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NATA DE COCO MATERIAL MONITORING SYSTEM USING INTERNET OF THINGS

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Abstract

The purpose of this research is to create a monitoring system for the solution-mixing process used to manufacture Nata de Coco using the Internet of Things. Nata de Coco's manufacturing process usually mixes coconut water solution with vinegar and seed solution. The mixing process is usually used with manual measurement. In the mixing process, the makers usually only measure the amount of the solution mixture regardless of the final result and the effect of temperature and acidity levels for the ingredients. This can lead to the failure of the mixing process for the Nata de Coco solution. Therefore, in order for the mixing process to be controlled and to improve the quality and success rate of the mixture, it takes a system that can monitor the mixing process and the result of mixing the manufacture of Nata de Coco. The method used in the creation of this monitoring system refers to the prototype method with the stages of communication, quick planning, model design, prototype building, and system usage. The result of this study is a system that can perform the process of mixing Nata de Coco material solution that can be monitored in realtime in order to produce an excellent product with a good acidity level that is with a value of 3.5 to 7.5. With a good acidity value, it can produce good quality Nata De Coco.

Keywords**:** Internet of things, Manucafture, Monitoring system.

1. Introduction

The use of coconut water as raw material Nata De Coco still comes from a mixture of various varieties of coconut. However, the nutritional content, especially sugar, is different for each variation of coconut [1]. The making of Nata De Coco is usually a mixture of coconut water solution with vinegar and then fermented [2, 3].The process of making nata de coco usually has several stages, namely filtering, boiling, mixing, preparing, pouring, cooling, inoculation, and storage. The mixing process is a very important process that is the main process in mixing materials Nata De Coco. All of these mixing processes are usually done manually. First, the makers of Nata de Coco need to mix coconut water, grains, and vinegar with a manual measuring instrument, which has limitations on different acidity levels.

Internet of Things is one of the systems that control, monitor in real-time, and manage autonomous functions. IoT is one of the various concepts that can connect objects, sensors, and tools to make it possible to share information [4, 5]. The monitoring system can be used to produce growth and survival [6]. Development of technology rate can facilitate every process carried out in daily life [7], as well as an aid to the management of the manufacturing process of Nata de Coco. The manufacture of the mixed monitoring system of Nata De Coco was carried out with several stages of research that refers to the prototype model, namely communication, quick planning, model design, building prototypes, and the use of systems that can be used to build the monitoring system. Some research that has been done related to the manufacture of Nata De Coco is able to provide knowledge in the use of appropriate technology to process coconut water into the results of Nata De Coco [8]. In addition, some of the research results focused on the quality of the results of making Nata De Coco [1].

In addition, the manufacture of Nata de Coco often fails due to the absence of mixed monitoring, especially temperature monitoring and acidity levels that affect the production of Nata De Coco. Therefore, they need a system that can monitor the mixing process of Nata de Coco material automatically by paying attention to the value of the measurement and fermentation process of Nata de Coco mixture.

This monitoring system aims to monitor the temperature level and ph produced during the manufacturing process of Nata de Coco. Nata de Coco's recommended incubation process is maintaining the temperature of 35 – 37 degrees Celsius, which can maximize the quality of Nata De Coco [9, 10]. Therefore, this research aims to help the makers of Nata De Coco can monitor the manufacturing process of Nata De Coco, which produces good and automated products.

2. Research Method

At this stage of research, there are several processes that must be done. Each of these processes refers to the stages in the prototype method model. The stages are Communication, Quick Planning, Quick Design Modeling, Construction of Prototype, as well as the Deployment and Feedback stage (Fig. 1).

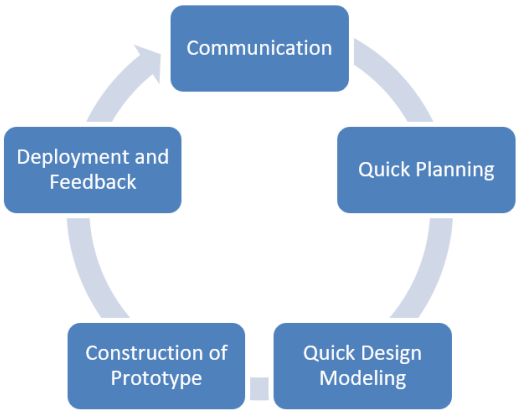

Fig. 1. Model prototype.

The approach of using prototype models has been widely done, namely by Mecconel this model is used to develop the selected part of the system and then develop the remaining system. Also, the development of prototypes there is continuing, and some are only used once in designing a system. Sustainable prototypes will have an easy impact in optimizing the operation of built systems [11]. In this study used prototype model stages with abstract and sustainable models. This process is combined to get a model with a good initial abstraction, then continued with the modeling system on an ongoing basis. Figure 1 shows the stages in the construction of the Nata de Coco solution monitoring system. The stages are described as follows:

2.1. Communication

Communication is the initial stage by conducting meetings and interviews with the parties needed. This is done to know and develop every need of the system to be built. The communication process becomes data collection, namely the data collection of all the processes of making Nata De Coco. The process on making is focused on the mixing process of the material. This is the most important process in producing Nata De Coco's production.

2.2. Quick Planning

Quick planning is an advanced stage after communication. This stage focuses on quickly planning the system to be built. This quick planning determines the prototype model of the system or tool to be built. This stage began to develop a system model that will be built for monitoring the mixing process of Nata De Coco materials. In this process created a model of monitoring tools to be used.

2.3. Quick design modeling

This stage is the next action of the second stage. At this stage, every system need is modelled according to the needs of both software and hardware. This stage is the implementation stage of the model that has been built. This monitoring system is built with hardware and software system. Therefore, the needs of Hardware and software are explained at this stage.

2.4. Construction of prototype

This stage is the stage of device development. The software and hardware needs that have been prepared will be used to build the system at this stage. Development at this stage is already in the form of a system design that will be used, implementing both hardware and software designs.

2.5. Development delivery and feedback

This stage is the final stage in this research. At this stage, every user has tried and used this Nata De Coco monitoring system. Then, the results of the use of this system will be evaluated and used as a material evaluation and development of the system for the better. The use of prototype methods is usually adjusted to the circumstances of a particular case. The prototype method can be used as a condition of the product in accordance with the requirements in which there is an initial process starting with the interview and ending with the product as a pilot [11, 12].

3. Results and Discussion

On the stage of Quick Planning, Fig. 2 shows the architecture of the monitoring system for the planned Nata de Coco system. In Fig. 2, there are three main system blocks, namely hardware, data storage media, and user block. In the hardware block, there are several devices used, including Relay, LCD, Arduino, MCU Node, as well as pH, Temperature, and Ultrasonic sensors. Each component of the device has its own functions - each of which relay serves to regulate inflows, LCD displays sensor data, Arduino receives and transmits data from sensors, MCU nodes connect between microcontrollers with application systems, each sensor sends their own data - each of which is temperature data, pH, and distance during the process of making Nata de Coco. The use of NodeMCU as a data retrieval control tool for all sensors can be used to monitor objects [13]. It is responsible for collecting data by sensors [14].

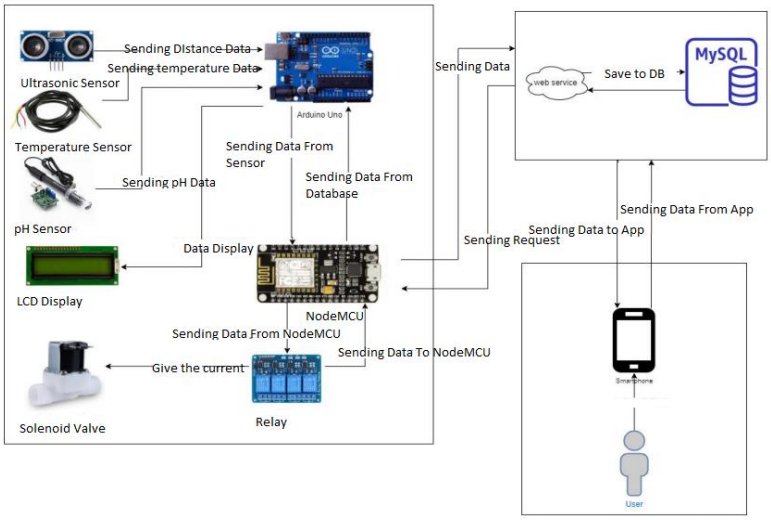

Fig. 2. Architecture system.

The built monitoring system will be displayed in the application, as shown in Fig. 3.

Fig. 3. System interface.

In the monitoring application, there are several data that can be monitored, including initial and final pH data, temperature data, high solution, and monitoring time. This serves to ensure that the makers of Nata de Coco get real-time data in the process of making Nata de Coco. pH and temperature are important components in the manufacture of Nata that must be monitored correctly. pH is a useful component to display because the low height of pH can affect a product [15]. Devices that interact with each other and are integrated provide convenience for the monitoring process [16]. Penelitian sebelumnya proses Nata De Coco hanya berfokus pada pembuatan nutrisi Nata De Coco, pencampuran kualitas larutan, dan produksi nata de coco [17-19].

In the monitoring system, there is a mixture of coconut water solution, nutrition, and vinegar solution. In the mixing and manufacturing process, the pH value and temperature must be paid attention to. Table 1 shows the results of pH value comparison value measured with manual tools and measured using a monitoring system in real-time.

Table 1. pH value comparison.

No.	pH measurement with sensor	pH measurement with manually	Error (%)
1	7.19	7.30	1.51
2	7.19	7.30	1.51
3	7.19	7.30	1.37
4	7.20	7.30	1.51
5	7.19	7.30	1.37
6	7.20	7.30	1.51
7	7.19	7.30	1.51
8	7.19	7.30	1.37
9	7.20	7.30	1.37
10	7.20	7.30	1.51
Average Error (%)			1.06

Table 1 shows that the reading of pH sensor data sent to the system has an error rate of 1.06%. Then, the temperature value is a comparison between the measurement with the manual temperature and with the automatically internet-based things (see Table 2).

Table 2 shows that the temperature sensor data reading with manual measurement and sensor has an error rate of 0.81%. This proves that the level of ph and temperature measurement used in monitoring the manufacturing process of Nata De Coco can be monitored properly. This research succeeded in making Nata mixing monitoring tools to facilitate the process of making Nata that can be managed through the use of technology. This is in line with IoT integration to reduce costs and save time [20]. If in other studies, the use of IoT focuses on every process, especially on the use of technology for agriculture [15, 16, 20], in this case, to help the household industry on a small scale. This study is in line with previous studies [21-24].

Table 2. Temperature value comparison.

No.	Temperature measurement with sensor	Temperature measurement with manually	Error (%)
1	28	28.0	0.00
2	28	28.0	0.00
3	28	28.0	0.00
4	28	28.2	0.71
5	28	28.2	0.71
6	28	28.2	0.71
7	28	28.2	0.71
8	28	28.5	1.75
9	28	28.5	1.75
10	28	28.5	1.75
Average Error (%)			**0.81**

4. Conclusion

Based on the system testing that has been done, it can be concluded that the monitoring system can help the process of making Nata de Coco automatically by mixing several solutions of coconut water, nutrients, and seed solution. Then, the monitoring system can also monitor the ph condition of the solution to match the pH value for the manufacture of Nata de Coco in the range of 3.5 to 7.5. The system

can maintain a pH value with an error percentage of 1.06%, indicating that it can be used with a very high success rate.

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