

ARCHITECTURE TOOLS SORT FRUIT STRAWBERRY BASED INTERNET OF THINGS (IOT)

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ABSTRACT

La Fresa is one of strawberry one of the strawberry fruit growers and suppliers are located in the Pasir Ipis Lembang, West Java. In the production of strawberries there are several processes that seeding, planting, maintenance, harvesting, sorting and selling. Sorting can be defined as an activity that separates products based on the level of integrity. Currently the process of sorting applied in La Fresa Strawberry still use manual, in this way often mixing between grade A, grade B and grade C in one container sorting this happens because the sorter is still relying on the estimated weight of strawberries in the sorting process. This has an impact on the level of consumer confidence in the fruit produced by La Fresa, because consumers buy at the appropriate grade is needed, but often get quality Strawberry mixed with various grade. This study aims to select the strawberries by grade by using a mini-conveyor unit as well as a arduino microcontroller, raspberry pi as a mini pc and sensor load cell as the weight measuring strawberries and servo motors as dividing. With a study entitled "Design Tool Strawberry Fruit Sort By Size Based Internet Of Things (IOT) could get Strawberry fruit sorting the results based on the size of the internet of things based on this that can homogenize grade strawberries. This study aims to select the strawberries by grade by using a mini-conveyor unit as well as a arduino microcontroller, raspberry pi as a mini pc and sensor load cell as the weight measuring strawberries and servo motors as dividing. With a study entitled "Design Tool Strawberry Fruit Sort By Size Based Internet Of Things (IOT) could get Strawberry fruit sorting the results based on the size of the internet of things based on this that can homogenize grade strawberries. This study aims to select the strawberries by grade by using a mini-conveyor unit as well as a arduino microcontroller, raspberry pi as a mini pc and sensor load cell as the weight measuring strawberries and servo motors as dividing. With a study entitled "Design Tool Strawberry Fruit Sort By Size Based Internet Of Things (IOT) could get Strawberry fruit sorting the results based on the size of the internet of things based on this that can homogenize grade strawberries.

Keywords: Sort, Strawberry, Internet of Things.

1. PRELIMINARY

Potential and market opportunities fruit industry continues meningkat. This increase can be seen from the data center and the Ministry of Agriculture Agricultural Opera- system that Indonesian fruit exports increased by 24 percent compared to the same period in 2017 [1]. Commodities fruits that are on the rise one of them is strawberries, judging from the price famous strawberry fruit expensive price for 1 kg of strawberries with quality grade C around Rp.18000 / Kg.

To produce strawberries have high selling power hence the need for an increase in strawberry fruit post harvest handling prior to delivery to the market, one of the sorting (selecting) a strawberry. As one of the commodities that people liked, strawberry require sorting process (election), as the market requires certain conditions to be met by quantitative or qualitative parameters. Sorting can be defined as an activity that separates the product based on the level of integrity of the product, either due to disability, or mechanical defects since former pests or diseases. Sorting activity when associated with agricultural products such as vegetables, fruits, tubers is the process of classification and separation products are already clean into an assortment of quality on the basis of physical properties. Sorting (election) is usually done with the principles of separation such as: Different weight, different shapes, different surface properties, different weight types, colors and different textures maturity [2]. According to previous research, has designed a separation tool apples by size by controlling the microcontroller atamega 8353. In that study the working principles of dividing this apple is an apple placed on a conveyor and then conveyors carry the apples to be detected by a laser sensor and photoida to detect whether the big apple or small, if apples pass a predetermined threshold or the laser light then apple is said to be large and the reading results will be displayed on the LCD then the servo motor will be active and move to the right,

Based on the interview with Mr. Lili as manager of La Fresa Strawberry, often mixing between strawberry grade A, grade B and grade C into one container sorting dikarnakan for the sorting process of strawberries in La fresa still use an estimate based on large size of the fruit with the assumption that the size of the fruit starwberry determine the ripeness of strawberries

ie the amount of water contained in strawberry. This can cause penurunanya consumer confidence towards La Fresa Strawberry as consumers bought with a price according to grade you want but often get quality strawberry mixed with some grade. The lack of uniform result of the selection of strawberries for repetitive work that can lead to saturation of the work of sorting strawberry. It can influence the quality of strawberry that cause no eligibility weights refer strawberry fruit from the Indonesian National Standards Agency.

Based on the above problems, the authors intend to design and build a tool strawberries Sort by size to choose / mengklasifikasikan fruit strawberry3 size (grade). The results are expected to facilitate the process of post-harvest handling of fruits starawberry, especially at the stage of sorting strawberries and get the uniform strawberry fruit selection.

2. THEORETICAL BASIS

2.1 Strawberry

Strawberry is one type of strawberry varieties in the genus *Fragaria* (strawberry) Strawberry is a fruit plant that was first discovered in Chile, USA. One strawberry plant species is *Fragaria chiloensis* L spread to various countries of America, Europe and Asia. Furthermore, other species, namely *L. F. vesca*. These same types of strawberries first entered Indonesia [4].

2.2 Internet of Things (IOT)

Internet of Things (IOT) is a structure in which an object, people are provided with an exclusive identity and the ability to move the data without requiring network malalui both directions between humans that is the source to the destination or from human to computer interaction [5].

2.3 raspberry Pi

Raspberry Pi is a single board computer (Single Board Circuit / SBC) or a mini computer that has the size of a credit card. Raspberry Pi is very useful for a variety of purposes, such as spreadsheets, games, play high definition video. Raspberry Pi was developed by a nonprofit foundation Raspberry Pi Foundation is managed by developers and computer scientists from the University of Cambridge, England [6].

2.4 Module

The module is an electronic circuit that has a specific function and can be connected to the Arduino to support certain functions in accordance with keperluannya [7].

2.4.1 Loadcell module HX711

Load cell is a device that emit an electric signal proportional to the force / load receives. Resistors are marked T1 and T2 is a Strain Gauge which receives tensile force (Tension) when the load cell to receive the load. Resistors are marked C1 and C2 are Strain Gauge that receives the compressive force (Compression) when the load cell is loaded [8].

2.4.2 Modules Motor Driver L298N

Module used to run stepper motors. Driver has a current-limiting protection, overcurrent and overtemperature protection are adjustable, and five different microstep resolutions (up to 1/16-step). It operates from 8-35 V and can deliver up to approximately 1 A per phase without a heat sink or forced air flow (it is rated for 2 A per coil with sufficient additional cooling) [7].

2.5 actuators

The actuator is a mechanical equipment tool to move or generate input to the plant in accordance with a control signal such that the feedback signal will be related premises reference input signal [9].

2.5.1 servo

Servo motor is a motor with a closed feedback system in which the position of the motor will be communicated back to the control circuit in the servo motor. This motor consists of a DC motor, a set of gear, potentiometer and control circuit. The potentiometer serves to determine the angle of rotation servo limit. While the angle of the servo motor axis is set based on the pulse width of the signal sent through the legs of the motor cable [10].

2.5.2 Motor DC

The electric motor is an electromechanical device that converts electrical energy into mechanical energy. This mechanical energy is used for, for example, rotate the pump impeller, fan or blower, drive the compressor, lifting materials, etc. [11].

2.6 conveyors

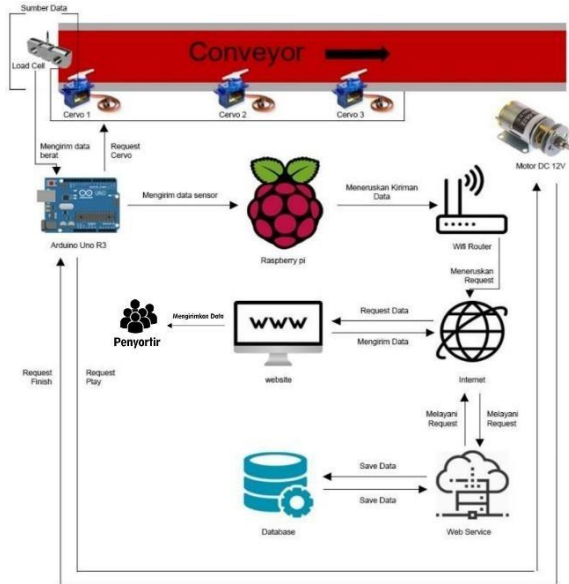
Conveyors are one type of conveyance which is used to transport materials - industrial materials in the solid form. Selection of transport (conveying equipment) material/padatan among others depends on the capacity of the material being handled, jarak material removal, hauling direction: horizontal, vertical and inclination, the size, shape and nature of the material [12].

3. DISCUSSION

3.1 Built Systems Analysis

The analysis system built that stage that provides an overview system built and

aims to give a more detailed picture of the workings of the system built.



Picture 1. System Architecture To Be Built

The following is an explanation of strawberry fruit sorting system architecture based on the size Picture 1 as follows:

1. Stages of the IOT (Hardware)
 - a. Arduino Uno as a microcontroller to retrieve data from the strawberry fruit weight load cell sensor module.
 - b. The data can be further processed using modems available on the raspberry Pi will continue to web services via networks that are connected with WIFI router.
 - c. Web service will perform weighting data storage strawberry and strawberry category into the database.
2. Stages of the user side (Pensortir)
 - a. Users sign in to the web application-based system through browser yang connected to the Internet network.
 - b. The user selects a menu of harvest to perform the sorting process of strawberry or viewing data sorting results strawberry in the web.
 - c. request will be sent to the Raspberry Pi and web service through the Internet.
 - d. web service processing the request to access the data in the database.
 - e. web servicesend the required data from the database to the user interface in a web application.

3.2 Analysis of Data Communications

Analysis of communication between the devices is the description of the device with other devices so that the system is integrated with one another. Here's an explanation of three main elements in the section data communication system as follows:

1. Data source
Loadcell module HX711, DC motor, Arduino UNO.
2. media Transmission
Raspberry Pi 3, WIFI Router, Web Service.
3. Recipient Data
Website, Smartphone.

3.3 Work Analysis Tool

Job analysis tool is used to describe, simplify circuit process or procedure that is easily understood and easily seen by the sequence of steps of a process

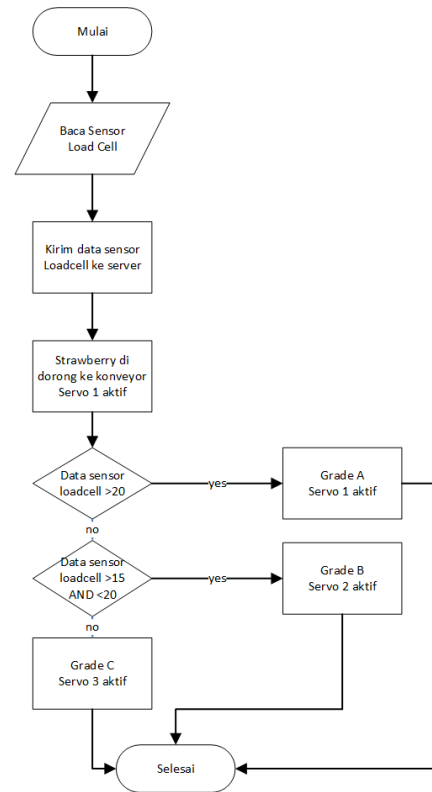


Figure 2. Employment Analysis Tool

3.4 Work Analysis System Application

Analysis of the application system work sorting system constructed using the framework codeigneter strawberry. Codeigneter chosen for its security risks for sebua website and its source quite a lot on the internet became the main point chosen as an application development framework codeigneter strawberry fruit sorting system based on the size-based IOT.

3.5 Functional Needs Analysis

Analysis of functional requirements is the process of activities to be implemented in the system and explain the necessary requirements for the system to run smoothly and in accordance with the system.

3.5.1 Use Case Diagram

Use Case Diagram is modeling for behavior (behavior) information system that will be made, can be seen on .Gambar 3

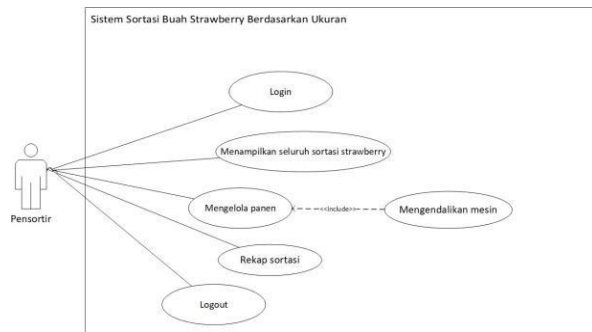


Figure 3. Use Case Diagram

3.5.2 Activity Diagram

Activity Diagram is a stage that is focused on business processes and sequences describe the activities in a process, stages of activity when pensortir will control strawberry sorting machine can be seen in Figure 4

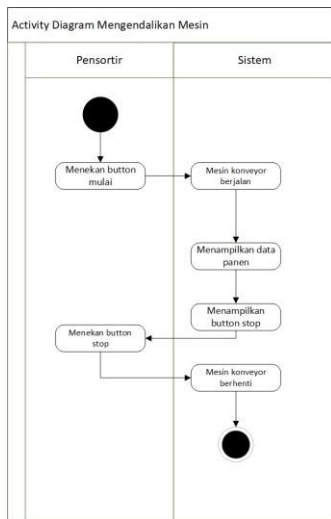


Figure 4 Activity Diagram Control Engineering

3.5.3 Class Diagram

Class Diagram is a specification of the functionality that the object and is the core of the development of this application. Class Diagram of strawberry fruit sorting system based on the size can be seen in Figure 7

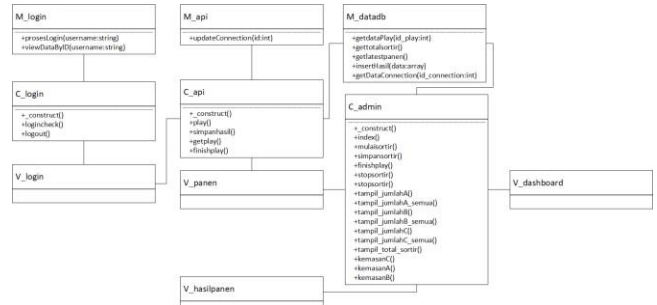


Figure 6 Class Diagram

3.5.4 sequence Diagram

sequence diagrams made aiming to describe the interactions between objects in use case. can be seen in Figure 7

3.6 Designing Databases

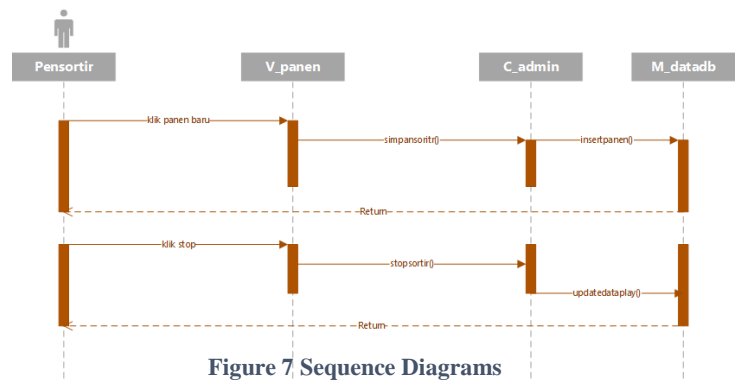


Figure 7 Sequence Diagrams

Database design is a step to map the conceptual model in the model database will be used.

3.6.1 Relation Table

Relation table is a series of relationships between some of the tables in the database system can be seen in

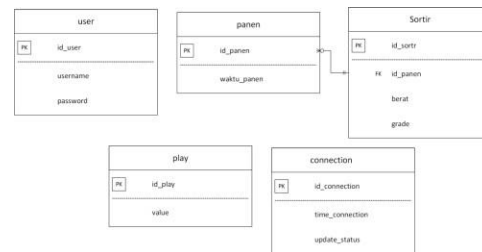


Figure 8 Relation Table

3.7 Hardware Implementation

This section discusses the hardware used to run the System Soritr strawberry fruit by size based IOT Details

xperangkat computer hardware used can be seen in Table 1.

Table 1. Used Computer Hardware

No.	Device Hard	Specification
1	processor	Intel Core-i5
2	memory	4Gb
3	Hard Drive	1 TB
4	VGA	2 GB
5	monitor	14 "with a resolution of 1336 x 768 pixels
6	Mouse	optical Mouse
7	keyboard	Standard
8	Network	Network connection using WIFI

Mobile Internet of Things (IOT) is a device that consists of a microcontroller, actuators and modules. IOT device specifications can be found at can be seen in Table 2

Table 2. IOT Used Hardware

No.	Hardware	Information
1	microcontroller	Arduino UNO, Raspberry Pi 3
2	Loadcell module	HX711
3	Servo Motor	Mini Servo 9G
4	Motor DC	Gearboax

3.8 Software Implementation

In order to run a Strawberry Fruit Sort Systems Based Based Size IOT, used computers already installed the necessary software can be found at Table

Table 3. Computer Software

No	Device Soft	Specification
1	Operating system	Windows 10
2	browser	Google Chrome
3	Internet	Connected with Internet Network

3.9 implementation interface

Figure 9 is a login interface.



Figure 9 Pageviews Login

Figure 10 is a Dashboard user interface.



Figure 10 Dashboard

Figure 11 is a user interface Harvest.

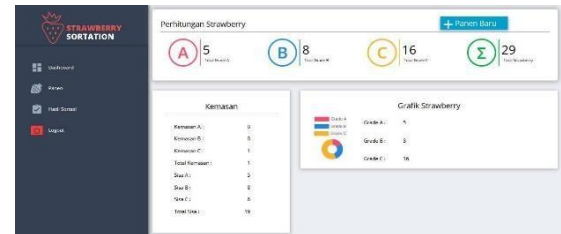


Figure 11 Harvest

Figure 12 is a user interface Sorting Results



Figure 12 Results Sorting

3.10 Hardware IOT testing

To determine whether the equipment running in accordance with the initial draft, we need a test.

Testing is done with Loadcell module HX711, servo motors, and overall tool work.

3.10.1 Testing Module Loadcell HX711

HX711 loadcell module is a module used to measure the weight of a strawberry. Weight module testing is done by putting a strawberry in the strawberry fruit loadcell modules. In the picture shows the display system when tested against loadcell module 3 times test.

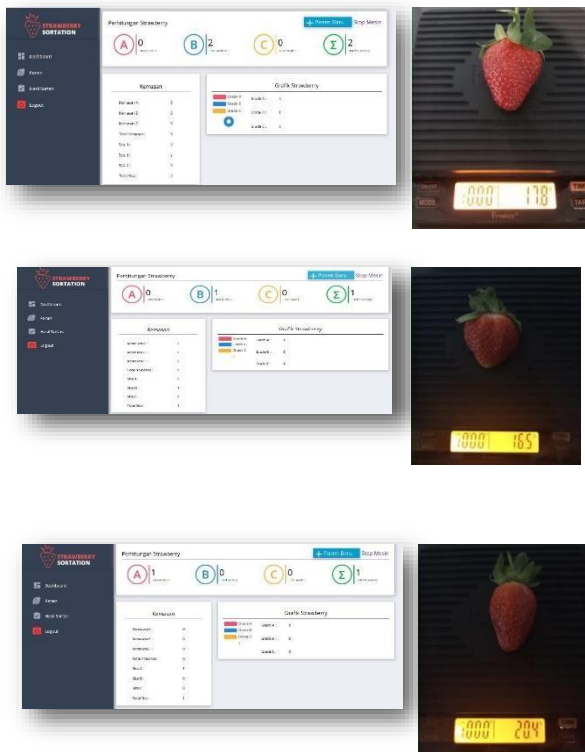


Figure 13 Testing Loadcell HX711

Table 4 Test 1

No.	Weight	grade
1	20.4	A
2	16.5	B
3	17.8	B

Table 5 Test 1

No.	Weight	grade
1	20.4	A
2	17	B
3	17.8	B

Table 6 Test 1

No.	Weight	grade
1	20.4	A

2	16	B
3	17.8	B

It can be seen that the module can work well, the results of testing conducted Bahwan gained weight size strawberry according to grade.

3.10.2 Servo Motor Testing

Servo Motor merupakan actuator that is used to get the accuracy when reading HX711 loadcell modules weighing strawberries

> 20 grams then the servo motor on the gate first opens, when the weight of strawberry > 15gram-20gram the second servo motor on the gate will open.

1. Testing servo motors for gate 1 strawberry weight 17gram.



Figure 14 Servo 1

2. Testing servo motor gate 2 to 23 grams weight.



Figure 15 Servo 2

3.10.3 Testing Overall System

Testing of the entire system is intended to test sensors and modules work that has been integrated with the website. Website as a control here it means the website is used pensortir to know how many strawberries sorting results, the amount of packaging strawberry sorting results.

with information obtained from stawberry sorting system.

4.2 Suggestion

Systems that have been made still needs to be developed further for the future, so that the system has been built to work better. As for suggestions for the development of software that is built is as follows:

1. The addition of a mini-conveyor unit for separating strawberries order sorter does not need to put one at a strawberry to the main conveyor, so that the sorting process more effective.
2. Develop a platform that can be supported by other software, since currently only supports the web only.

The system can be developed by using image processing to detect the magnitude of the size of the fruit and strawberry fruit maturity



Figure 16 Overall System

3.11 Beta testing

Beta testing is done to determine the assessment of Strawberry Fruit Sort Systems Based on IOT-based size built by interview.

Table 7. Beta Testing Interview

Question	answer
Is the fruit sorting system by size based IOT can sort Strawberry well?	For Grade separation is good enough but for advice from I epektifan future for all, I hope it yields satrwberry can automatically separates one by one, after being apart one by one and then will go to the tools that you create for sorting or separating strawberry by gradenya
What do you think about the use of this sorting system ?	Quite comfortable to use, and I also use it easily.
Do you think using satrwberry fruit sorting system based IOT-based measures can assist you in dealing with post-harvest strawberries in lafresa Satrwberry	Yes, help me, so I can know how many packs of strawberries harvested and also I can analyze the yield satrwberry of application this

4. CLOSING

4.1 Conclusion

Based on the results of testing of software and hardware that has been built as a strawberry sorting system based on the size-based IOT it could be concluded that the system has been built to meyeragaman grade strawberries and pensortir can analyze the results of sorting strawberry

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