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Design of Automatic Brick Dough Mixer Using 1 Phase AC Induction Motor

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ABSTRACT

Bricks are the main component in a building, the increasing demand for bricks makes bricks sought after by the public so craftsmen have to produce enough bricks to meet market needs. From this problem, a design of an automatic brick dough mixer using a 1-phase AC induction motor was made, a concept design was carried out for making tools. In making the tool, the most important component of this research is the 1 phase AC induction motor where this motor will work to stir a dough so that it is evenly mixed. So that the humidity level of the dough can be measured with a moisture sensor, what is the level of density in a brick mixture that is made. To test the humidity level so that the dough becomes dense, 3 L of water and 9 L of soil are obtained at a temperature of 63%, the average cut in one minute is 24 bricks and for manual manufacture it produces 3 bricks in one minute so that it can be obtained conclusion with this tool the brick craftsmen can be helped to speed up production results in order to obtain efficiency in work results.

1. Introduction

Bricks in a house building have a very vital role, no matter how beautiful a house is without bricks it cannot be said to be a house. But along with the development of architecture, bricks are not only limited to protecting a house, now the role of bricks is shifting towards a broader direction for a building design or architecture [1].

The problem faced by brick craftsmen is that the supporting equipment for the production process is inadequate, the use of manual brick molding tools is the main cause of less than optimal production results, this causes a lot of consumer demand to be unbalanced with the production produced, as a result From the slow production process, the selling power of the craftsmen will decrease because consumers want to get more bricks quickly.

In making bricks, the longest process is the process of mixing brick materials. At this time, there is actually a technology that is used for mixing sand and cement, namely a brick mixer machine [2].

Soil is the surface layer of the earth consisting of mineral materials resulting from weathering of rocks and organic matter from the remains of plants and animals [3]. Soil is composed of four main ingredients, namely mineral matter, organic matter, water and air [4]. Soil is also very influential for the process of making the dough and also the level of moisture obtained from the dough, don't add too much water. Another definition states that soil moisture states the amount of water stored between the pores of the soil is very dynamic, this is caused by evaporation through the soil surface [5].

Single phase induction motor is a tool to convert electrical energy into mechanical energy by induction [6]. This motor has only a squirrel cage type stator winding and operates on a single-phase mains supply. It is called an induction motor because this motor works in the presence of an induced current as a result of the pole difference between the rotor and stator magnetic fields [7]. This motor has advantages in terms of simplicity and low maintenance costs so that this type of motor is widely used in industrial and household environments [8].

In this study using Arduino and moisture sensors. Moisture sensors consist of YL-39 and YL-69. YL-69 sensor is a sensor capable of detecting moisture in the soil [9] Soil moisture sensor is a sensor capable of detecting the level of water saturation in the soil. The working principle of the soil moisture sensor is to measure the level of saturation in the soil by knowing the resistance of the soil. If the soil is dry, the resistance of the soil will be even greater. Conversely, if the soil is wet, the resistance of the soil will decrease. The tools made in this study combine the capabilities of Arduino UNO as a data acquisition system equipped with an Ethernet shield for data transmission, a YL-69 humidity sensor to read soil moisture [10]

2. Method

The object of this research is a single-phase AC motor found in an automatic brick making machine. The motor will grind the materials in the form of water and soil and then produce a brick mixture. In this study, the measurement of the humidity level of the dough that has been tested, the results of the dough will be measured humidity level using a soil moisture sensor.

2.1. System Working Principle

Research on the design of an automatic brick dough mixer using a 1-phase AC induction motor has a research flow chart as shown in Fig. 1.

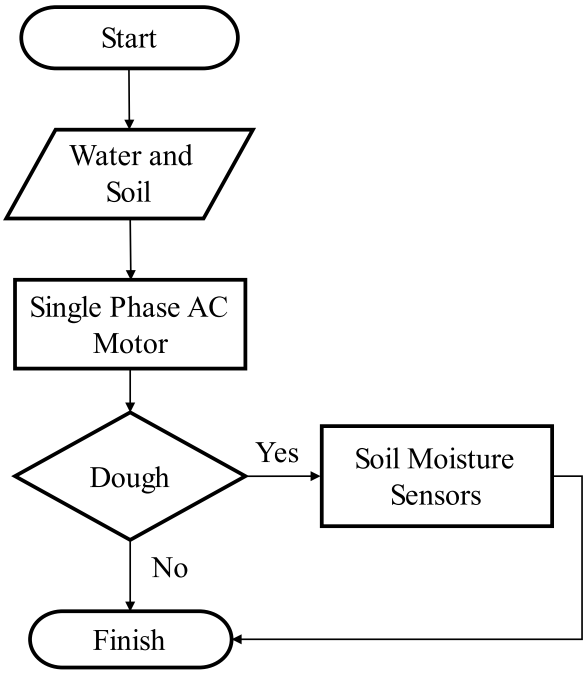

Fig. 1. Research flowchart

The flow of this research is by preparing materials in the form of soil and water, the materials are put into a tube to be mixed so that it is evenly distributed when processing a grinder assisted by a gear and driven by a 1 phase AC motor. When the dough comes out, the humidity level is measured using the Soil Moisture sensor.

2.2. Tool Design

The design of the hardware in this study is to design a 1-phase AC motor and a soil moisture sensor. The 1 phase AC motor functions to stir water and soil ingredients to make a dough. Soil Moisture Sensor and Arduino to measure the moisture level in the dough that comes out. For the design of the hardware design shown in Fig. 2 and Fig. 3.

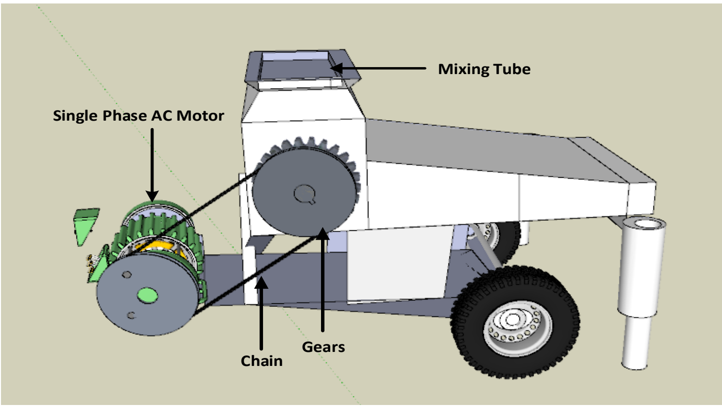

Fig. 2. Design of a single phase AC motor

The design of the automatic dough mixer is in the form of a single-phase AC motor assisted by a gear to run a grinder in the tube. This tool can mix ingredients in the form of water and soil to make a brick dough.

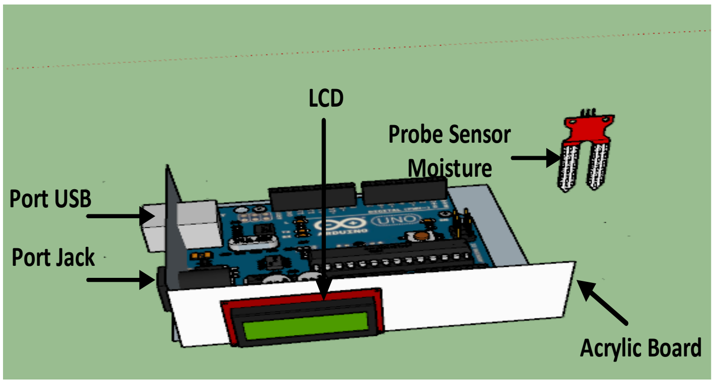

Fig. 3. Arduino design and moisture sensor

The design is arranged with an acrylic board to make it look neat. To run it, namely by attaching a moisture sensor to Arduino with a jumper cable and for programming Arduino requires a printer cable connected to the USB port.

2.3. Software Design

After the hardware design is complete, the next step is to make software. This software design uses Arduino IDE software which will include listings on an Arduino and a soil moisture sensor. The following is a flowchart of the software (software) can be seen in Fig. 4.

The process starts with reading the analog sensor if it reads 1023 or more it will be changed to 0, otherwise the sensor that reads 200 or less will be changed to 100, the resulting data will be displayed on the LCD

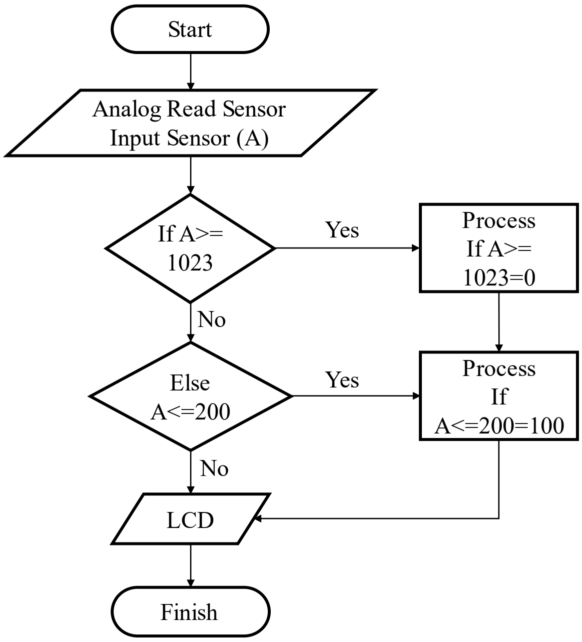

Fig. 4. Software flow chart

3. Results and Discussion

This discussion will display the results of testing the tools and the results of a comparison of manual and automatic brick making and the results of the mold will measure the humidity level.

3.1. Testing of 1 Phase AC Motors

The test was carried out by providing an input voltage of 220 V AC for 4 hours to determine the performance and strength of the motor. In this test the parameter used is the nameplate of the electric motor, so that the test will obtain the RPM value of the voltage and current on the electric motor for 4 hours. testing will provide a result of the condition of the motor whether it has decreased the level of quality of work the motor has tested for 4 hours or the results remain stable according to the parameters that have been obtained. Testing the Motor 1 Phase obtained quite good results by testing the motor for 4 hours including temperature test, RPM test, resistance value test, current value, and voltage value. It can be concluded that the 1 phase electric motor as one of the components of the tool is in good condition and can be seen in Fig. 5.

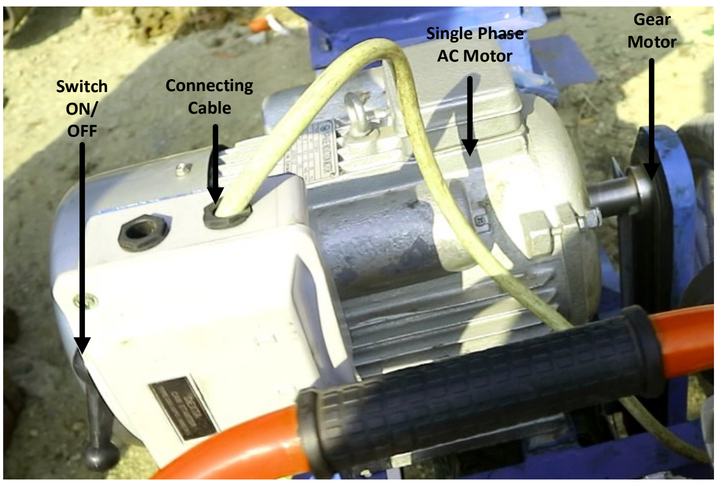

Fig. 5. Physical condition of 1 phase AC motor

3.2. Soil Moisture Sensor Testing

Sensor testing is carried out to determine the performance of the moisture sensor to analyze data. In this presentation, as a standard or reference for measuring the moisture level in the brick mixture, by plugging the sensor into the brick mixture that has been printed, it will then issue an output that is channeled to the LCD. The following is a picture of the tools that have been arranged, seen in Fig. 3.2. The tool has also been programmed through several trial and error processes as can be seen in Fig. 6.

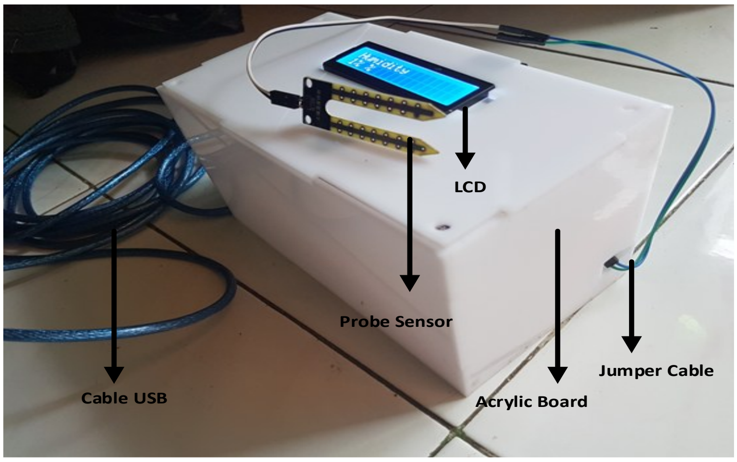

Fig. 6. Realization of the land measurement tool with a moisture sensor

The tool has been assembled in the form of an Arduino as a microcontroller which is programmed in the Arduino IDE application via a Printer cable, arranged with an acrylic board to make it neat and added an LCD as data output and a moisture sensor for humidity input. which is on the device so that everything is connected.

Arduino is programmed using the listing above to read the humidity sensor, the sensor will detect and send the data to the LCD in the form of numbers (%) and can be seen in Fig. 7.

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(7, 6, 5, 4, 3, 2);   // Setingan awal konfigurasi dari pin
                                        Lcd.
int sensorPin = A0;    // Pilih input analog pin pada A0
int sensorValue = 0;   // Pilih input analog pin nilai sensor
int percentValue = 0;  // Pilih input analog pin nilai persen

void setup() {   // Program dijalankan
  Serial.begin(9600); // Mengirimkan data ke port serial awal
  lcd.begin(16, 2);   // Program membaca pada lcd  ukuran 16x2

}

void loop() {  //Fungsi perulangan pada program
  SensorValue = analogRead(sensorPin); // Data pada nilai sensor akan
                                          sama pada analog ke port
                                          serial
  Serial.print("\n\nAnalog Value: "); // Mengirimkan data ke port serial
                                         analog
Serial.print(sensorValue);  //Mengirimkan data ke port serial sensor
PercentValue = map(sensorValue, 1023, 200, 0, 100);   // Pembacaan
                maping jika sensor membaca suhu 1023 akan di ubah
                menjadi 0 dan jika sensor membaca suhu 200 maka
                diubah menjadi 100
Serial.print("\nPercentValue: ");   // Mengirimkan data ke port serial
                                       nilai jumlah persen
Serial.print(percentValue);     // Mengirimkan data ke port serial nilai
                                   persen
Serial.print("%");   // Mengirimkan data ke port serial %
lcd.setCursor(0, 0);  // Menentukan posisi cursor mulai penulisan
lcd.print("Soil Moisture");     // Lcd akan menampilkan tulisan Soil
                                   Moisture

lcd.setCursor(0, 1);  // Menentukan posisi cursor mulai penulisan
lcd.print("Percent: ");  // Lcd menampilkan Percent
lcd.print(percentValue);    // Lcd menampilkan  nilai persen
lcd.print("%");    // Lcd menampilkan %
delay(1000);     // Waktu tunda untuk menyiapkan pembacaan
                    berikutnya
lcd.clear();      // Menghapus layar Lcd
}
```

Fig. 7. Humidity sensor program

3.3. Test Results for Measuring Humidity Levels

The process of mixing the ingredients is then measured at the humidity level to obtain some data. The humidity level was measured using a moisture sensor on the dough obtained from the data based on the table in the form of the measured composition, the results obtained and the measured temperature obtained. To see the data can be seen in Table 1.

Table 1. Observation of humidity levels

No	Manufacture of the	Composition in Liter (L)	Results	Temperature (%)
1	1	3 L water and 1.5 L soil	Watery Land	100
2	2	3 L water and 3 L soil	Watery Land	100
3	3	3 L water and 5 L soil	The ground started to solidify	90
4	4	3 L water and 6 L soil	The ground started to solidify	79
5	5	3 L water and 9 L soil	Solid Soil	63

From the analysis of the data above, it is obtained that the mixing of the soil and water must be in accordance with the portion, namely the data that is not too wet or ideal is obtained, namely with a ratio of 1 to 3, namely 3 liters of water for 9 L of soil.

3.4. Dough Mold Test Results Automatically

The testing process is carried out by pouring the material in the form of water and soil into the stirring funnel, then the material is stirred automatically which is controlled by a single-phase AC motor. The ingredients will mix well and become a brick dough. To find out the printout of every second that is generated in an automatic way, it can be seen in Table 2.

Table 2. Observation of humidity levels

No	Manufacture To	Time in one print (second)	Amount of One Print
1	1	5	2
2	2	5	2
3	3	5	2
4	4	5	2
5	5	5	2
6	6	5	2
7	7	5	2
8	8	5	2
9	9	5	2
10	10	5	2

The time obtained for producing brick dough using an automatic method can be concluded that the average value in table 4.3 is obtained by a value of 5 seconds in one minute printing bricks automatically to produce 24 bricks. The forms that are printed automatically have the same size, which is approximately 20 cm long, 5 cm high and 7 cm thick.

3.5. Results of Manual Dough Mold Testing

The mixing process is done manually, that is still using the feet as a foothold to mix the soil and water. To find out the printouts of every second produced manually can be seen in Table 3.

Table 3. Time in one manual cut

No	Manufacture To	Time in one print (second)	Amount of One Print
1	1	40	2
2	2	42	2
3	3	40	2
4	4	43	2
5	5	40	2
6	6	40	2
7	7	45	2
8	8	43	2
9	9	40	2
10	10	44	2

4. Conclusion

To test the humidity level so that the dough becomes dense, 3 L of water and 9 L of soil are obtained with a temperature of 63%, the average cut in one minute is 24 bricks and for manual manufacture it produces 3 bricks in one minute so that with This tool can help brick craftsmen to speed up production results so that efficiency is obtained in work results.

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