International Journal of Latest Engineering and Management Research (IJLEMR)
ISSN: 2455-4847
www.ijlemr.com || Volume 05 - Issue 02 || February 2020 || PP. 13-18

Upcoming Industry 4.0: Development of ROBOCHOP with Embeded Control System to Strengthen Creative Industries in Surabaya

Lasman Parulian Purba[1], Ridho Said A. Laurence[2], Aldhinno Cristian[3]
[1,2,3](Industrial Engineering Department, Darma Cendika Catholic University, Indonesia)

Abstract: It is a need to strengthen creative industries in Indonesia as well as in Surabaya City according to the information now adays that as we all know that the city is a barometer or a miniature of Indonesia, respectively. One of the efforts to strengthen creative industries in Indonesia was the development of a digital economy with upcoming realization of Industry 4.0 for every part of our life aspects. One of the ways is the development of robot line follower to help small medium enterprice to handle the movng materials in the any industries as well as in the creative industry. ROBOCHOP will help worker and or owner and or operator to handle the materials in their factory production system as well as culinary café and shops. Firstly ROBOCHOP will deliver 'list of menu' from front office or a well-defined place in the room/the production floor as well as a culinayr shop / café to the table that the customers used at the time they come into the room. Then after the first task, the robot will perform the second task, an so on until the customer pay and receive money change and leave the table and the door of the culinary café shop.It means that the robot will automaticly serve any person who come and sit in the chairs-table.

Keywords: Creative Industries, Embedded control system, Industry 4.0, Line follower robots, ROBOCHOP

I. Introduction

The development of the Creative Industry is increasingly showing its existence in supporting prosperity in the economy of Indonesia. Various parties argue that human creativity is the main economic resource. This is indicated by the increase in the contribution of Gross Domestic Product (GDP) in several Creative Industry sectors out of a total of 16 sectors, but the most dominating contribution to the increase in GDP is the culinary sector by 41.40% . In the culinary sector, it is classified as a type of business restaurant, restaurant, shop, catering, cafe and part of it.

On the other hand, the results of the Creative Economy Agency (Bekraf) survey showed that the number of workers or resources in the Creative Industries is very minimal with an accumulation of 48.94% [1] in the category of 1-4 workforce. The accumulation of this category is the largest of the other 4 categories in the survey results. The amount of resources involved is very important to increase the amount of economic income in the business unit. Therefore we need innovation to help Creative Industries in running their business units, especially in the culinary sector.

From this explanation, robot technology was designed as a substitute for Arduino-based cafe servants. Besides being designed for cafes, this robot can also be used in other culinary sectors as a substitute for waiters or waiters where there are business units that have fewer resources, this robot can replace the servant function. This product is expected to help the culinary sector, especially in the cafe business unit in overcoming the problem of limited resources in its business activities.

According to the report of [2] and the introduction of the industry 4.0 paradigm, it is a need to develop robot that can help owner and or worker as well as operator to be more efficient especially in material handling movement in the production line and so on.

The research then making a new robot -(namely Robochop, after running well in its minimal function of a mobile robot)- with understand the previous robot namely "Robot LFMHPTUPTUPHS Version Alfa 1.5x" (shown in Fig. 1) [2] and its embedded control system [3]. This paper present a research progress in preparation of an autonomous robot especially for a coffee shop. That is why we called as ROBOCHOP version alpha (Robochop- α) ROBOt Coffee sHOP in a general start (alfa) version. In the mean time, the Robochop- α migration become Robochop version beta (Robochop- β). Robochop- β (shown in Fig. 2) is a robot as the example product that need to produce in Integrated Design Laboratory of Industrial Engineering Department, Engineering Faculty, Darma Cendika Catholic University.

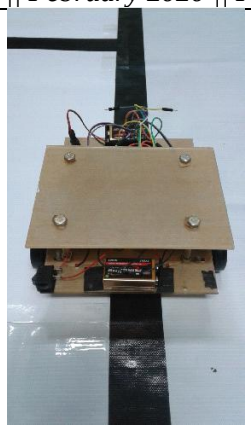


Figure 1. Robot LFMHPTUPTUPHS Version Alfa 1.5x.

Figure 2. Robochop-β.

II. Research Method

It is well evaluated the Fig 2. The robot needs to upgrade to be smaller but increase more speed of the movement with 1.0 kg in weight of load. That is why we evaluate in the three aspects below and the results is in progress.

Tables and Figures are presented below are step by step of the process held to build the current robot namely Robochop-β.

No	Name of the Robot		Hardware Machine	Software / Embedded Control (Program) System
1	Robot lfmhptuptuphs version 1.0	Roboserve version betha	2018, 2017	no Intellectual Property Right IPR) until now
2	Lfmhptuptuphs version alfa 1.5x		2018 [2]	IPR granted [3]
3	Lfmhptuptuphs version alfa 2.0 (Fig. 3)		2018 [2]	no IPR until now
4	Robochop-α		2019	no IPR until now
5	Robochop-β		2019, this Paper	no IPR until now
6	Robochop-γ		in progress	no IPR until now

Figure 3. Robot lfmhptuptuphs version 2.0

III. Results and Analysis

In this section, it is explained the results of research and at the same time is given the comprehensive discussion. The results consists of electrical, mechanical, and informatics system.

3.1. Electrical system configuration

Electrical system configuration of the robot consists of embedded system (Arduino), sensor, motor driver, motor and its parts, free wheel, and some times comparator system is used.

3.2. Informatics system by using Arduino Board

Below, in Fig. 4 shown a program as a computer controlled-system based-on the C-Arduino from [4] as a basic controller of the Robochop-x movement and the preparation of them to the next of the Robochop-γ as well.

```
int sensor1=2;
int sensor2=3;

int sensor3=4;
int sensor4=5;

int sensorValue1;
int sensorValue2;
int sensorValue3;
int sensorValue4;

int sensValue1;
int sensValue2;
int sensValue3;
int sensValue4;
```

```
//motor one

int enA = 11;
int in1 = 9;
int in2 = 8;

// motor two
int enB =
10; int in3 =
7; int in4 =
6;

void setup() {

 pinMode(sensor1,INPUT);
 pinMode(sensor2,INPUT);
 pinMode(sensor3,INPUT);
 pinMode(sensor4,INPUT);
 pinMode(enA, OUTPUT);
 pinMode(enB, OUTPUT);
 pinMode(in1, OUTPUT);
 pinMode(in2, OUTPUT);
 pinMode(in3, OUTPUT);
 pinMode(in4, OUTPUT);
  Serial.begin(9600);
}
void mundur()

{
```

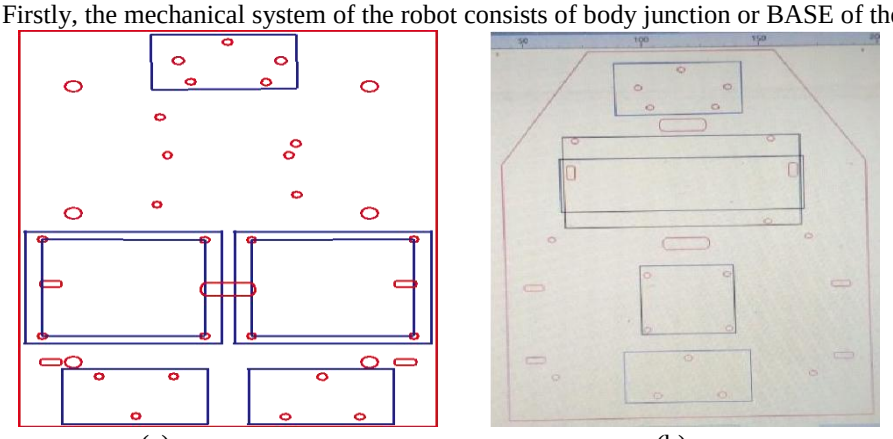
```
  Serial.println("Mundur");
  digitalWrite(in1, HIGH);
  digitalWrite(in2, LOW);
  analogWrite(enA, 150);
  digitalWrite(in3, HIGH);
  digitalWrite(in4, LOW);
  analogWrite(enB, 150);

  delay(250);

}

void maju()

{

   Serial.println("Maju");
  digitalWrite(in1, LOW);
  digitalWrite(in2, HIGH);
  digitalWrite(in3, LOW);
  digitalWrite(in4, HIGH);

  analogWrite(enA, 150);

  analogWrite(enB, 150);

  delay(250);

 }

void belokkanan()

{

  Serial.println("Belokkanan");
  digitalWrite(in1, LOW);
  digitalWrite(in2, HIGH);
  digitalWrite(in3, LOW);
  digitalWrite(in4, HIGH);
  analogWrite(enA, 150);
  analogWrite(enB, 25);
  delay(250);

 }

void berhenti()

{

  Serial.println("Berhenti");
  digitalWrite(in1, LOW);
  digitalWrite(in2, LOW);
  digitalWrite(in3, LOW);
  digitalWrite(in4, LOW);
  delay(250);

}
```

```
void loop() {

 Serial.println("-----------------");

 delay(250);

 sensorValue1=digitalRead(sensor1);
 sensorValue2=digitalRead(sensor2);
 sensorValue3=digitalRead(sensor3);
 sensorValue4=digitalRead(sensor4);
 Serial.println(sensorValue1);
 Serial.println(sensorValue2);
 Serial.println(sensorValue3);
 Serial.println(sensorValue4);

 //Komparasi [sensorValue berniai 1 artinya sensor SF4 mengenai GARIS HITAM, sebaliknya 0
 //berarti mengenai GARIS PUTIH]

 if ((sensorValue1==1) && (sensorValue2==1) && (sensorValue3==1) &&
 (sensorValue4==1)) {
  maju();

  delay(250);


 }

 else if ((sensorValue1==1) && (sensorValue2==1) && (sensorValue3==1) && (sensorValue4==1))

 {

  berhenti();

  delay(250);

 }

}
```

Figure 3. Computer program in C-Arduino for Robochop-x

3.3. Mechanical system of the line follower robot

Firstly, the mechanical system of the robot consists of body junction or BASE of the robot (Figure 4).



(a) (b)

Figure 4. (a). BASE of the robot LFMHPTUPTUPHS version 1.0 .. 2.0 and (b). BASE of the Robochop-α and Robochop-β

3.4. Robotics system Robochop-β

In figure 4 and 5 shown the real robotics system built in the research

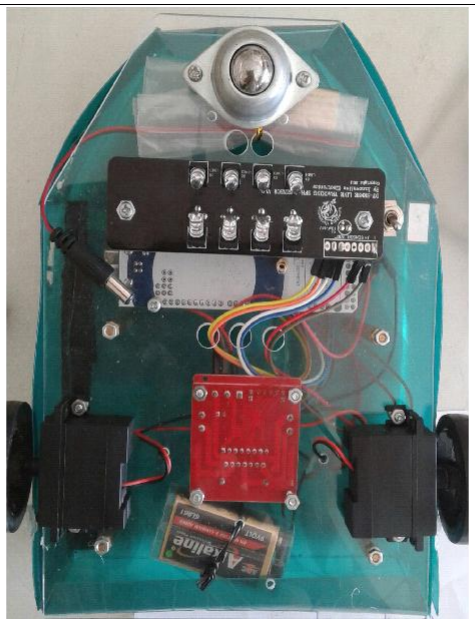


Figure 5. Robochop-β (bottom view)

IV. CONCLUSION

An effort to upcoming industry 4.0 paradigm was developed in the research. The research is still in the process to make the robots more precise especially on their speed and control system. The improvement will be made according to the aims for handling the movement effectively especially in the culinary shops. For further studies into the next near after this publication need to perform to improve the performance of the Robochop-β so that the speed of the left hand motor relatively the same as the speed of the motor in the right hand side.

REFERENCES

[1]. http://www.bekraf.go.id/berita/page/9/83-infografis-ringkasan-data-statistik-ekonomi-kreatif-indonesia
[2]. L. P. Purba, R. Magdalena, E. K. Julistiono, J. Wijaya, Laporan akhir tahun penelitian terapan unggulan perguruan tinggi robot line follower berbasis arduino untuk material handling industri kreatif, tahun ke 1 dari rencana 3 tahun (UPH Surabaya, November 2018).
[3]. L. P. Purba, R. Magdalena, E. K. Julistiono, J. Wijaya, Copyright of Intellectual Property Right Registered Number: 000136567 "Program Komputer Berbasis Arduino Uno R3 Untuk Mengendalikan Robot LFMHPTUPTUPHS Versi Alfa 1.5x." 2018.
[4] http://arduino.cc=