

DIGITAL TECHNIQUE BASIC LEARNING MEDIA FOR INDUSTRY ELECTRICAL ENGINEERING ON SMK GUNA DHARMA NUSANTARA

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ABSTRAK

On Guna Dharma Nusantara Vocational Senior High School has obtained Industry Electrical Engineering having Digital Technique Basic subject for its student. Based on student achievement for this subject has known that there is still about 60% student performance grades in below Minimum Completeness criterion grade. The obstacles have faced by student in this subject learning that is substances delivering. Teacher had been difficulty to give illustration for some substances such as logic gate and flip-flop combine technique. Beside it, the device restrictiveness for the practicum implementation caused student has not been able to try using Digital Trainer device. From above problem, it was offering solution such as to develop Digital Technique Basic learning media with purpose to help both student and teacher. Method research has used for a research that is descriptive method, while software-developing method that is MDLC (Multimedia Development Life Cycle) method. It is based on research has been carried out for 39 students, 85% very agreed that digital technique basic learning media application help student to understand both substance and simulation. It has shown from hypothesis testing explanation that there is significant difference for examination result achievement by used this learning media
Kata kunci : Media Pembelajaran, Teknik Elektro Industri, Teknik Digital, Digital Trainer.

Keywords: Learning Media, Industrial Electrical Engineering, Digital Engineering, Digital Trainer.

1. INTRODUCTION

1.1 Background

Vocational secondary school (SMK) to Guna Dharma Nusantara which is located at Jl. Raya Km. 30 Bypass Cipeutag Kec.Cicalengka Kab.Bandung is a vocational school that was founded in 2007. The school has three programs, namely: pharmaceutical, computer network Engineering, and electrical engineering industries. One of the subjects given to

the Department of Electrical Engineering Industry is the Foundation of digital techniques.

Based on the results of the interview with Mr. Tata Risdian St., m. Pd. as teachers of the basic engineering subjects, the learning process consists of a discussion of the material and practical. Discussion of the material is done by using the module and package for the implementation of practical work, students practice logic gates using a tool such as a digital practice trainer. Based on the results of the achievement of pupils for subjects of the basic techniques of digital note that not all of the 39 students understand the basic techniques of digital material one logic gate, it can be seen from the results of the assessment and the assessment of midterm the end of the semester, that the results of the midterm assessment of the 19 students were still under the below Minimum Completeness criterion grade and the results of the assessment of the end of the semester 25 students were still under the below Minimum Completeness criterion grade. Based on a detailed questionnaire committed against students of class X is obtained that 60% of the 39 students stated that they have yet to fully understand the basic techniques of digital material, one of the reasons is the lack of illustrations when the learning process.

In addition to the study done processed also carried out practical for basic digital engineering subjects. In practical work, students have difficulty to practice the use of the practice, because of lack of practical tools so that students can't participate try directly practical when the teacher explains the use of digital tools trainer.

Some research has been conducted for the manufacture of a medium of instruction to help students understand the material. For example, i.e. research conducted by Eco prastyo and Nurhayati [1] making learning media to help to learn the Program Logic Control, providing illustrations and description of material and manufacture simulation of wire diagram. Based on the results of such research, an increase in student learning results after using the medium of instruction. This is proven by thitung < tabel where thitung of 16.24 and ttabel-1.68, the overall results of the now student response on learning with media results rating 84.49% getting

a positive response from the majority of the students. In addition, there is also a research for basic electronics subjects conducted by Joseph tadjiri [2] with the basic electronics learning media become a tool that can be used to help the learning process of students in learning calculate the value of electronic components.

Based on problems already described earlier then the solution can be used to overcome this problem is by using a computer-assisted learning media instructional (CAI). By applying the learning medium then expected students study program electrical engineering industry can have a clearer picture of the basic theory of digital techniques and practical basis of digital techniques.

1.2 Research Methods

Research methodology is a process used to solve a problem that requires logical data to support the implementation of a research. The methods used in the writing of this thesis is a descriptive method [3]. This method is used because the research done with surveying and attempted to describe a symptom, the events and the events that occurred in a place that is being examined, namely SMK To Guna Dharma Nusantara search based on facts with interpretation as well as get the meaning and implications of an issue that will be figured out. This research method has two stages, namely data collection phases and stages of development of the software.

1.3 Methods Of Data Collection

Method of data collection used in the construction of the multimedia application is as follows:

1. literature Study
2. The interview
3. The questionnaire
4. Observations

1.4 A Method Of Software Development

The method development of the software used, namely Multimedia Development Life Cycle. This method has 6 stages [4], covering some of the processes include:

1. Concept

On the stage of the concept, that is the intent of this research was done to build a basic engineering study digital media for industrial electrical engineering majors in SMK Guna Dharma Nusantara.

2. Design

At the stage of design, media of learning that will be built is Android based. Modeling of this design using modeling Unifed Modeling Language (UML). And the language used is C # programming. As well as doing the making of storyboards to make the display of the media learning that will be built.

3. Material Collecting

At the stage of collecting material that is doing the creation and collection of materials in the form of the material base of digital techniques, digital image equipment trainer and cable jumper, characters, audio, text, logos, navigation buttons, the material question of the evaluation of the assets and will relate to the construction of the basic techniques of digital learning media.

4. Assembly

At this stage of assembly (manufacturing) is a stage where all the multimedia material or object is created. Making digital media learning basic technique is based on the stage of design. So at this stage of assembly and the interrelated design and designing initial and final results should match.

5. Testing

At this stage of testing is the testing stage of learning the basic techniques of digital media is done after finishing the stage of manufacture, assembly or manufacture and all the supporting data have been incorporated with the running applications/program dan views If there is an error or not. Testing done for modular does functionality already walk as expected or not.

6. Distribution

At the stage of basic learning, media is distribution techniques digital distributed and stored on storage media such as hard drive. Learning media is used and maintained to specific interests.

2. RESEARCH CONTENTS

2.1 Problem Analysis

Based on the analysis of a problem that has been done, found some problems in the process of learning, namely:

1. In learning yet there is an overview and illustrations when discussion of the material.
2. In the practical work of students experiencing difficulties due to the limitations of digital tools traner, students can't participate try as soon as the teacher explains how to use the tools of practice.
3. Yet the existence of a learning tool in learning the basic techniques of digital.
4. The number of computers in all schools Facilities are still limited to students, does not allow for media-based learning web or desktop because the computer does not match the number of students, from the results of the questionnaire.

2.2 Analysis of the application of learning are built

The application of learning will be built based on this android for the basic engineering subjects contains digital material contained on digital engineering books and curriculum materials used in SMK Guna Dharma Nusantara. This

application is indicated for class X students majoring in the electrical engineering industry, to assist students in understanding the basics of digital techniques with a material that has illustrations and description on each material and discussion of how digital installation simulation trainer for logic gates. The application of learning will be built has a few menu i.e. main menu, menu, menus, and menu simulation evaluation.

2.3 Material Analysis

Analysis of material on learning with media case study basic subjects employed digital in SMK Guna Dharma Nusantara will be described on the basis of the respective material pertaining to.

Tabel 1.1 Material Analysis

No	Material	Competence Basic	Indicator The achievement of the	Activity Learning
1	Number System	-Introduction of number systems - Converts decimal numbers to binary numbers and binaries to decimals - Convert decimal numbers to octal and vice versa	-Understand about the number system -Can convert decimal numbers to binary numbers, decimal numbers to octal & vice versa	-Learn how to convert decimal numbers to binary -Learn how to convert decimal numbers to octal
2	Code System	4-bit BCD and BCD codes -3 Excess Code -Gray code	-Students understand the code system in binary numbers -Can calculate 4-bit BCD and BCD codes	-Learn to count from the number system to the BCD code -Learn to calculate 4bit BCD
3	Logic gates	- Gate of basic logic: AND, OR, NOT - Gate logic: NAND, NOR, EXOR -Make logic gate tables	- Students can understand and get a picture of the basic logic gate - Students can understand AND, OR, NOT logic gates	-Learn how to install Integred Circuit (IC) AND, OR, NOT, NAND, NOR, EXOR on digital trainer Trying to install Integred Circuit (IC) AND, OR, NOT, NAND, NOR, EXOR legs on a digital trainer device
4	Simplification of Functions	-AND-OR logic circuit -Karnaugh Map -NAND logic Simplification of product of sun	-Students understand AND, OR, NAND logic circuits -Understand how to assemble AND, OR NAND logic	-Learn to make NAND logic circuits -Learn to calculate the simplification of product of sun
5	Combinat	-Add binary,	-Students	Understand the

Tabel 1.1 Material Analysis

No	Material	Competence Basic	Indicator The achievement of the	Activity Learning
	ional circuit	half, full, parallel, BCD	understand combinational circuits	calculation of binary, half, full, parallel and BCD additions
6	Flip-Flop	Flip-Flop using the transistor Blocked SR -JK Flip-Flop -Maer-Slave JK Flip-flop - Flip-flop operation	-Understand the working principle of flip-flops and some types of flip-flops Able to identify the work of flip-flops from several types of flip-flops	-Learn to understand JK Flip-Flop -Understand the master-slave JK flip-flop Learn to count flip-flop operations

2.4 Analysis Of Software Requirement Specification

Analysis of software requirements specification is a software requirement as a result of the analysis process will be undertaken in the context of software development. Analysis of software requirements specification which will be explained is the analysis of functional requirements specification and non-functional. Analysis of software requirement specification functional frontend is found in the following table:

Tabel 1.2 Frontend Software Requirements Specifications

No	Requirement Code	Needs Description
1	SKPL-FF-01	This system provides login facilities to the system for students
2	SKPL-FF-02	This system provides facilities for students to choose the learning menu
3	SKPL-FF-02	This system provides facilities for students to view material
4	SKPL-FF-04	This system provides for downloading material
5	SKPL-FF-05	This system provides facilities for students to see material explanations
6	SKPL-FF-06	This system provides facilities for students to see tutorials and do simulations
7	SKPL-FF-07	This system provides facilities for students to practice questions

2.5 Non Functional Requirements Analysis

Non-functional requirements analysis describes the needs outside the system that needed to run applications built. As for the non-functional requirements in the basic techniques of digital learning applications, including hardware requirements, software requirements, and the needs of users of the system who will wear applications.

2.5.1 Needs Analysis Hardware

Hardware requirements analysis aims to know the hardware required to build the application. As for the hardware required for development applications.

Tabel 1.3 Hardware Requirements Analysis

No	Hardware	Specification
1	Processor	Intel core i3 2120
2	Monitor	1366x768 pixel
3	VGA	2 GB
4	Harddisk	500 GB
5	Memori	RAM 4 GB
6	Mouse	Standar
7	keyboard	Standar

2.5.2 Needs Analysis Software

The analysis software is crucial in supporting the performance of a system. The software used in a development system so that the hardware can mutually interact with one another. The software required to build the basic techniques of digital learning applications.

Tabel 1.4 Needs Analysis Software

No	Software	Software
1	Sistem Operasi	Microsoft Windows 10
2	Tools Compiler	Unity
3	Tools Design	Adobe Photoshop CS6 Blender3d

2.5.3 Analysis Of User Needs

The user needs analysis is an analysis of the user or users who will use the system to be built. As for the needs of the users who will be involved in the use of the basic techniques of digital learning applications.

Tabel 1.5 Analysis Of User Needs

User	Teacher	Student
Access rights	1. Vocational School Teacher for Dharma Nusantara as admin 2. Manage student data 3. Update the Problem	1. Students of class X SMK Guna Dharma Nusantara 2. Trying Material, Simulation and Exercise
Level of education	Minimum SMK	Minimum SMK
User Experience	Understand the use of Android-based mobile applications	Understand the use of Android-based mobile applications
User Job and Task	1. The teacher understands the instructions and instructions given 2. The teacher can use a smartphone	1. Students understand the instructions and instructions given 2. Students can use a smartphone
Types of Training Provided	Procedure training for the use of the system	Procedure training for the use of the system

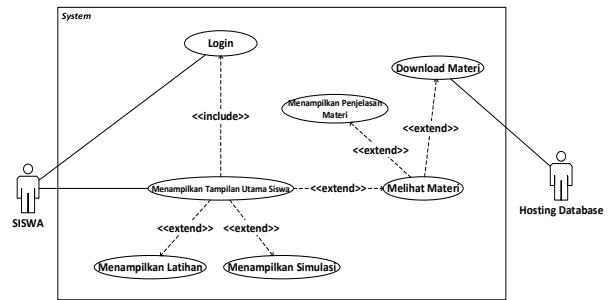
1.6 A Functional Needs Analysis

Describe the process of functional needs analysis activities will be implemented in the system to be built so that the system can run well and in accordance with their needs. System modeling applications to be built and modeled using UML (unified modeling language). Stages of modeling in

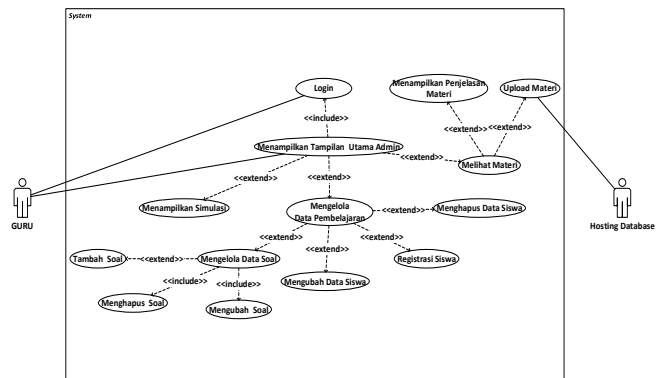
the analysis of use among others such as UML Use Case diagram, use case scenarios, activity diagrams, class diagrams and sequence diagram.

1.6.1 Use Case Diagram

Use Case diagram an actor is a function of the description of a system from the perspective of the user. This chart also describes what will be done to the system. Below there is a use case of frontend and backend.



Gambar 1.1 UseCase Diagram Forntend



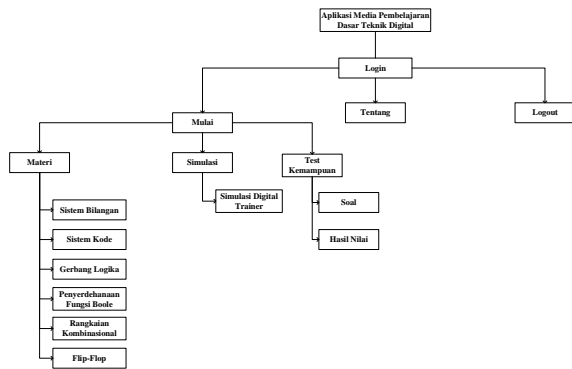
Gambar 1.2 UseCase Diagram Backend

1.7 Design System

Specifies the aspect of the system is the design technique be the solution in the design. At this stage, the design will be defined in detail to address more technical problems, related to the design of activities ranging from the design data, the design of interfaces, and semantic network design.

1.7.1 Design Menu structure

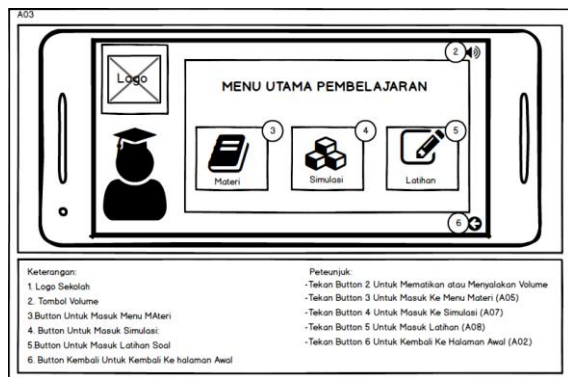
The design of the structure of the menu is an overview of the usage of the application. The following alpha the design of the structure of the applications menu of basic learning techniques of digital media can be seen in Figure 1.3.



Gambar 1.3 The Design Of The Menu Structure

1.7.2 Designing Interfaces

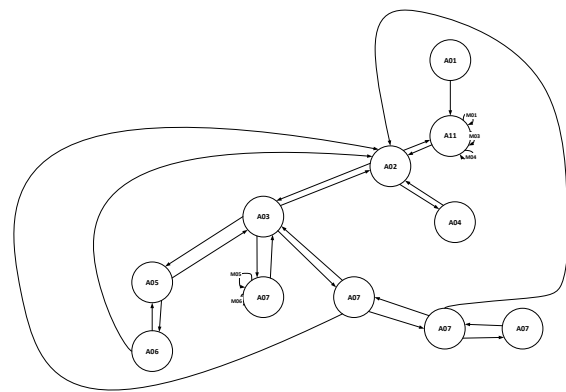
System interface design phase aims to search for the appearance or form of application to be optimally built with consideration of factors, problems, and needs that exist in the system as specified at this stage of the analysis. In this stage, the upaya yang carried out namely by means of the combined use of technology hardware and software that place so obtained optimal results and easily implemented in.



Gambar 1.4 The Design Of The Main Menu Interface

1.7.3 Semantic Network Design

The design of the semantic network is the image of a graphic that shows the relationship of knowledge a range object that consists of a variety of object information from the object, as for the semantic network for learning basic applications of digital technique in SMK Guna Dharma Nusantara based mobile is as follows.



Gambar 1.5 Semantic Network Frontend

1.8 Application Implementation

The application of learning basic techniques of digital X-grade engineering industry Elektronik in SMK Guna Dharma Nusantara built is a mobile-based application. This application needs to be done in the process of installing Android-based smartphone, application of learning the basic techniques of digital class X in SMK Guna Dharma Nusantara in this archipelago, made up of material, simulation, and evaluation.

1.8.1 Interface Implementation

Implementation of the interface will be implemented in the program interface in the wake.



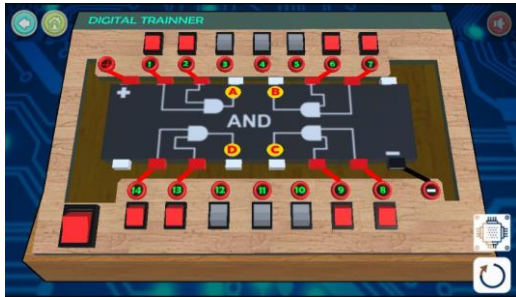
Gambar 1.6 Implementation Of The SplashScreen Interface



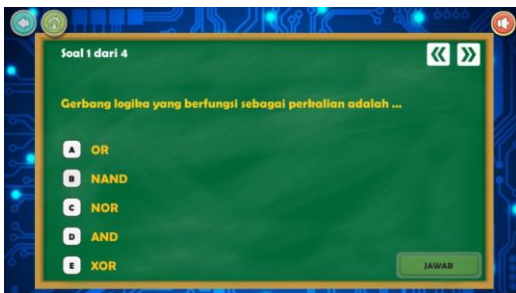
Gambar 1.7 The Main Menu Interface Implementation Study



Gambar 1.8 Material Menu Interface Implementation



Gambar 1.9 Material Menu Interface Implementation



Gambar 1.10 Interface Implementation Exercise Problem

1.9 Testing System

System testing is the most important thing done to find flaws and errors in the software tested. The test is meant to know software is created already meets the criteria as appropriate. In this study the testing done to the system i.e. testing (alpha) and beta. Methods used in this test is the black box testing focuses on the functional requirements of the system being built.

1.10 Black Box Testing Conclusions

This test is the result of observation of the response of respondents who use basic learning media applications of digital engineering grade X from the backend and the frontend side also. Responses in the form of an interview or questionnaire that will be given to one of the teachers of the basic subjects of digital techniques and also students of class X Department of the electrical engineering industry.

1.11 Conclusion The Application User Responses

Based on the results from testing the response to user applications, it can be concluded that the objective to make the learning media applications as media help students to learn basic digital engineering subjects, with respondents students an average of more than 85% agree so that first goal is met. Then a goal to assist students in understanding the material by giving an overview of the material, simulation with student respondents on average over 80% agreed so that second goal is met.

1.12 Testing

At this stage of the testing done in order to find out if there are any changes before and after the application of the basic techniques of digital learning media by way of doing a pretest and posttest trials against students by creating two classes of i.e. the class of the control and the experimental value obtained after the pretest and posttest then performed testing of n-Gain in the control class that is due and experimentation.

Calculation of N-gain obtained from the score pretest and posttest each class and grade control experiments. The improvement of the competence which occurred before and after the study is calculated by the formula g factor (N-Gain) with the formula:

$$\text{Index Gain} = \frac{\text{postes} - \text{pretes}}{\text{nilai maksimum} - \text{pretes}}$$

As for the results of a pretest and posttest of calculation on a class X-TEIN as many as 19 students as sample 1 (grade control) and class X-TEIN Road as many as 20 students as sample 2 (experimental class) can be seen in Table 1.6 and 1.7 of the following Table.

Tabel 1.6 Control Class

Class XI-TEIN (Control)	Value		Gain
	Pretest	Posttest	
1	60	75	0,38
2	70	75	0,17
3	70	75	0,17
4	75	80	0,20
5	75	80	0,20
6	85	85	0,00
7	40	60	0,33
8	50	70	0,40
9	85	85	0,00
10	45	55	0,18
11	85	85	0,00

Tabel 1.6 Control Class

Class XI-TEIN (Control)	Value		Gain
	Pretest	Posttest	
12	85	85	0,00
13	85	85	0,00
14	50	65	0,30
15	50	70	0,40
16	55	75	0,44
17	80	85	0,25
18	45	65	0,36
19	70	80	0,33

Tabel 1.7 Class Experiments

Class XI-TE IN (Eksperi men)	Value		Gain
	Pretest	Posttest	
1	80	85	0,25
2	65	75	0,29
3	80	85	0,25
4	80	85	0,25
5	60	75	0,38
6	70	80	0,33
7	75	80	0,20
8	70	80	0,33
9	70	80	0,33
10	70	75	0,17
11	70	80	0,33
12	70	75	0,17
13	80	80	0,00
14	80	85	0,25
15	50	70	0,40
16	70	75	0,17
17	80	85	0,25
18	70	75	0,17
19	85	85	0,00
20	60	75	0,38

On the hypothesis test did testing that is a test of normality for a decision from the data, and then

tests its homogeneity to know the variance of both data.

Based on the results of the test data obtained normality output value of significance for the control of 0.106 classes while the value of significance for class experiments of the second significance level because 0.142 class larger > 0.05 then it can be inferred berdistribusi normal data, that can be seen in the following table:

Tabel 1.8 Results Normalization

Kelas	Kolmogorov- Smirnov ^a					
	Statistic			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Hasil kontrol	,180	19	,106	,889	19	,030
Belajar Eksperimen	,168	20	,142	,908	20	,059

a. Lilliefors Significance Correction

Based on the results of its homogeneity test output data obtained the value of the control class for its homogeneity of 0.057, due to the extent of its homogeneity is smaller so it can be 0.05 < concluded that the data is both homogeneous then H0 is rejected and the H1 in the receipt which means there is the difference in variance between groups gain score is experimental and control group, can be seen in the following table:

Tabel 1.9 Results Homogeneity

Hasil Belajar

Levene Statistic	df1	df2	Sig.
3,844	1	37	,057

Based on the results of its homogeneity and normality test data was tested using SPSS statistics application then can be drawn the conclusion that the data have been tested normal and homogenized stated, by comparison, test it because of the average measured by test independent T-test.

Tabel 1.10 Independent Test Results T-test

	Levene's Test for		t-test for Equality of Means					
	Equality of Variances							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	
Hasil Belajar	Equal variances assumed	3,844	,057	-.663	37	,512	-.029	,043
	Equal variances not assumed			-.657	32,441	,516	-.029	,044

Based on the results of the independent T-test output test N-gain data obtained significant value (Sig 2-tailed), namely of 0.512 and 0.516 significant value because (Sig 2-tailed) larger > 0.05 then it can be inferred between the results of the study on second class or can it be that H1 is accepted and H0 is rejected, namely an average value of experimental class larger than the average value of the controller class. Then it can be inferred that when application usage-media learning has increased on the results of work reserved.

3. CLOSING

3.1 Conclusion

Based on the results of the implementation and the testing that has been done, then obtained that:

1. The application of the basic techniques of digital learning media as media helps students to learn basic subjects on digital techniques.
2. Students can try the stages of use of the practice of using the medium of instruction.
3. Teachers helped to give an overview and illustrations and exercises reserved for students learning to use media.

3.2 Suggestions

In the construction of basic learning media applications of digital engineering electrical engineering majors grade X industry in SMK Guna Dharma Nusantara this there are a few other things for the development of Furthermore, hence the tagline development to make This application better. As for the suggestions towards the development of the application to In the future as applicable:

1. This application is developed by adding the pictures on a matter of practice.
2. Add video animation on the material so that the delivery of the material looks more attractive.

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