



Buana Information Tchnology and Computer Sciences (BIT and CS)

Changing Data Image Into Numeric Data on Kiln Manufacture Machinery Use Optical Character Recognition (OCR)

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Abstrak— Pada proses pembuatan genteng keramik terdapat proses pembakaran menggunakan mesin kiln manufacture atau oven. Untuk memastikan proses pembakaran berjalan dengan baik, dilakukan pemantauan 39 parameter yang ada pada mesin kiln tersebut yang harus di awasi secara manual berdasar data yang dihasilkan citra pada mesin kiln tersebut. Proses pemantauan parameter tersebut tidak efektif yang disebabkan oleh kesalahan atau kelalaian manusia dan sifat manusia lainnya yang mengakibatkan kerugian bagi perusahaan. Oleh karena itu, dibutuhkan sistem untuk menyimpan data parameter mesin pembakaran genteng keramik yang dapat disimpan kedalam sebuah data base. Setelah dilakukan analisis pada perangkat pembakaran (kiln) tersebut, recorder sensor yang menampilkan data parameter dapat diakses melalui jaringan LAN (Local Area Network), akan tetapi data yang dihasilkan dalam bentuk citra bukan dalam bentuk data digital alfanumerik. Data citra yang didapat perlu diterjemahkan menjadi data alfanumerik sebagai sumber data. Melalui pengenalan optical character recognition (OCR) dengan metode template matching, citra tersebut diubah menjadi data alfanumerik sehingga dapat di simpan dalam sebuah data base. Dari hasil penelitian ini, prototype sistem yang dibuat mendapatkan akurasi sebesar 100.00% untuk konversi data citra ke data alfanumerik,

Kata kunci: Citra Digital, Data Numerik Optical Character Recognition, Kiln Manufacture.

Abstract— In the process of making ceramic tiles, there is a combustion process using a kiln manufacture or oven. To ensure the combustion process goes well, 39 parameters are monitored on the kiln engine which must be monitored manually based on the data generated by the image on the kiln engine. The process of monitoring these parameters is ineffective due to human error or negligence and other human traits that result in losses for the company. Therefore, a system is needed to store the parameter data of the ceramic tile combustion engine which can be stored in a database. After analyzing the kiln, the sensor recorder that displays parameter data can be accessed via a LAN (Local Area Network), but the data generated is in the form of an image, not in the form of alphanumeric digital data. The image data obtained need to be translated into alphanumeric data as a data source. Through the introduction of optical character recognition (OCR) with the template matching method, the image is converted into alphanumeric data so that it can be stored in a database. From the results of this study, the prototype system made obtained an accuracy of 100.00% for the conversion of image data to alphanumeric data,

Keywords: Digital Image, Optical Character Recognition Numerical Data, Kiln Manufacture.

I. INTRODUCTION

PT. XYZ is a leading manufacturer of glazed ceramic tile (and its accessories). One of the manufacturing processes for these products is the combustion process at a temperature of 1100 degrees Celsius using a kiln manufacture machine or oven so that it can produce quality and durable ceramic tiles. In the process of burning ceramic tile products, direct monitoring is carried out by employees for 24 hours by observing 39 data parameters displayed through images on the monitor on the kiln engine panel.

In the process of monitoring the kiln manufacture (oven) machine, the sensor data will be displayed in the form of an image that appears on a screen that will be updated every 5 seconds which must be monitored during the process. The image displayed on the oven screen will then be recorded manually and really must be monitored directly. However, human endurance and physical condition greatly affect the results of the monitoring. Based on the initial analysis of the problem, it can be concluded that the kiln manufacture (oven) machine only displays 39 parameter data on a screen in the form of an image that will be updated every 5 seconds, the data is stored on a small capacity record machine and cannot be accessed by data. To overcome this problem, it would be possible to create a system or tool that can convert the image into alphanumeric data that can provide real-time information (monitoring automation).

Technological developments are increasingly developing more advanced than before, as well as image processing technology or digital images. Image processing is a method of processing images (images / images) into digital form for certain purposes. One of the digital image processing studies is Optical Character Recognition (OCR) which is a character recognition process through preprocessing, segmentation, feature extraction and recognition, Optical Character Recognition (OCR) is one of the study areas of pattern recognition (pattern recognition) in digital images that classifying or describing an object based on quantitative measurements of its main features or properties. With this method is expected to provide a solution to PT. XYZ in overcoming the problems that exist in the kiln manufacture (oven) machine.



The image can be accessed via a Local Area Network (LAN) and through the introduction of optical character recognition (OCR) the image can be converted into data in alphanumeric form as needed and can be stored into a system that can process the data and it is hoped that the application can provide information automatically, quickly and precisely to the user or user.

II. METHOD

2.1 . Study of Literature

a. Image Processing

Image processing is the process of processing pixels in a digital image for a specific purpose. Initially, image processing was carried out to improve image quality, but with the development of the computing world, which is marked by the increasing capacity and speed of computer processing and the emergence of computational sciences that allow humans to retrieve information from an image[3]. The image processing process is a diagrammatic process starting from image retrieval, image quality improvement, up to a representative statement of the imaged image can be seen in the figure 1.



Figure 1 Diagram of the digital image processing process.

b. Optical Character Recognition (OCR)

OCR takes care of the problem of recognizing optically processed characters. Optical recognition is done offline as well as online. Offline after writing or printing is complete whereas online recognition is done where the computer recognizes the characters as they are drawn. Printed and/or handwritten characters are recognizable but the results directly depend on the quality of the input document. The more limited the input, the better the performance of the OCR system. But when it comes to the completely unrestricted handwriting performance of the OCR engine it is Figure 2.3 questionable. shows a schematic representation of the various character recognition areas [2].

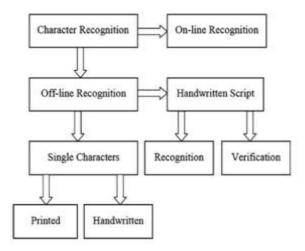


Figure 2 Schematic of Optical Character Recognition (OCR.) Area)

c. Template Matching Correlation

Template matching is a technique in digital image processing that has a function to match each part of an image with the image that becomes the template/reference [4]. This is done by comparing the input image with the template image in the database, then looking for similarities using a certain rule. The image matching process that produces a high level of similarity / similarity determines that an image is recognized as one of the template images.

d. Kiln Manufacture

Furnace or also often referred to as a combustion furnace is a device used for heating. The name comes from the Latin Fornax, oven. Sometimes people also call it a kiln. A kiln is a tool or installation designed as a place of combustion using certain fuels that can be used to heat something [1]. The furnace is simple, composed of stones arranged so that the fuel is protected and heat can be directed. In manufacturing companies, the furnace is made in such a way that the fire or heat that is formed is not too dangerous for the user.

Klin At PT XYZ, the kiln used is a Single Layer Tunnel Kiln which consists of 6 combustion zones, namely sub dryer, pre heating, firing, rapid cooling and cooling, with asbestos insulation and using LNG (Liquid Natural Gas) as fuel. The fuel will produce heat energy for the ceramic tile burning process. The heat that has been used in the firing section is not completely removed. Most of it will be reused to flow to the dryer and sub dryer. But there is also some heat energy that is wasted because it contains carbon which can affect the results of tile products.



2.2 Research Method

This research is applied research to identify character in image in kiln machine by using Optical Character Recognition (OCR) method. Based on the identification of problems obtained in the field observation process, literature study and interviews, namely during the combustion process in the kiln engine, so an application system was created to convert image data into alphanumeric data, using the Optical Character Recognition (OCR) method based on template matching, which then results the conversion can be saved into a database. The research method can be seen in Figure 3.

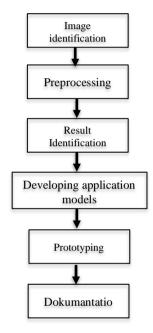


Figure 3 Research Flowchart Block

2.3 Prototype Architectural Design

Figure 4 depicts the prototype architecture for monitoring the parameters of the ceramic tile combustion engine (kiln manufacture) for intensive monitoring of the engine.

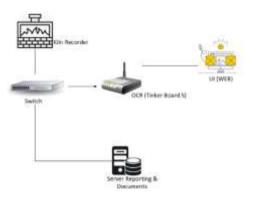


Figure 4 Prototype Architecture

The prototype of this OCR data processing application was made by following the steps shown in Figure 5 below:

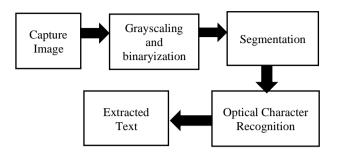


Figure 5. System Workflow

2.4 Test Design

The result of the trial on the application is the result parameter in the conversion of image data into alphanumeric data using OCR. The resulting parameters will be used as a basis for predicting the value that will come out. In order to know how accurate, the prediction will be, before the parameter is formed, the parameter is first evaluated and validated by using a confusion matrix calculation consisting of Accuracy, Precision and Recal [5]. The confusion matrix table can be seen in table 1.

Tabel 1 Tabel Confusion Matrix

		True Value						
		TRUE	FALSE					
		TP	FP					
	TRUE	(True Positive)	(False Positive)					
Predicted		Corect Result	Unexpected Result					
Value		FN	TN					
	FALSE	(False Negative)	(True Negative)					
		Missing Result	Corect Absence Of Result					

So, the Precision, Recall and Accuracy formulas can be seen in formulas 1, 2 and 3.

$$Precision = \frac{TP}{TP + FP}$$

$$Recall = \frac{TP}{TP + FN}$$

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$
 3



III. RESULTS AND DISCUSSION

3.1 Preparation of Training Data and Test Data

In this study, as many as 100 image data taken from the kiln machine in .png format which will later be prepared for training data and test data which is the result of web capture which will later be converted into alphanumeric data. The figure contains parameters that must be monitored intensively for 24 hours. These parameters contain the temperature, gas pressure and air humidity which are read by sensors in certain parts along the ceramic tile combustion engine. At this writing, 10 of the 39 parameters were taken as samples for testing the conversion of images to alphanumeric data using OCR based on template matching. In detail can be seen in figure 6 table 2 below.

OVERVIEW 2821/87/84 15:12:13	DISP .	2hour	0 ∰
86.4 °C	TR7 No5 Firina Zone 1128.1 °C	TR16 Under Car 154.7 °C	11-3 No.3 Zone Se abstrature 43.1 °C
TR2 Preheating Zone 488-8 °C	1111.8 °C	TR17 Sub Driver 47.3 °C	specialist Case Se. 35.8 °C
TR3 Not Firing Zone 385.3 °C	g felat 988.3 °C	TRIS Exhaust Fan 168-1 °C	Marrature 43.9 °C
ntroller 514.8 °C	THE Report Could be a Joseph 627.6 °C	TR19 Vaste Heat 191.4 °C	noerature 74.7 °C
TR4 No2 Firing Zone 438.3 °C	TRIB Cool inc 250 o Driet 571.3 °C	TAPE 34.9 °C	11-7 No7 Zime Se wordfurd 91 .6 °C
ntroller 551.3 °C	TRI1 Coling Zone 528.4 °C	TR21 Gas Pressure 2.28 kg/cm2	3" nau0+
TR5 No3 Firing Zone 788.1 °C	TR12 Coolins Zone 467.3 °C	Gas Flow Meter 118.23 m3/h	HI-I Not -2 are No mid to 38.16 \$
ntruller 752.8 °C	TR13 Cooling Zone 258.8 °C	Kiln Car Hydraulio 8.34 kg/cm2	42.36 I
TR6 No4 Firing Zone 1882.2 °C	1914 Laft Side 1 c 519 588.4 °C	11-1 No. 2000 To specialized 48.1 °C	HI-7 Red Zano Au mid-fis 38.34 I
Atrillier 1845. 8 °C	TRIS River Side 5: 718 565-8 °C	11-0 Not done To seemahare 48.4 °C	

Figure 6 Capture images of the kiln machine.

Tabel 2 Description Sample parameters for the OCR conversion process.

		Description
NO	Parameter	-
1	TR1	Preheating Zone, which is the initial zone or area for the product to be heated before being burned in the next zone. The unit used is degrees Celsius (°C).
2	TR3	Is firing zone No.1 compaction process (pressure) at high temperatures so that changes in microstructure occur. In this parameter the unit used is degrees Celsius (°C).
3	TC2	It is a thermocontroller parameter no2 to measure the temperature in the combustion process in the zone before firing zone no 3. The unit used is degrees Celsius (°C).
4	TC3	In this zone, thermocontroller parameter no 3 is used to measure the temperature in the combustion

		process in the zone before firing
		zone no 4. The unit used is
		degrees Celsius (°C).
		Is the zone after passing through
		the cooling zone no. 3 or to lower
5	TR14	the temperature before entering
	11(14	the sub dryer. The unit used is
		degrees Celsius (°C).
		It is a drying area (sub dryer) after
		cooling the product. The
6	TR17	parameter unit used is degrees
		Celsius (°C).
		Is a parameter to see the hydraulic
		pressure (hydraulic kiln car) in
7	КСН	running the conveyor while the
/		machine is running. The unit used
		is kg/cm ²
		Is the area to measure the
		temperature of the product no. 3
	TI3	(zone temperature) before the
8		product comes out of the machine
0		after the drying process. The
		parameter unit used is degrees
		Celsius (°C).
		Is an area to measure the product
		temperature no. 7 (zone
		temperature) before the product
9	TI7	comes out of the machine after
		the drying process. The parameter
		unit used is degrees Celsius (°C).
		Is a sensor to measure the
		humidity of the air in the kiln
10	HI3	machine in zone no 3 (Zone
		· ·
		humidity)

3.2 Modelling

Making a model or prototype at this writing, the author makes a prototype which is divided into 3 parts, the first for processing OCR data using thinker board from Asus, the second dummy or imitation to display the image of the kiln machine using Oracle VM VirtualBox, and the third prototype for the application server. The OCR uses Oracle VM VirtualBox to represent it as a documentation server.

3.3 Character Recognition

The OCR system was created using the Tesseract OCR software which was run on python 3.7 for OCR recognition from converted and segmented binary images. Tesseract OCR will recognize each character from the segmentation results in the image after previously training the character template. The process of recognizing the character of the kiln machine image on the template uses four parameters when initialized, namely data path, language, mode, and white list [6] so that to obtain accurate detection results, a template is created as a path source as shown in Table 4.3. below this:



Table 3 Implementation of the Tesseract OCR Template

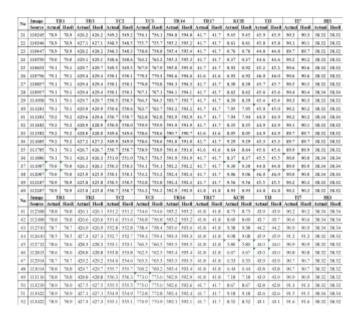
No	Citra Hasil Segmentasi	Template	Karakter
1	0	Ø	0
2	1	1	1
3	2	2 3	2
4	3	თ	3
5	4	4	4
6	5	<u>4</u> 5 6	5
7	6	60	6
8		7	7
9	8	80	8
10	9	9	9
11		-	•

3.4 OCR Application Research Results

The results of the research on the prototype model of data conversion using OCR on the kiln machine PT. XYZ can be seen from table 4 for Type A tile products and table 5 for MAROON 1000918 products below:

Tabel 4 OCR conversion result for Type A tile products

No.	Emage	e THI		TRS		TC2		TCS		TR14		TRAT		RXTH		TD		337		285	
200	Searce	Actual	Hedl	Actual	Hard	Actual	Herit	Actes	Hedi	Actual	Harit	Actual	Hed	Actual	Hedl	Actual	Hack	Actual	Hedi	Actual	Harif
1.	194123	78.3	78.2	429.1	429.1	547.9	947.9	755.8	753.8	595.5	593.5	41.6	41.6	9.53	9.52	44.7	44.7	89.3	89.3	38.32	38.32
1	104323	78.3	78.3	430.2	430.2	548.3	345.3	257.5	757.5	595.6	593.6	41.6	41.6	8.36	0.36	45.3	45.3	89.6	89.6	39.32	38.32
3	104423	78.5	78.5	430.2	430.2	550.3	259.3	363.9	763.9	595.4	593.4	41.5	41.5	8.18	6.18	45.7	45.7	89.7	89.7	38.38	34.30
4	104536	78.5	78.5	428.9	428.5	350.0	258.0	503.2	269.3	585.4	595.4	41.5	41.5	1.55	8.55	44.8	44.8	89.4	89.4	28.12	38.32
3	104628	78.6	78.6	427.9	427.8	351.0	350.4	779.0	770.0	565.6	262.6	41.5	41.5	9.02	9.02	43.9	43.9	89.1	89.5	29.24	39.31
6	104729	TS.T	18.1	427.2	421.2	251.4	270.4	208.4	209.4	393.7	393.7	41.4	41.4	5.24	9.34	44.1	44.1	89.3	29.3	38.12	38.32
7	194823	T8.8	78.8	437.0	427.8	250.9	359.9	268.5	768.3	393.4	590.4	41.4	41.4	0.50	8.51	43.7	43.7	89.4	89.4	38.32	38.32
8	194929	79.0	79.8	436.8	426.8	350.6	259.6	266.1	766.3	595.5	593.5	41.4	41.4	5.00	9.00	44.5	44.5	89.T	89.7	39.32	38.32
9	109031	79.1	79.1	436.3	426.3	550.0	259.0	763.6	763.8	595.4	593.4	41.5	41.5	5.6T	9.67	44.7	44.7	90.0	90.8	34.32	38.32
10	105133	19.1	79.1	425.9	425.5	548.0	548.0	362.1	202.1	585.2	585.2	41.5	41.5	5.13	9.13	44.8	44.0	90.2	90.2	98.92	38.32
11.	100134	19.2	79.2	425.7	425.7	518.0	548.0	50.3	261.3	585.5	585.5	41.5	41.5	5.00	9.08	44.9	46.9	90.5	90.5	38.32	38.32
12	103134	19.2	79.2	425.6	423.6	347.8	347.8	361.2	201.2	596.5	596.5	41.5	41.5	1.56	3.56	44.5	44.5	90.4	90.4	19.12	18.12
11	100433	79.1	79.0	423.6	422.6	247.6	247.6	229.8	729.8	397.3	397.0	41.5	41.2	1.83	8.82	44.6	44.6	BBT	89.7	38.12	38.32
34	100308	79.3	79.2	425.6	423.6	347.5	947.5	736.3	796.3	397.4	897.4	41.5	41.2	9.10	9.10	43.9	43.9	89.3	89.3	38.32	38.32
15	105630	79.3	79.3	425.7	425.7	341.2	547.2	755.0	735.0	597.3	591.3	41.4	41.4	5.11	9.11	44.3	44.3	89.7	89.7	38.32	38.32
16	100799	19.2	79.3	425.8	423.8	547.0	547.0	257.4	227.4	597.8	591.0	41.5	41.5	5.60	9.68	44.3	44.3	89.8	89.8	38.32	38.32
17	100109	19.1	79.1	425.8	425.8	548.1	548.1	252.4	227.4	586.9	596.9	41.6	41.6	8.0T	8.07	44.5	44.5	90.0	90.8	28.32	38.32
18	100941	19.2	79.2	426.8	426.8	508.0	548.0	220.4	722.4	596.8	596.0	40.7	41.7	1.00	8.68	44.6	44.6	90.1	90.1	28.12	18.12
19	118084	79.1	79.1	426.2	426.2	508.6	548.6	220.4	222.4	596.8	596.0	41.7	41.7	1.06	8.46	45.2	45.2	90.4	90.4	18.12	18.12
30	110147	79.1	79.1	436.1	426.1	349.3	343.1	115.2	235.2	191.2	383.2	41.7	41.7	9.50	9.55	45.8	45.8	90.3	90.3	18.12	38.12



Tabel 6 OCR conversion result for product MAROON100918

	Emage	TI		13	D.E.		C2	Ti	C5	19	14	TR	107	80	78	T	11.	71	7		85
Ne	Segre	Actual		Actual		Actual		Actes		Actual		Actual		Actual		Actual		Actual	Hed		Hari
1	093345	77.3	77.0	435.4	426.4	347.1	947.1	754.3	734.3	599.4	599.4	41.3	4L3	5.79	5.79	42.4	42.4	87,T	87.7	34.24	
2	093447	77.4	77.4	427.8	427.8	54T.6	547.8	756.3	796.3	599.3	559.3	41.3	41.3	8.63	0.63	42.4	42.4	87,6	87.6	34.29	38.26
1	091548	77.4	77.4	435.8	420.8	448.6	148.0	758.6	758.6	190.7	499.2	41.4	41.4	0.33	0.35	42.3	42.3	87.9	87.5	38.26	38.16
4	09568	T2.T	77.7	429.7	429.7	150.1	258.1	562.4	301.4	599.8	589.0	41.4	41.4	8.44	0.44	42.8	42.0	97.9	17.5	28.18	28.18
3	0907gs	77.8	77.8	429.7	429.7	151.0	350.0	365.6	265.6	598.4	598.4	41.3	41.3	1.60	3.49	44.0	44.4	98.2	88.2	10.16	38.26
							-			_					9.57			-		-	-
6	093851	17.9	77.5	429.3	429.3	256.8	376.8	766.7	766.2	198.1	398.1	41.4	41.4	9.57		44.2	44.7	88.4	88.4	38.28	38.28
7	089991	T8.0	78.8	438.8	428.8	150.5	358.3	765.4	765.4	597.5	891.9	41.4	41.4	9.50	9.50	43.5	43.5	88.4	88.4	38.74	38.36
8	190003	T8.0	78.8	438.8	428.8	549.2	345.2	263.1	763.3	597.5	591.5	41.4	41.4	9.50	9.52	42.8	42.8	88.2	88.2	34.24	38.28
9	300153	78.0	76.9	436.5	426.5	548.2	348.2	261.5	761.2	596.5	596.9	41.4	41.4	1.10	6.69	41.7	41.7	85.1	86.1	38.28	38.16
10	100154	19.2	79.2	429.2	429.2	541.9	547.9	350.9	729.9	586.2	586.2	41.4	41.4	5.49	9.45	42.8	42.0	99.0	90.8	28.28	38.18
11	100155	78.5	78.3	427.7	427.7	587.2	547.2	758.9	738.3	585.6	585.6	41.4	41.4	1.69	2.49	41.7	41.7	99.3	89.3	29.19	38.18
12	100453	TR.2	78.2	427.2	421.2	306.7	346.7	232.1	297.1	594.7	594.7	41.5	41.5	1.49	2.49	42.4	42.4	88.1	88.5	39.18	38.28
11	100353	T8.3	78.3	426.9	426.9	346.1	348.1	236.3	736.3	595.2	393.2	41.5	41.2	1.99	8.99	43.6	43.6	88.4	88.4	38.28	38.28
34	198657	T8.3	78.2	436.3	426.3	3461	346.1	282.1	297.3	595.0	593.8	41.5	41.2	3,21	2.77	43.1	43.1	88.T	88.7	34.24	38.38
15	100000	78.1	70.1	425.9	425.5	347.2	547.2	756.3	756.3	595.9	593.8	41.5	41.5	8.67	0.67	42.6	42.0	80.0	90.9	38.29	38.28
36	100901	79.1	70.1	425.9	425.5	547.0	547.0	156.3	756.3	595.8	593.8	41.6	41.6	5.69	9.68	43.0	43.0	89.1	89.1	28.28	38.38
17	101001	79.0	79.8	436.4	456.4	548.5	548.5	257.1	227.1	585.6	583.6	41.6	41.6	5.85	9.95	40.1	49.1	99.6	99.6	28.28	38.38
18	101181	78.0	79.8	436.2	426.2	549.2	549.2	229.1	229.1	585.6	583.6	41.6	41.6	9.95	9.95	42.8	42.0	99.3	89.3	28.18	38.18
19	101181	TR.0	78.8	425.6	421.6	349.6	548.6	220.9	229.9	595.0	593.0	41.6	41.6	9.43	9.43	43.0	43.0	88.3	88.3	28.28	18.10
20	101181	77.8	77.8	423.3	423.1	249.1	343.1	724.4	796.4	196.0	200.0	41.6	41.6	1.07	2.33	42.4	42.4	88.1	88.1	13.19	18.10
Ne	Emage	TI	u	13	8.5	T	C2	T	C5	19	14	TR	107	100	78	T	D.	T	P .		85
500	Segre	Actual	Hedl	Actual	Hard	Actual	Herit	Actes	Hedi	Actual	Harit	Actual	Hed	Actual	Hed	Actual	Harl	Actual	Hedl	Actual	Harit
21.	393483	17.8	77.8	425.4	423.4	548.4	348.4	736.5	736.3	595.5	593.9	41.6	41.6	10.68	11.68	43.1	43.1	88.4	88.4	38.38	38.39
32	101503	17.8	77.8	425.6	425.6	548.7	544.7	754.0	758.0	595.7	593.7	41.7	41.7	18:21	18.23	45.7	43.7	88.5	86.5	38.29	38.16
23	10360	77.7	77.7	435.1	426.1	548.4	348.4	257.0	757.3	595.5	593.9	41.6	41.6	5.09	9.09	43.7	43.7	88.6	90.6	38.38	38.38
26	101793	77.7	77.7	427.5	421.5	548.5	548.5	156.0	756.0	596.3	596.2	41.6	41.6	1.45	8.45	44.0	44.0	89.3	89.3	28.29	28.29
25	101181	T7.T	77.7	429.2	429.2	549.9	548.9	222.6	227.6	596.2	596.2	41.7	41.7	8.80	0.88	43.6	43.6	89.4	29.4	29.19	32.33
36	103794	17.8	77.8	430.9	430.9	253.4	339.4	761.0	201.0	196.3	296.3	41.6	41.6	1.39	0.39	43.0	43.0	89.2	89.2	38.38	38.33
37	193006	T8.0	78.8	403.1	433.1	352.5	330.5	265.3	265.3	596.3	596.3	41.6	41.6	1.29	0.29	42.6	42.6	89.0	89.8	38.28	38.38
38	102197	T8.0	78.8	433.2	433.2	550.3	353.3	268.7	769.T	596.0	596.0	41.6	41.6	10.06	18.06	42.7	42.7	89.0	89.8	34.24	38.38
29	102297	78.1	78.1	431.T	431.7	552.7	950.7	772.6	712.6	595.6	593.6	41.5	41.5	5.13	9.13	42.4	42.4	88.9	85.5	34.24	38.26
30	102107	79.1	79.1	401.1	401.1	151.0	153.9	773.9	271.3	595.4	585.4	41.5	41.5	9.40	9.45	42.9	42.9	89.1	89.1	28.28	28.28
31	103410	79.1	79.2	430.8	430.8	151.9	151.9	563.7	262.7	595.4	585.4	41.5	41.5	9.01	9.00	43.8	42.9	99.4	89.4	28.28	28.28
32	102512	TR.2	78.7	430.4	430.4	351.0	350.4	367.5	242.5	595.0	591.0	41.4	41.4	1.00	2.22	44.1	44.1	89.T	89.7	28.28	28.28
311	103403	78.7	78.7	430.2	430.2	252.0	330.4	202.5	202.2	194.6	204.6	41.4	41.4	1.70	8.10	44.9	44.9	22.5	20.5	12.12	18.10
36	102703	TS.1	78.1	429.7	429.7	251.5	334.5	262.1	262.1	194.0	194.0	41.4	41.4	10.00	18.16	44.7	44.7	27.2	20.0	13.19	18.19
15	103803	79.3	70.3	429.1	429.1	253.0	251.0	168.3	765.3	593.2	583.2	41.4	41.4	10.42	18.42	43.6	43.6	89.3	89.3	28,28	14.11
36	102903	79.3	70.3	429.4	409.4	350.0	258.0	164.9	268.9	593.2	500.1	41.4	41.4	5.04	9.04	40.0	43.0	90.9	80.5	28.26	38.30
32	103004	19.3	79.3	429.8	409.8	350.0	358.0	364.0	764.0	599.8	583.0	41.4	41.4	8.95	8.95	42.8	42.0	89.1	89.1	28.28	28.30
39	103114	79.3	79.3	427.5	4015	151.0	950.0	503.0	261.9	594.2	594.2	41.4	41.4	9.00	9.99	42.9	42.9	99.2	89.2	28.26	28.30
39	103114	19.3	78.2	427.3	427.3	351.4	350.1	758.2	798.2	594.4	394.0	41.4	41.4	9.42	9.42	44.0	44.0	89.6	89.5	28.28	38.30
40	103317	78.1	78.1	426.9	426.9	351.0	350.4	797.4	2924	194.1	794.1	41.4	41.4	9.26	9.18	44.5	44.5	27.6	F2.4	19.12	38.32
-	******	18.1		436.9 TI		350.2		292.4 Tr		394.3		41.4 TH		9.26			13	29.6 T	20.6		98.32
No	Source	Actual	Haell	Actual	Hasil	Actual	Havit	Actual	_	Actual	Havil	Actual	Havit	Actual	Hasil	Actual		Actual	Haelt	Actual	
41	103417		78.0	426.3	426.3	550.6	250.8	758.2	758.3	594.2	594.2	41.3	41.3	9.33	9.35	44.2	44.2	89.7	89.7	38.32	-
42	103517	78.0	78.0	425.6	425.6	549.6	548.6	756.8	796.8	594.4	594.4	41.3	41.3	5.00	9.00	44.7	44.7	90.1	90.1	38.30	-
43	103618	78.0	78.0	425.2	425.2	548.2	548.2	753.5	753.5	594.7	594.7	41.3	41.3	9.16	9.16	44.6	44.8	90.1	90.1	38.32	34.32
44	103720	78.0	78.0	425.T	425.7	547.9	547.9	251.4	751.4	594.7	594.7	41.4	41.4	9.52	9.52	44.5	44.5	89.1	P2.1	98.90	38.30
45	103921	78.0	78.0	436.3	436.3	548.0	548.0	252.9	752.8	594.7	594.7	41.4	41.4	9.26	9.26	44.2	44.2	98.4	88.4	38.37	36.32
46	103921	77.9	77.9	426.3	426.3	548.1	548.1	752.0	792.0	594.5	594.8	41.4	41.4	5.99	8.00	40.1	49.1	98.1	88.2	36.32	38.32
47	104021	17.9	77.9	426.9	426.9		506.8	250.0	_	595.3	595.3		41.5	9.34	9.34	40.4	43.4	98.7	88.7	16.12	
48	104122		78.0	_		-	_	290.T	-			41.6	41.6	0.04	0.54	44.1	44.1	99.1	P9.1	-	
46	194123	18.0	38.0	438.0	436.8	546.8	546.8	756.7	221.7	595.3	595.5	41.6	41.6	8.94	9.54	44.1	44.1	89.5	893	58.50	38.32

3.5 OCR Implementation Test Results

The test results of the OCR conversion prototype model on the kiln machine that have been made using 11 training data as in table 4.2 and 100 test data containing 1000 parameters which are divided into two types of tasks / products can be seen in table 4.4 as many as 520 parameters for type A tile products and in table 4.5 there are 480 parameters for the maroon 100918 tile product.



The results of testing the application of OCR can be seen in table 7 below.

Table 7 Confusion Matrix Test Results

		Resu	ılt Class		
		current	Result		
Class	current	520	0		
current	Result	0	480		

From table 5 and table 6 above, both the parameters of the Type A roof tiles and Maroon100918 products obtained accurate conversion results and it is certain that there are no inappropriate parameters. From table 7, the following accuracy is obtained:

Accuracy
$$= \frac{TP + TN}{TP + TN + FP + FN}$$

$$= \frac{520 + 480}{520 + 480 + 0 + 0}$$

$$= \frac{1000}{1000}$$

$$= 1 \times 100\%$$

$$= 100 \%$$

Based on the results of these calculations, the accuracy of 100.0% is obtained.

IV.CONCLUSION

Based on the discussion of the results of the research and testing of the research above, it can be concluded that the application model for converting images to numerical data using the Optical character recognition (OCR) method based on template matching obtained an accuracy of 100.00%.

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