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Automatic Control System on the Machine Vision Volume and Weight Gauges

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ABSTRACT

The advancement of industrial automation technology is growing rapidly. The existence of technology in the computers field, mechatronics allows the creation of automation systems on machine vision. Machine vision is a machine that can obtain information from an image or digital image automatically, taking digital images using a camera and laser in the form of lines, added in the imaging method that obtains 3D images of objects so that the volume of objects can be measured. The laser beam that hits objects and reflected objects form a triangle. In this study, the triangulation method was applied to the machine vision to measure logistics packages. In Indonesia, freight forwarding services measure the volume and weight of objects that are the basis for determining shipping costs. Volume is used as a determinant of costs if the mass is small, while the weight for the large volume. This machine vision tool has functions to measure the volume and weight in the long run which is fast and accurate. In this study, machine vision is designed and built of capable measuring various forms of logistics packages by using a camera and laser beam to record images on a rail connected to a drive motor. The camera moves translatively over the logistical package when the camera position in the middle of the drive motorbike stops for a moment, the camera will record the image to take the volume of the package and load cell takes to load data, then the motor moves back to its original position. Simultaneously the lower motor will drive the driver the package reach the storage area, the motor moves back and forth until the pusher returns to the starting position and the next measurement is carried out. Long wavered laser spectrum, digital camera, microcontroller, triangular measurement method, portable machine. With this machine vision, the work done by several people will be done with one person, so that it will reduce costs and the time needed will be faster.

KEY WORDS: *Automatic System, Motor Stepper, Microcontroller Program.*

1.0 INTRODUCTION

The progress of industrial automation technology is now increasingly rapid and widespread, this is driven by the growing needs of industry and varies from year to year. Technological advances in the field of computers, mechatronics enable the creation of automation systems in various fields such as the automobile, mobile phone and laptop industries. With the automation system, will help users in doing a job by saving time and money.

Goods shipping services in Indonesia are a growing business, where competition between service providers is increasing. The existence of express delivery services and services between addresses will make it easier for consumers to ship, compared to traditional shipping services that often face obstacles and constraints that result in damage, loss, unclear address, route error (misroute), and other things on the shipment. This happens due to two factors, namely human factors (human error) and natural factors (force majeure), causing delays in sending.

The process of shipping goods in Indonesia is generally carried out traditionally, starting with the receipt of goods (from consumers to customers, then goods to be shipped, the packaging is carried out according to predetermined standards. Shipping costs are carried out by calculating the weight of goods, but the weight of the goods consists of two types that are based on the actual weight and weight on the basis of volume. For goods that

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are small then the actual weight that will be measured, while the items are large but weighing lightly, the weight of the volume used.

Machine vision is a machine that can obtain information from digital images or images automatically, which is used for quality control. Its use is increasing in manufacturing industries to replace human inspection personnel. Machine vision is needed for repeated inspections in a short time because it is faster, more objective, and can work continuously (Cognex, 2016). This system vision system works using software and other supporting tools, such as Arduino hardware using C language.

Based on the above problems, the design of an automatic control system in machine vision is made for measuring volume and weight using Arduino hardware, this system is expected to help facilitate the measurement of weight based on the right mass and volume and efficiency at logistic shipping companies.

2.0 METHODOLOGY

In the design of automatic and heavy-duty machine vision control systems, there are several steps that must be done, namely, design mechanism the machine vision, selecting and placing components of the control system, making the program and testing the feasibility. In running the control system using an Arduino microcontroller with C language software, this C language software program will move and manage the process of measuring volume and weight in machine vision tools. The research diagram can be seen in Figure 1. as follows.

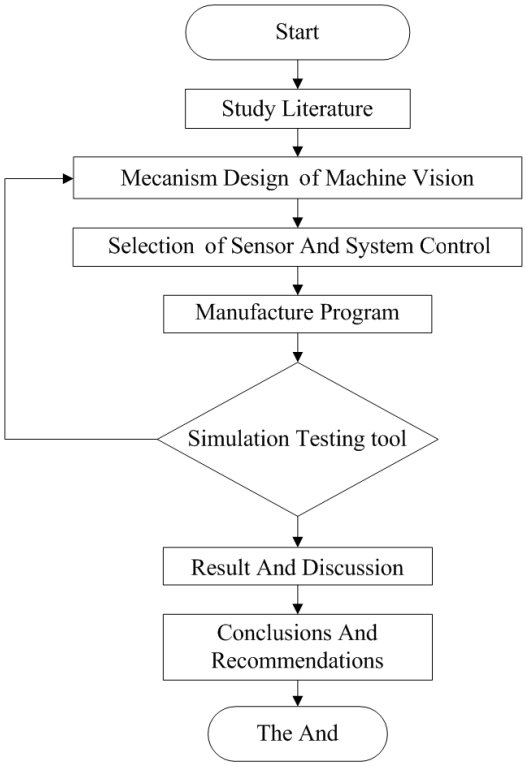

Figure 1: Research Diagram

2.1 Control System Components

The components of the control system are hardware (equipment) used in machine vision control systems measuring volume and weight. The equipment will then be arranged in such a way as to form an electronic circuit that functions as a driver for machine vision tools.

The choice of control system components greatly affects the performance of the engine. In this machine vision, there are several important components of the machine that need attention. For the selection of control system components in machine vision, there are several parameters to consider, namely accuracy and toughness of components, price and availability in the market.

The several components used in the automatic control system in machine vision are stepper motors, motor drivers, power supply, Arduino microcontrollers and cable cables.

2.1.1 Stepper Motor

A stepper motor is one of the electromechanical devices that works by converting electronic pulses into distric mechanical movements. Stepper motors move based on the order of pulses given to the motor (Hanafi, 2012). Because the stepper motor drive stepper motor controllers are required generate pulses periodically.

The use of stepper motors has several advantages compared to ordinary motors. The advantages include:

1. Rotational angle rotors are proportional to input pulses so that it is more easily regulated.
2. The motor can directly provide full torque when starting to move.
3. The position and repetitive movement can be determined precisely.
4. Has a very good response to starting, stopping and turning.
5. Very real because there are no brushes that come into contact with the rotors like in a DC motor.
6. Can produce slower turns so that the load is coupled directly to the head.
7. The rotation frequency can be determined freely and easily over a wide range

2.1.2 Motor Driver

Motor Driver is a component that serves to communicate between the controller and the actuator and strengthen the signal output from the controller so that it can be read by the actuator.

2.1.3 Power Supply

A power supply is an electronic device that is useful for other devices, especially electric power (Wikipedia). Basically, the power supply is not a device that produces electricity, but there are several power supplies that produce mechanical energy, and other energy. The way the power supply works converts the AC voltage into another smaller DC voltage with the help of a transformer. This voltage is then rectified by the voltage rectifier circuit, and the condenser is added at the end as a voltage smoothing so that the DC voltage is generated by a non-wavy power supply.

2.1.4 Mikrokontroller Arduino

Arduino is an electronic interface or microcontroller that is open source and has hardware and software that is easy to use. Arduino

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can recognize the surrounding environment through various types of sensors and can control lights, motors, and various other types of actuators. The advantage of Arduino is that it has its own programming language in the form of C language, has USB, making it easier when programming. Arduino Uno is one of the Arduino models which is a circuit board based on the ATmega328 microcontroller. This IC (integrated circuit) has 14 digital inputs/outputs (6 outputs for PWM), 6 analog outputs, 16 MHz ceramic Crystal resonator, USB connection, adapter sprocket, ICSP pin header, and reset button. It is needed to support the microcontroller are easily connected with a USB power cable or power supply cable AC to DC adapter or battery also.

2.2 System Control Software

Software on the control system is software that is used to control machine vision measuring weight and volume. The software used in this tool is the C language, then the software will then be installed on the computer that acts as an interface. The interface is software that functions to communicate all commands that can be read properly by all hardware. With the machine vision interface, the weight and volume gauge will move according to the program that has been designed before. A display of C language programs can be seen in Figure 2.

Figure 2: C language program

3.0 RESULTS AND DISCUSSION

3.1. Control System Sis

After determining the design and device (hardware) on the automatic control system in machine vision measuring weight and volume, then testing the program that has been designed using Arduino software using C language. Push/button is pressed so the Arduino microcontroller will give signals and pulses to the motor driver to drive the stepper motor, motor rotation movements will be converted into translation motion using a shaft screw

1. Power supply circuit
   Power supply plays an important role in flowing electric current to the motor as a driver. The power supply will send an electric current to the motor driver and forward it to the stepper motor. There is a power supply in this tool that uses "24V" and "12" currents. Two first port function connect the power supply with AC current.

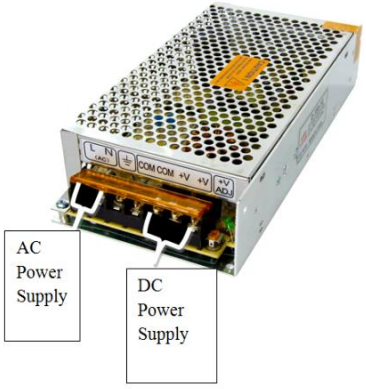

Figure 3: Power supply circuit

   Then the "V +" port and "COM" port for connecting DC current to as many as "24" motor drivers. While arrangement cable contained on power port supply this is "L" and "N" for entering AC current, then "V +" and "V-" for channel DC current to Motor driver soon to the stepper motor at once for channel current to microcontroller Arduino. The power supply circuit can be seen in Figure 3.

2. Mikrokontroller Arduino
   Arduino microcontroller is hardware that functions as the brain of machine vision, a program to move components in vision machines using C language software which will later be inserted into Arduino hardware so that the components can work as desired, the power used uses a voltage of 0-5V. Can be seen in Figure 4. function of each Arduino port.

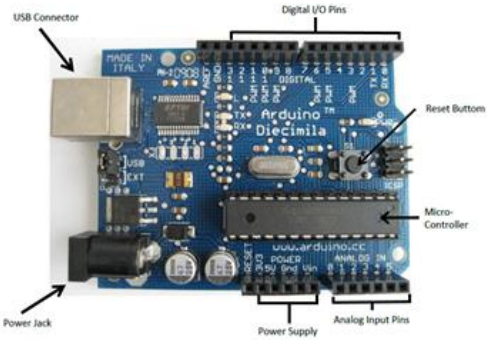

Figure 4: Image per port on Arduino

The function of each Arduino port The USB connector is a program builder from a computer :

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a. USB Connector functions as a program builder from a computer.
b. Digital I / O Pins function as input or output can be set by the program.
c. Analog Input Pins functions to read the voltage produced by analog sensors.
d. Buttom Reset serves to reset the board, so the program will start again from the beginning.
e. Microcontroller functions as the brain of Arduino, in which there is a CPU, ROM.
f. The Power Supply has a power pin and ground pin.
g. Power Jeck serves to supply DC current Arduino microcontrollers.

3. Motor Driver

The motor driver works Matching voltage and DC current from the power supply to the stepper motor, as well as maximize torque from the stepper motor. The motor driver has some ports later connected to each - each port as some control ports from Arduino, DC power supply port, and several ports for move the stepper motor. Could be shown on Figure 5.

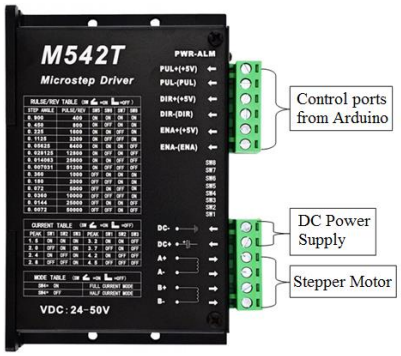

Figure 5: Motor driver circuit

Information picture :

- PUL+ and PUL– : are for setting the incoming flow
- DIR+ and DIR– : are set current voltage high and low representing the two direction motor rotation, max voltage of 4 – 5 V and when low 0 – 0.05 V.
- ENA + and ENA– : function for activating and disable the driver.
- A+, A–, B+, B– : Function his motorcycle movement per step. If for the motor used for one round as many as 800 steps.
- DC+, DC–: works for display DC power to drive the motor.
- Schematic Results of a Series of Machine Vision control systems.

After selecting the control system components in the volume and weight measuring machine vision, then all the control components are assembled. In the figure showing the results of the control system schematic circuit in machine vision. In the schematic, there are several important components as a constituent of machine vision including an Arduino microcontroller, motor driver, stepper motor, and power supply.

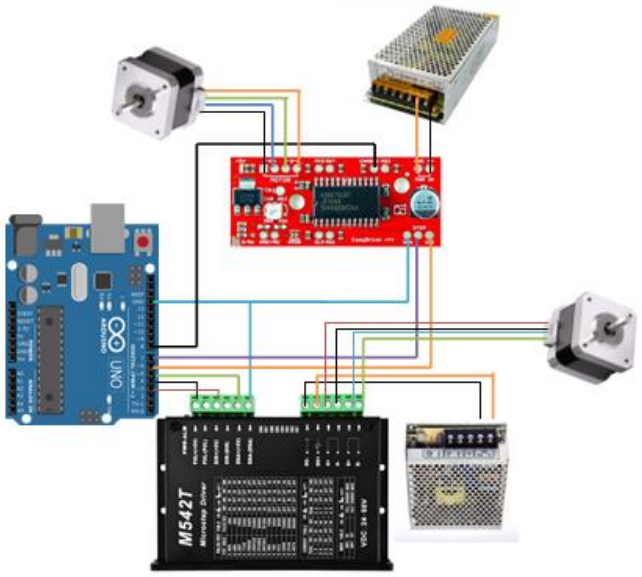

Figure 6: Schematic drawing of Machine Vision

In this study, the machine vision will be used as a measure of the weight and volume of logistics package delivery services. In taking heavy data using load cell and for volume data retrieval using a camera and laser with a triangulation method. Control system as a complement to the work of machine vision. The control system in machine vision is a combination of several important components contained in the machine vision control system including the Arduino Microcontroller, Motor Driver, Stepper Motor and Arduino.

The microcontroller is a command centre in machine vision, where all commands for the control system that are entered from C language software into the Arduino microcontroller will then give orders to the motor driver. The motor driver used is the M542T and easy V44 A3967 driver, the motor driver can be adjusted according to needs, which requires enough thrust to drive the logistics package and camera to the middle position of the logistics package, so that the stepper motor used has the power according to the needs machine vision.

In the engine drive control system uses a stepper motor because the stepper motor can move per step according to the input signal given. The movement in the form of this step gives the engine an advantage because it is able to move at a better level of accuracy. In this machine vision, it uses a stepper motor type NEMA 23 for item propulsion and NEMA 17 to move the camera to the middle position of the logistics package. In addition to these types there are still several types that are larger or smaller, but because the mass of the logistics package to be pushed is not too large, the selection of theme 23 and NEMA 17 has been able to meet the needs of the machine.

4.0 CONCLUSION

The conclusion that I can take from the design and manufacture of a control system in the west and volume measuring machine

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vision using an Arduino microcontroller is.

1. Schematic design of the machine vision control system for volume and weight gauges has been obtained that can move the stepper motor to move the camera to the middle position of the logistic package using the sliding shaft and to the bottom as a driver of the goods until it reaches the storage and returns to its original position.
2. Based on the form of design that has been made, then machine vision control systems have been assembled which are compiled by several components such as Arduino, motor driver, stepper motor and power supply and have been running as desired.
3. The time needed to measure the logistics package for three minutes 23 seconds operated by one operator.

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