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Prototype Nutmeg Sorting Innovation for Classify Ripeness Fruit

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Abstract

The level of maturity of Fakfak nutmeg (Myristica Argantea Warb) is still determined traditionally, namely by looking for signs of golden-brown skin, cracking and revealing blackish brown seeds with red membranes (fuli). When harvesting, farmers usually don't wait for all the fruit to open. They will pick all the fruit from the tree and then cut it in half at a time to take the seeds and mace from the color of the fruit. Judging the level of ripeness of nutmeg from the color fruit's skin is difficult. Through experiments on 50 fruits by two people, the average error in guessing the level of ripeness was 39%. This may also be the reason why the farmers have inherited the habit of slitting the nutmeg directly under the tree when harvesting, and the rest is thrown away the economic value of nutmeg has been increased to become candied products, syrup, soy sauce, jam, balm and soap. So that all parts of the nutmeg can be utilized, it is very important to sort the Fakfak nutmeg before it is split. In this study we introduce Nutmeg Sorting Innovation (NSI) as an innovative method that utilizes RGB sensors to sort nutmeg in real-time without splitting them. NSI will be integrated with Arduino Uno. This breakthrough allows farmers to avoid waste disposal and nutmeg product entrepreneurs to improve the quality of their raw materials.

Keywords
Nutmeg, Myristica Argantea Warb, Ripeness fruit, Sorting and RGB-sensor.

1. Introduction

Nutmeg, a high-value spice commodity that is characteristic of Indonesia specially in the Fakfak area, nutmeg is the main source of income for the local community, but in reality the community poverty rate is still high (Rifky et.al(,2019, Natawidjaya, dkk., 2015)). Has a harvesting process that is still fraught with challenges. One common practice is to harvest directly under the tree, followed by removing the pulp and taking only the seeds and mace. This process, even though it has been going on for generations, has a number of problems that have a significant impact on the quality of nutmeg derivative products, such as: (1) the weight of the nutmeg flesh has a high water content, making it heavy to bring home in large quantities, (2) the perception of value during this time is that nutmeg seeds and mace are considered the most economically valuable part, so that the flesh of the fruit is often considered waste, (3) lack of difficult road access infrastructure, and (4) limited processing facilities in nutmeg producing areas. (Ricardo et.al, (2023), Nurasiah et.al, (2022))

Apart from that, disposal of nutmeg pulp has an impact on: (1) decreasing the quality of derivative products, (2) environmental pollution, and (3) wasting resources. Decrease in the quality of derivative products related to essential oils (Baszary (2022), Djumarman et. al, (2008)). Nutmeg pulp contains essential oils which have the potential to be processed into various value-added products, such as perfume, cosmetics and medicines. Discarding the pulp means losing a potential source of valuable essential oils. Apart from that, it is related to other processed products (Ikhsanudin et. al (2025), Acosta-Vega et. al (2025)). The fruit flesh can also be processed into other processed products, such as jam, sweets, or even used as raw material for making fermented drinks. Removing the pulp automatically reduces the diversity of nutmeg derivative products that can be produced. Careless disposal of fruit pulp can cause environmental pollution, especially if done on a large scale. Rotting fruit pulp can be a source of unpleasant odors and attract various types of pests. The fruit flesh that is thrown away actually still has economic value (Sipahelut & Patty (2020), Herlina et. al (2020)).

This waste of resources can have an impact on farmers' income and reduce the competitiveness of Indonesian nutmeg products in the global market. Quality of Derived Products Affected: Nutmeg Oil: The quality of nutmeg oil produced from seeds is greatly influenced by the storage conditions of the seeds after harvest. If the seeds are not dried properly or stored in damp conditions, the quality of the nutmeg oil will decrease. Nutmeg mace: High quality nutmeg mace has a bright red color and a distinctive aroma. The quality of mace can be affected by drying and storage methods. Other Processed Products: The quality of other processed products, such as jam or sweets, is very dependent on the quality of the fruit flesh used. Fruit flesh that has rotted or fermented cannot be used to make safe and quality processed products. Potential Uses of Fruit Flesh: Food and Beverage Industry: Nutmeg pulp can be used as an additive to food or drinks to provide a distinctive aroma and taste. Cosmetic Industry: Nutmeg pulp extract can be used as a raw material for making perfume, soap and other skin care products. Pharmaceutical Industry: The essential oil contained in nutmeg flesh has potential as a raw material for making medicines.

Based on the description above, it is necessary to develop an automatic sorting tool that can determine the ripeness level of nutmeg without splitting it on the spot. The method of sorting nutmeg without splitting to determine the level of maturity has been previously carried out on Banda nutmeg (Myristica fragrans houtt) using digital images (Mulyani, Atmajaya and Umar, 2021). NSI is also aimed at determining the maturity level of Tomandin nutmeg (Myristica argentea warb) without splitting it using the TCS3200 RGB Sensor. This sensor was chosen because tools that use images are less efficient because they are not done directly (real time), whereas farmers need real-time sorting results.

1.1 Objectives

Based on the background above, this research aims to produce a nutmeg sorting prototype using the TCS3200 RGB Sensor, which will be named Nutmeg Sorting Innovation (NSI).

2. Literature Review

2.1 Nutmeg Tomandin (Myristica Argentea warb)

Typical Tomandin nutmeg with unique characteristics, having various types and levels of maturity, has been an international trade commodity since the 15th century. One of its unique characteristics is its high water content. Even though it sounds contradictory, traders in Surabaya have long been aware that the high water yield in Fakfak nutmeg contributes to the quality and distinctive aroma of their processed products. "In the history of the spice trade, this water content is thought to have a unique influence on the taste and aroma of Fakfak nutmeg, making it a highly valued commodity." (Waromi, (2021), Lakupais & Wanma (2019))

There are 3 harvest seasons for Fakfak nutmeg, namely the West season, the Sun season (Subsequence) and the East season. The West Season starts in coastal areas (October) 2 months later in mountainous areas. Usually in the Western season the quality of the fruit is better. Harvesting in the Eastern season is usually carried out in coastal areas starting in March, while in mountainous areas in June. The quality of the fruit harvested this season is lower in nutmeg and mace. Nutmeg in the Sun season is an additional picking season carried out in the West and East seasons or in the middle of the West and East seasons.(Waromi, (2021)

The process of harvesting nutmeg from ancient times was carried out by farmers without looking at the physical characteristics of the fruit (skin color) like fruit in general but with two assumptions, namely (1) waiting for 100 pieces of fruit to fall before the harvest season, (2) The process of splitting the nutmeg directly to ensure the ripeness of the nutmeg from the results of an interview with Saiful Alkatiri from the Plantation Service
As shown in Figure 1

Figure 1. The Process of Splitting Nutmeg Directly (Location in Kampung Bisa, Teluk Patipi District)
Source: personal documentation

Based on preliminary studies, it shows that the physical characteristics visible on nutmeg do not determine the level of ripeness of the fruit, this can be seen in Figure. 2. You can see that the physical characteristics of the overall color of the nutmeg fruit are almost the same, but the ripeness conditions are different, indicated by the color of the mace and the color of the seeds. However, there is a connection between the density of the color of the diamond and the color of the mace, this is what underlies the use of the TCS3200 RGB sensor.

Figure 2. Characteristics of nutmeg skin color.
source: personal documentation

2.2 System

Arduino Mega, is a microcontroller made from the ATMega 2560 microcontroller. This Arduino is equipped with an ATMega2560 processor which has 54 digital input/output pins where 15 pins can be used as PWM output, 16 analog input pins, 4 UART pins, 2x3 ICSP pins for programming the Arduino with other software, and a computer USB cable which is also used as a voltage source. The Arduino Mega 2560 is equipped with 54 digital pins that can be used as input or output and 16 analog pins labeled A0 to A15 as ADC. Each analog pin has a resolution of 10 bits. This Arduino Mega has its own special features, namely 4 serial inputs, namely serial port 0: pin 0 RX and pin 1 TX; serial port 1: pin 19 RX and pin 18 TX; serial port 2: pin 17 RX and pin 16 TX; serial port 3: pin 15 RX and pin 14 TX (Figure 3). The Rx pin is used to receive TTL serial data and the Tx pin to send TTL serial data (Junaidi & Prabowo, 2018).

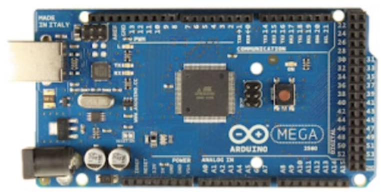

Figure 3. Arduino Mega 2560
source :https://www.arduino.biz.id/2023/01/penjelasan-tentang-arduino-mega-2560.html

The TCS3200 is a photodetector in the form of a stack (array), consisting of red, green and blue filters. Each color filter is distributed across each stack to eliminate bias locations along the colors (Figure 4). There is an oscillator or frequency generator that produces a square wave which will produce a frequency quantity depending on the intensity of the color received. (Silalahi dan satria, 2025)

Figure 4. The TCS3200 color sensor
source :https://www.arduino.biz.id/2023/01/penjelasan-tentang-arduino-mega-2560.html

3. Methods

In this research, the method used is qualitative research with an experimental approach. The choice of this method is based on its suitability to the research objectives which focus on developing a tool and testing it directly on the research object (sugiyono & lestari (2021)). The experimental approach allows researchers to observe in depth the influence of the independent variable (nutmeg) on the dependent variable (color) in a controlled context. This research discusses the design of the TCS3200 color sensor system for an Arduino Uno-based tool for sorting Fakfak nutmeg. The design of this device includes hardware and software design.

In this research, researchers developed a system that utilizes a TCS3200 color sensor and an Arduino Uno board to recognize nutmeg. This system is designed with a certain algorithm so that it can work automatically and accurately in sorting nutmeg based on its quality, so that it is hoped that it can increase the production efficiency of nutmeg derivatives. To build a system that automatically sorts nutmeg based on their level of ripeness, we need a careful algorithm. This algorithm functions as the brain of the system, determining how the system recognizes and groups nutmeg based on their level of ripeness.

Problem identification Introduction of a problem and the initial stage in the research process. The problem of this research is the disposal of nutmeg flesh which has the impact of: (1) decreasing the quality of derivative products, (2) environmental pollution, and (3) wasting resources. Decrease in the quality of derivative products related to essential oils. Nutmeg pulp contains essential oils which have the potential to be processed into various value-added products, such as perfume, cosmetics and medicines. Data Collection. Data was collected from Firma Village, a village supported by the Fakfak Regency Plantation Service, as well as a resident's garden called Sangkala Laja T Weripih. Data Processing, Data obtained from problem identification and data collection studies are then processed to produce appropriate solutions, Literature Study This research refers to several journals as additional sources of information. Observation The nutmeg processing process was observed directly to identify the level of ripeness of the nutmeg fruit. Making Tools Tools are specifically designed to overcome the problems found. Tool Testing The prototype of the nutmeg sorting tool was tested for its ability to detect the ripeness level of nutmeg using the TCS3200 color sensor. The servo will direct the fruit to the appropriate place. The results of this research succeeded in designing a prototype and developing a nutmeg sorting tool that can be applied directly. A visual explanation of the research flow can be seen in Figure 5

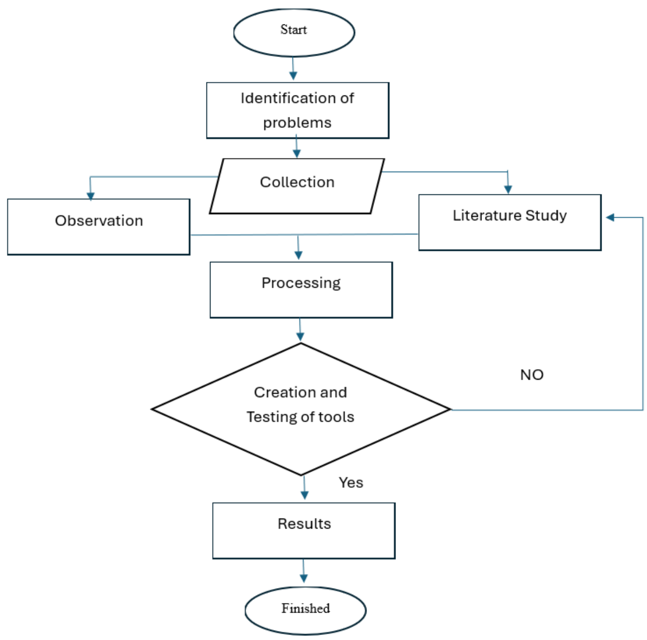

Figure 5. Research Flow

To determine the color code used on the TCS3200 color sensor, research uses data comparisons between the RGB sensor color data and the color data in the RGB color picer camera application, then the middle or median value of the two data is taken to get the RGB color code which is then applied to the TCS3200 color sensor with the following calculations

Code R (Red)

$$R = \left|\frac{r1+r2}{2}\right|$$

whith:

$R = code\ colour\ Red$ $\quad r1 = code\ colour\ red\ aplikation$ $\quad r2 = code\ colour\ red\ sensor$

Code G (Green)

$$G = \left|\frac{g1+g2}{2}\right|$$

whith:

$G = code\ colour\ Green$ $\quad g1 = code\ colour\ green\ aplikation$ $\quad g2 = code\ colour\ green\ sensor$

Code B (Blue)

$$B = \left|\frac{b1+b2}{2}\right|$$

With:

$B = code\ colour\ Blue$ $\quad b1 = code\ colour\ Blue\ aplikation$

$r2 = code\ colour\ Blue\ sensor$

4. Results and Discussion

The results of the design of the nutmeg maturity sorting tool carried out by the researchers were implemented in the form of a prototype and simulation, where the tool will work if the nutmeg is placed on the nutmeg sorting tool where the servo drops the nutmeg onto the TCS3200 color sensor to read the color of the nutmeg and after that the servo will sort the ripe, ripe and immature nutmeg (Figure 6).

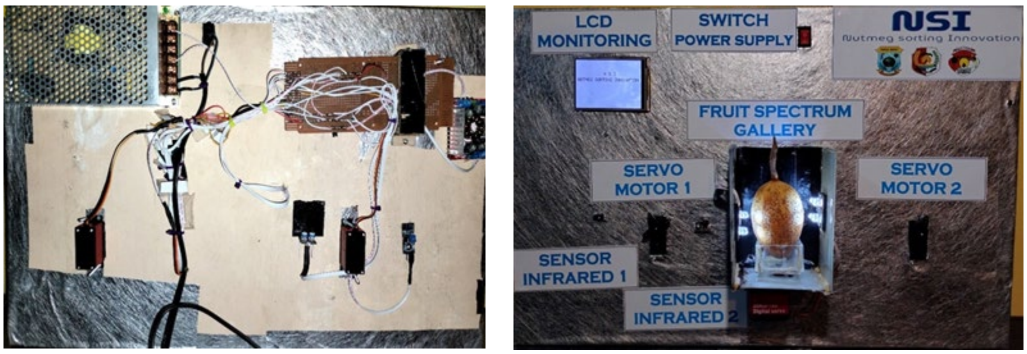

Figure 6. Prototype NSI
Source: personal documentation

The servo will direct it to a predetermined nutmeg location to adjust the maturity level according to the standards for downstream products that have been set in the program that has been input into the Arduino Atmega 328p memory. In making a nutmeg sorting prototype using a TCS3200 color sensor based on an Arduino Atmega 328p, researchers need to collect data from several needs as references, either from journals or books that can be accounted for so that in making the tool there are no unwanted obstacles (Figure 7).

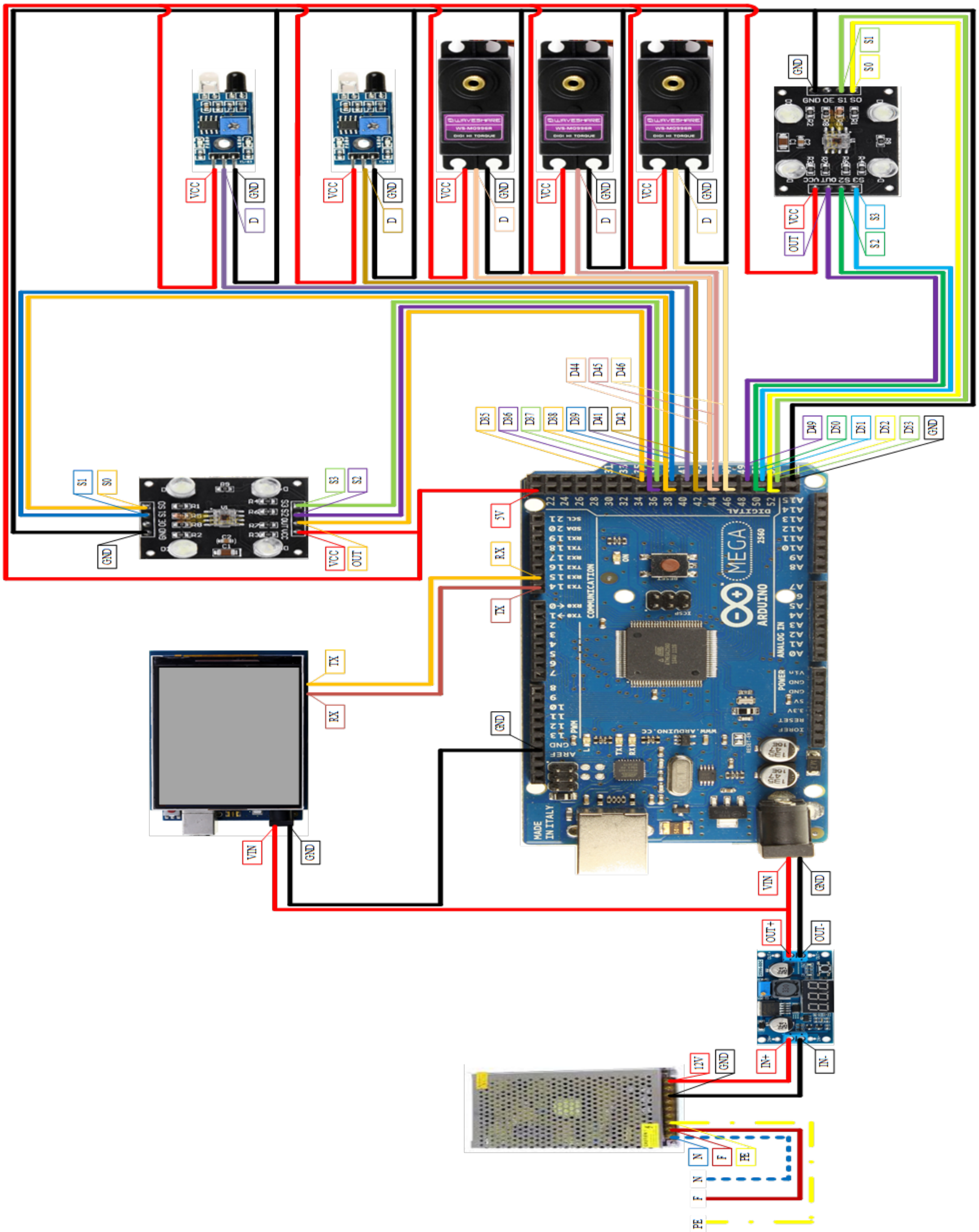

Figure 7. The Entire Suite of Tools NSI

Tool schematic

Explanation of the Flow chart symbol, the working principle of the tool (Figure 8).

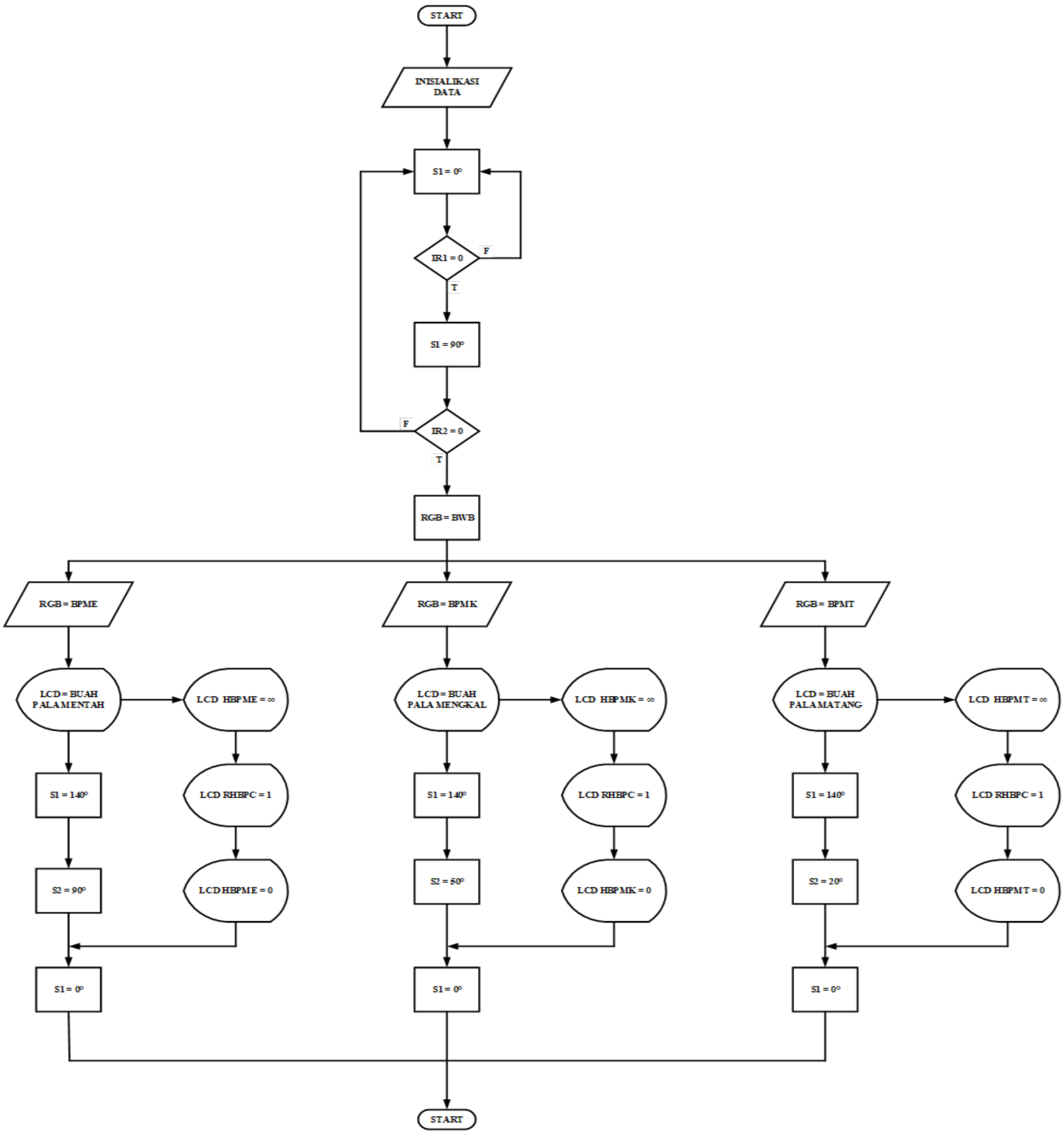

Figure 8. Flow Chart NSI

Data Initialization: the process of assigning initial values to variables or data structures before they are used in a program or system. The main purpose of initialization is to ensure that the data has valid values and can be used for further operations.

S1 is the driving servo for the fruit scene

S2 is the trigger servo to divide the fruit into designated places

IR1 is a fruit detector that enters the tool

IR2 is a calibration process
RGB = BWB is an RGB sensor that reads fruit color
RGB = BPME is an RGB sensor that reads fruit that is still raw
RGB = BPMK is an RGB sensor that reads fruit that is still ripe
RGB = BPMT is an RGB sensor that reads when the fruit is ripe
LCD = BUAH PALA MENTAH the LCD displays the unripe fruit
LCD = BUAH PALA MENGKAL the LCD displays the semi ripe fruit
LCD = BUAH PALA MATANG the LCD displays the ripe fruit
LCD HBPME = ∞ is an LCD displaying the value of unripe fruit
LCD HBPMK = ∞ is an LCD displaying the value of the semi ripe fruit
LCD HBPMT = ∞ is an LCD displaying the value of ripe fruit
LCD RHBPC = 1 is the reset button for the nutmeg value on the LCD screen
LCD HBPME = 0 is the initial value of Raw Nutmeg
LCD HBPMK = 0 is the initial value of the semi ripe Nutmeg fruit
LCD HBPMT = 0 is the initial value of Ripe Nutmeg fruit

Explanation of the flowchart of the working principle of the tool.
The tool is in ON or active condition and ready for operation, servo1 position is at 0°. If no fruit enters the tool then the IR1 sensor = 1, the IR1 sensor does not read any fruit entering the tool, then the servo1 position remains at 0°. If there is fruit entering the tool then the IR1 sensor = 0, the sensor reads that there is fruit entering the tool, then the position of servo1 moves 90° towards the RGB sensor to detect the color of the fruit. If the IR2 sensor = 0 then the color reading process will be carried out and if not or the IR2 sensor = 1 the color reading process will not be carried out.

The process of reading the RGB sensor on the nutmeg skin shows that the nutmeg is in raw condition, then the LCD screen will display "RAW nutmeg" and will immediately count the number of nutmegs that are still raw. If there are no more nutmegs counted, press the reset button on the LCD screen to return the calculated value to 0 or the initial value of the raw nutmeg reading. If raw nutmeg is detected, servo1 will move 140° bringing the nutmeg to servo2. Servo2 will move to a 90° position to separate the nutmeg from the raw nutmeg container. Servo1 moves to the initial position 0° to receive the next nutmeg.

The process of reading the RGB sensor on the nutmeg skin shows that the Nutmeg fruit is in the semi ripe condition, then the LCD screen will display "BUAH PALA MENGKAL" and will immediately count the number of Nutmeg fruit that are still Un ripe. If there are no more Nutmeg fruit counted, press the reset button on the LCD screen to return the calculated value to 0 or the initial value of the Un ripe Nutmeg reading. Un ripe nutmeg is detected, servo1 will move 140° bringing the nutmeg to servo2. Servo2 will move to a 50° position to separate the nutmeg from the Un ripe nutmeg container. Servo1 moves to the initial position 0° to receive the next nutmeg.

The process of reading the RGB sensor on the skin of the nutmeg shows that the nutmeg is in a ripe condition, then the LCD screen will display "BUAH PALA MATANG" and will immediately count the number of ripe nutmegs. If there are no more nutmegs counted, press the reset button on the LCD screen to return the calculated value to 0 or the initial reading value for ripe nutmegs. Un ripe nutmeg is detected, servo1 will move 140° bringing the nutmeg to servo2. Servo2 will move to a 20° position to separate the nutmeg from the ripe nutmeg container. Servo1 moves to the initial position 0° to receive the next nutmeg.

4.1 Numerical Results

Data on guessing the ripeness of nutmeg by samples 1 and 2

Sample 1

Table 1. Data on Guessing The Ripeness of Nutmeg by Sample 1

Guess	Category			
	A	B	C	D
1	2/0	4/9	8/9	4/0
2	0/0	9/9	8/9	1/0
3	1/0	7/9	6/9	4/0
4	1/0	7/9	9/9	1/0
5	1/0	7/9	8/9	2/0

Table 1 presents data regarding the choice of maturity level for sample 1 based on predetermined criteria. Criterion A (Raw) indicates a preference for unripe nutmeg. Criterion B (50% less than half ripe) describes a preference for nutmeg that is partially ripe. Criterion C (50% more than half ripe) reflects a preference for nutmeg that is mostly ripe. Criterion D (Ripe) indicates a preference for fully ripe nutmeg. as well as the level of accuracy in guessing sample choice 1 regarding the condition of the nutmeg after splitting. It can be seen that in experiment 1, sample 1 chose category A 2 times with an accuracy level of 0%, B 4/9 with an accuracy level of 11.11%, C 8/9 with an accuracy level of 55.56% and D 4 with an accuracy level of 0%. Overall, the average accuracy level for experiment 1 was 43.33%.

Experiment 2 sample 1 chose category A as 0 with an accuracy level of 0%, B as many as 9/9 with an accuracy level of 55.56%, C as many as 8/9 with an accuracy level of 55.56% and D as 1 with an accuracy level of 0%. Overall, the average accuracy level for experiment 2 was 55.56%. experiment 3 samples 1 chose category A 1 with an accuracy rate of 0%, B 7/9 with an accuracy rate of 22.22%, C as 6/9 with an accuracy rate of 33.33% and, D as 4 with an accuracy rate of 0% overall - the average accuracy rate for experiment 1 was 27.78%

trial 4 samples 1 chose category A 1 with an accuracy level of 0%, B as many as 7/9 with an accuracy level of 44.44%, C as many as 8/9 with an accuracy level of 55.56% and, D as many as 1 with an accuracy level of 0% overall the average accuracy level of trial 1 was 50% trial 5 samples 1 chose category A as many as 1 with an accuracy level of 0%, B as many as 7/9 with an accuracy level of 44.44%, C as many as 8/9 with an accuracy rate of 55.56% and, D as many as 2 with an accuracy rate of 0%. Overall the average accuracy rate for experiment 1 was 50%. Overall, sample 1 guessed the ripeness of the nutmeg with an accuracy rate of 43.33%. This shows that guessing the maturity of the nutmeg based directly on the human eye still tends to be wrong.

Sample 2

Table 2. Data on Guessing the Ripeness of Nutmeg by Sample 2

Guess	Category			
	A	B	C	D
1	0/0	8/9	8/9	2/0
2	1/0	12/9	3/9	2/0
3	0/0	11/9	5/9	2/0
4	0/0	13/9	4/9	1/0
5	0/0	13/9	3/9	2/0

Table 2 presents data regarding the choice of maturity level for sample 1 based on predetermined criteria. Criterion A (Raw) indicates a preference for unripe nutmeg. Criterion B (50% less than half ripe) describes a preference for nutmeg that is partially ripe. Criterion C (50% more than half ripe) reflects a preference for nutmeg that is mostly ripe. Criterion D (Ripe) indicates a preference for fully ripe nutmeg. as well as the level of accuracy in guessing sample choice 2 regarding the condition of the nutmeg after splitting. It can be seen that in experiment 1, sample 2 chose category A as 0 with an accuracy level of 0%, B as many as 8/9 with an accuracy level of 44.44%, C as many as 8/9 with an accuracy level of 44.44% and, D as many as 2 with an accuracy level of 0%. Overall, the average accuracy level for experiment 1 was 44.44%. experiment 2 sample 2 chose category A as 1 with an accuracy level of 0%, B as many as 12/9 with an accuracy level of 55.56%, C as many as 3/9 with an accuracy level of 0% and, D as many as 2 with an accuracy level of 0%. Overall the average accuracy level for experiment 2 was 27.78%.

experiment 3 samples 2 chose category A as 0 with an accuracy level of 0%, B as many as 11/9 with an accuracy level of 44.44%, C as many as 5/9 with an accuracy level of 11.11% and, D as many as 2 with an accuracy level of 0% overall - the average accuracy level for experiment 1 was 27.78%. trial 4 samples 1 chose category A as 0 with an accuracy level of 0%, B as many as 13/9 with an accuracy level of 55.56%, C as many as 4/9 with an accuracy level of 11.11% and, D as many as 1 with an accuracy level of 0% overall - the average accuracy level for experiment 1 was 27.78%.

experiment 5 samples 2 chose category A as 0 with an accuracy level of 0%, B as many as 13/9 with an accuracy level of 55.56% C as many as 3/9 with an accuracy level of 11.11% and, D as many as 2 with an accuracy level of 0%. Overall the average accuracy level for experiment 1 was 33.33%. Overall, sample 2 guessed the ripeness of nutmeg with an accuracy rate of 32.22%

Result experiment 1

Table 3. result experiment 1

Sample	1	2	3	4	5	6	7	8	9
answer	B	S	B	B	S	S	B	S	B

information
B = True
S = False

Based on initial trials on one of nine device units, the results showed that the device was able to provide correct predictions 5 times out of 9 trials, while the other 4 trials produced wrong predictions. The accuracy level achieved in this test was 55.56%. However, there are several obstacles or errors that need to be overcome (Table 3).

During testing, two main problems were identified. First, the sensor used is only capable of reading 5 data points and producing 5 appropriate outputs. This indicates a lack of sensor ability to capture more comprehensive information. Second, only one sensor was active during testing. In fact, to get more accurate and representative results, ideally all available sensors should function and participate in the data collection process (Table 4)

Result experiment 2

Table 4. Result Experiment

Sample	1	2	3	4	5	6	7	8	9
Take 1	Unripe	Unripe	Unripe	Ripe	Unripe	Ripe	Ripe	Semi Ripe	Semi Ripe
Take 2	Semi Ripe	Unripe	Unripe	Ripe	Unripe	Ripe	Ripe	Semi Ripe	Semi Ripe
Take 3	Semi Ripe	Ripe	Semi Ripe	Ripe	Unripe	Ripe	Ripe	Semi Ripe	Semi Ripe
Answer	True	False	True	False	False	True	False	False	True

By implementing these revisions, it is hoped that the device can function more optimally and produce more accurate predictions. Using two sensors will provide more complete information, while simplifying the output into one category will make data analysis easier. However, further testing may be required to ensure that the device actually functions as expected and achieves the desired level of accuracy.

After revisions were made to the device and a second experiment was carried out, the device was able to produce output in one category. However, the level of accuracy has decreased. Of the 9 trials carried out, only 4 trials produced correct answers, while the other 5 trials produced wrong answers. This resulted in a decrease in the accuracy rate to 44.44%.

6. Conclusion

Based on the results of the NSI research, it was categorized as successful in guessing the ripeness level of nutmeg based on the color of the nodules when compared with guessing directly using the eye , however, there are several obstacles, including 1. the initial condition of the nutmeg 2. there is no global category for the maturity level of nutmeg based on color. 3. Limited nutmeg samples because the research was carried out after the harvest season

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Biographies

Wa Ode Sadillah Nada Syifa is a student in grade 11th at SMA Negeri 1 Fakfak, Papua Barat. She was born on October 8, 2008. She has a deep interest in mathematics, science, and the arts. She achieved 5th place in the district-level Science Olympiad, which motivated her to further explore the field of knowledge. Currently, she is active in the Youth Scientific Group (KIR), where she conducts research on the local potential of the Fakfak nutmeg (Myristica Argantea Warb). She also has a talent for the arts and literacy. Some of her poetry has been published, and she is a member of a literacy organization that supports the development of her creativity. She believes that the arts, science, and mathematics complement each other, creating harmony in understanding the patterns of life. She has served as the Student Council President in junior high school.

Sultan Daffa Alkahfi Bayu. A is a student in grade 11th at SMA Negeri 1 Fakfak, West Papua, Indonesia. He was born on February 16, 2008. He has an interest in both academic and non-academic fields, the sultan won 1st place in the district-level scout quiz competition and gold medal in the math olympiad. She has been a participant in the colossal dance of Fakfak district in commemoration of the birthday of the city of Fakfak in 2023. He heads the Youth Scientific extracurriculla Group.

Chandra Sri Ubayanti is a mathematics teacher at the High School (SMA Negeri 1 Fakfak, West Papua) Indonesia where she has been heading the Youth Scientific extracurricular Group since 2015 till now. He got magister at Mathematics Education programme at Cenderawasih University, Papua. She has been actived as a master teacher in National Project Casio. She heads Community of Teachers in West Papua. She has published on ethnomathematics and higher order thinking skills matters. She is as Committee of Indonesian Mathematics Teacher in Indonesian Teacher Assosiation (IGI). She also active arrange webinar for Indonesian teacher by Sadar Organization since 2017 till now.

Rangga Narendra La Hasaleh K is a passionate math teacher with a mission to help students understand the beauty and relevance of mathematics in everyday life. With a bachelor's degree in education in mathematics from Muhammadiyah University of Surakarta and completing a Diploma IV in Tourism from Sahid Tourism College of Surakarta, he has 4 years of teaching experience at the high school level. He has mastered various innovative teaching methods, such as the use of technology, problem-based projects, and cooperative learning. In addition, Rangga Narendra La Hasaleh K is also active in mentoring students in extracurricular activities that focus on scientific work or the Youth Scientific Group extracurricula.