (IoT)," *AVITEC*, vol. 4, no. 2, 2022, doi: 10.28989/avitec.v4i2.1317.

[22] H. J. R. G. B. Shelly, *Systems Analysis and Design, 9th Ed.* New York, 2011.

[23] R. S. Pressman, *Software Engineering : A Practitioner's Approach, Seventh Edition*. 2009.

[24] M. C. Ramadhan, J. Wiratama, and A. A. Permana, "A Prototype Model on Development of Web-based Decision Support System for Employee Performance Assessments with Simple Additive Weighting Method," *JSiI (Jurnal Sistem Informasi)*, vol. 10, no. 1, 2023, doi: 10.30656/jsii.v10i1.6137.

[25] S. F. Ariyanti, "Analisis Pengaruh Kualitas Produk, dan Dimensi Kualitas Layanan Terhadap Kepuasan Pelanggan.," 2019.

[26] F. Tjiptono, *Strategi Pemasaran*. Yogyakarta: CV Andi Offset, 2008.

[27] Y. Heriyanto, "Perancangan Sistem Informasi Rental Mobil Berbasis Web Pada PT.APM Rent Car," *Jurnal Intra-Tech*, vol. 2, no. 2, 2018.

[28] S. Selina Anindita Oktiva Deputri, C. Mahendra, M. endra, S. Tinggi Ilmu Komputer Yos Sudarso Purwokerto, J. Smp, and K. Purwokerto Kabupaten Banyumas, "Sistem Kontrol dan Monitoring Jemuran Pakaian Berbasis IoT dengan Menggunakan Aplikasi Blynk," *Jurnal Media Aplikom*, vol. 13, no. August, 2021.