Capstone Project

Wacayang

Members:

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3. Nauval Muhammad Firdaus (A2005F0453) - Mobile Development - Universitas Bina Nusantara
4. Dimas Aji Permadi (C2152F1678) - Cloud Computing - Sekolah Tinggi Teknologi Bandung

Team Code: C22-PC383

GitHub:
https://github.com/Wacayang-Bangkit-2022

Wacayang

Background & Problems

Wayang is a traditional Indonesian performing art that developed on the islands of Java and Bali. However, quoted from the famous puppeteer Ki Manteb Sudarsono, this art has lost its existence over time and has difficulty competing with modern entertainment.

This is due to the lack of people's knowledge about wayang, especially about its characters. There are hundreds of wayang characters, so it's quite difficult to memorize them. Therefore, there needs to be a technological solution that makes it easy to access information about wayang characters.

Our Reasons & Goals

Wayang is designated by UNESCO as a Masterpiece of Oral and Intangible Heritage of Humanity. And we want to maintain its preservation.

To achieve this, we want Wacayang to tackle these problems.

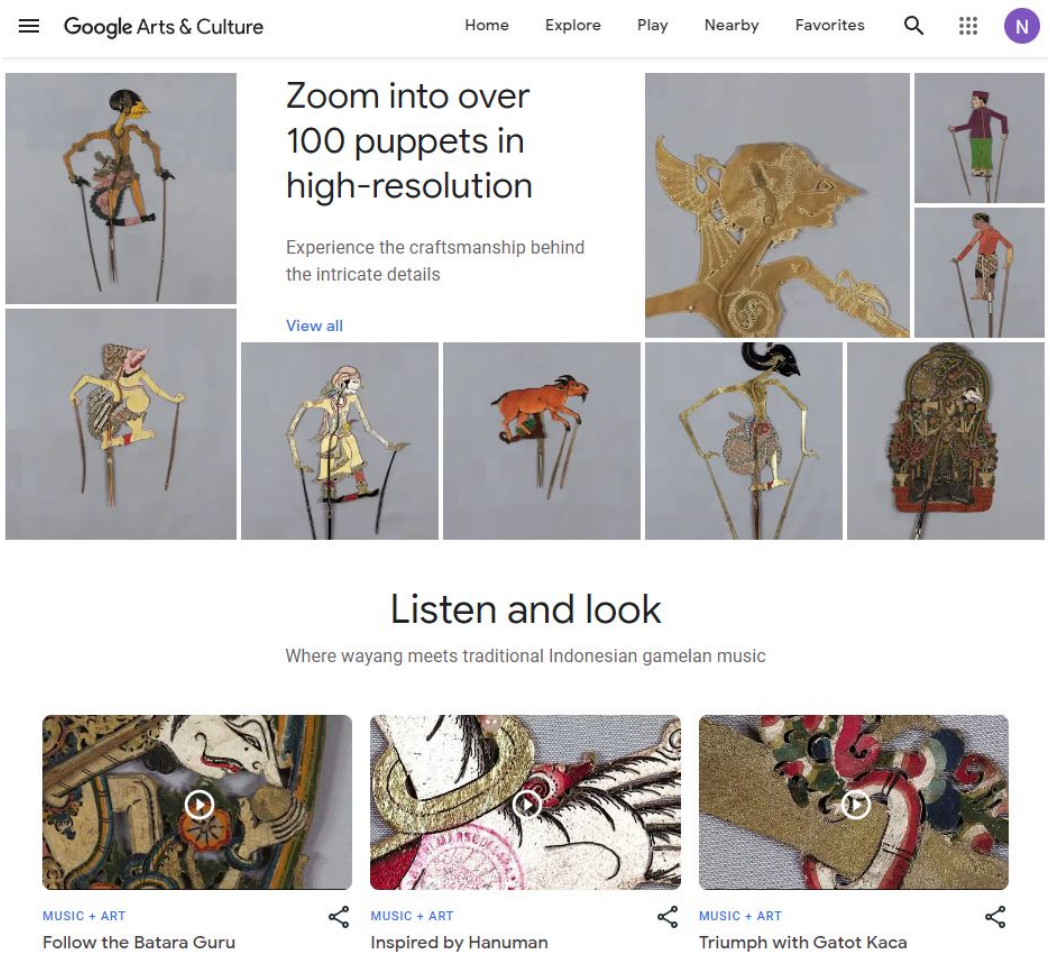
1. To make people easily recognize wayang characters.
2. To popularize wayang as part to maintain its preservation.
3. To popularize puppeteer and their wayang shows.

Existing Result

Most solutions to this problem are conventional books, articles, or news found online.

One of the most interesting one is from **Google Arts and Culture.** It has a lot of features, but we found several important ones missing such as:

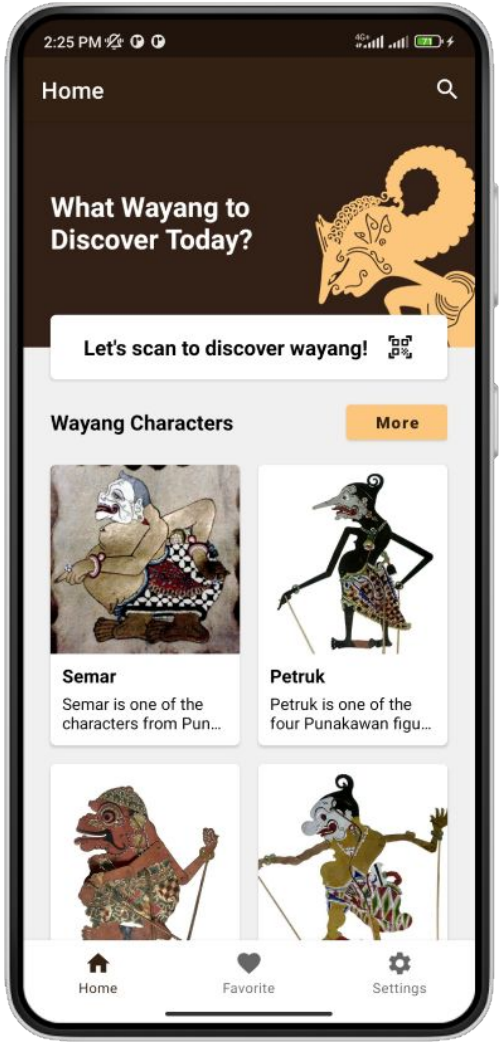
1. No searching feature.
2. No prediction by image.
3. No relevant video per wayang.
4. No brief or detailed story about each wayang.



Implementation, Improvement & Reasoning

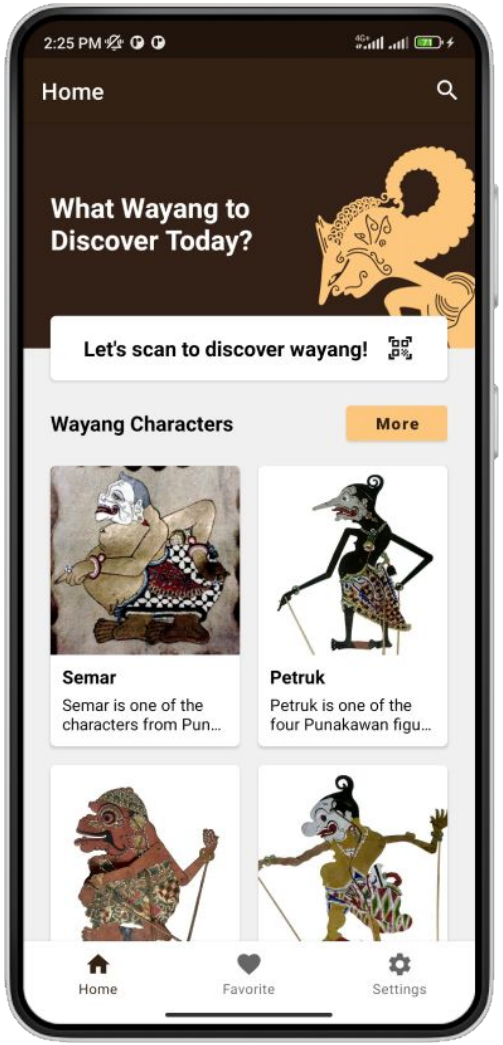
We want to improve the “wayang exploration” experience by implementing features that might help people to discover Indonesian wayangs. All these features can be found in our Wacayang app:

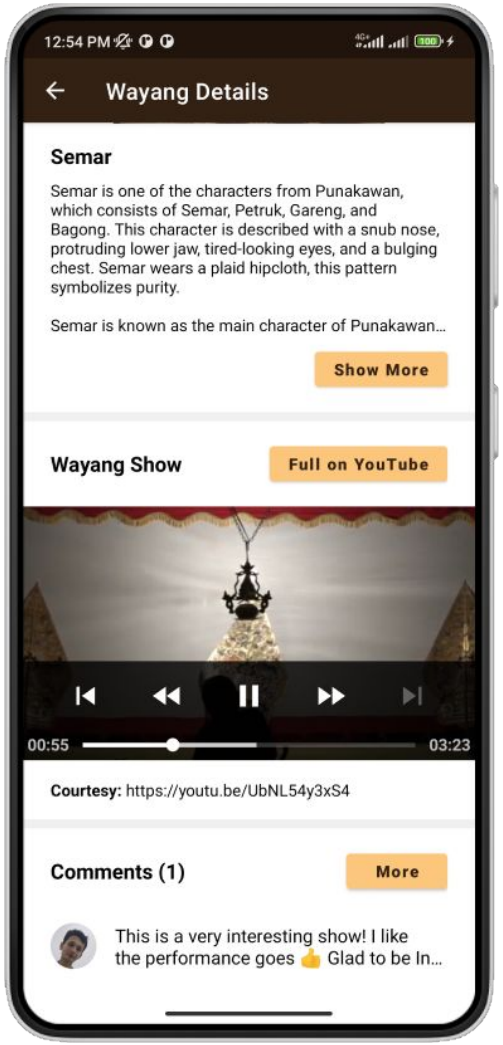
1. Information and the tales/story about wayangs.
2. Searching by text or discover wayang using ML image prediction.
3. Personalization to save favorites wayangs on personal library.
4. Post comments to share thoughts about wayangs.
5. Bahasa Indonesia and English language support.

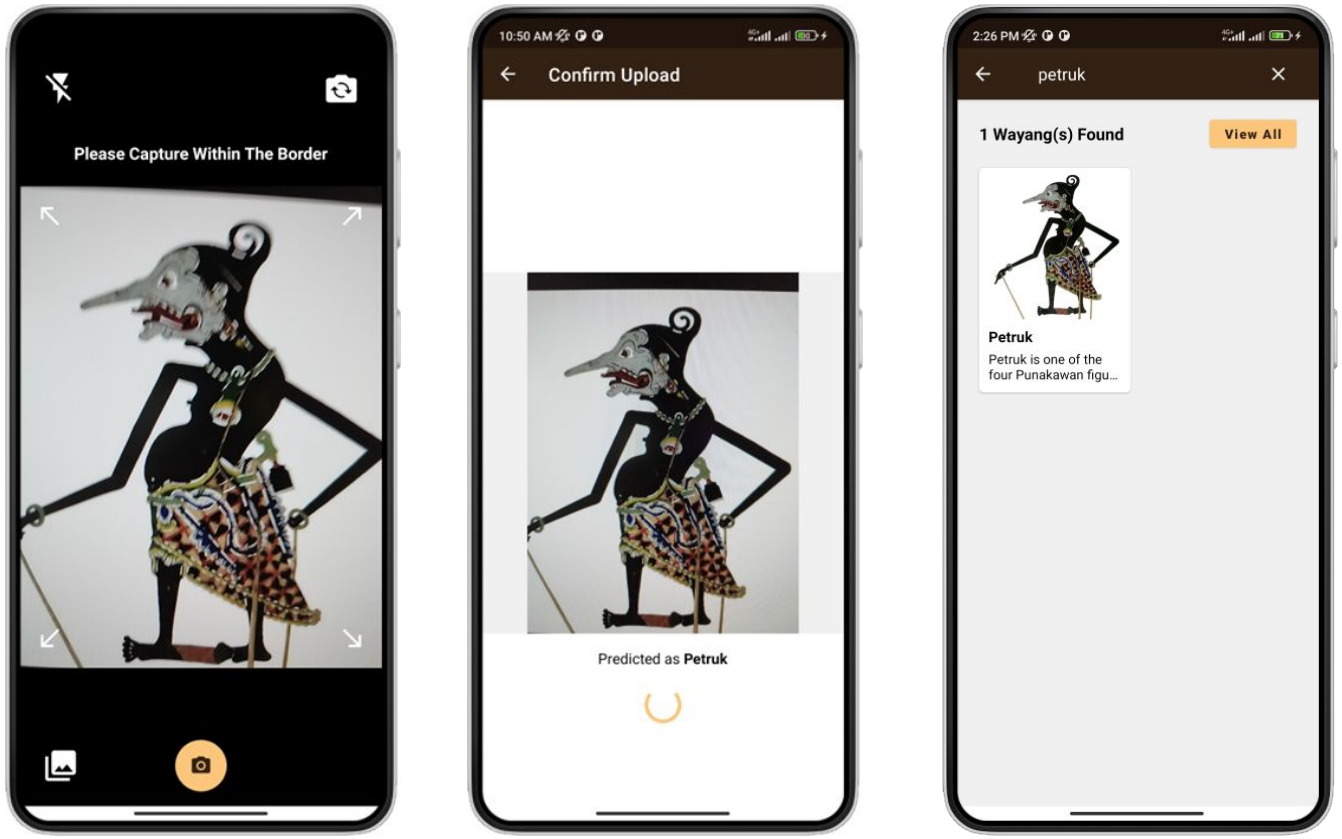


Learn It Tales by Reading or Watching

Wacayang provide information to let user easily get to know about the wayang the search for, from images, wayang story literature, and relevant wayang shows from local Indonesian wayang puppeteer.





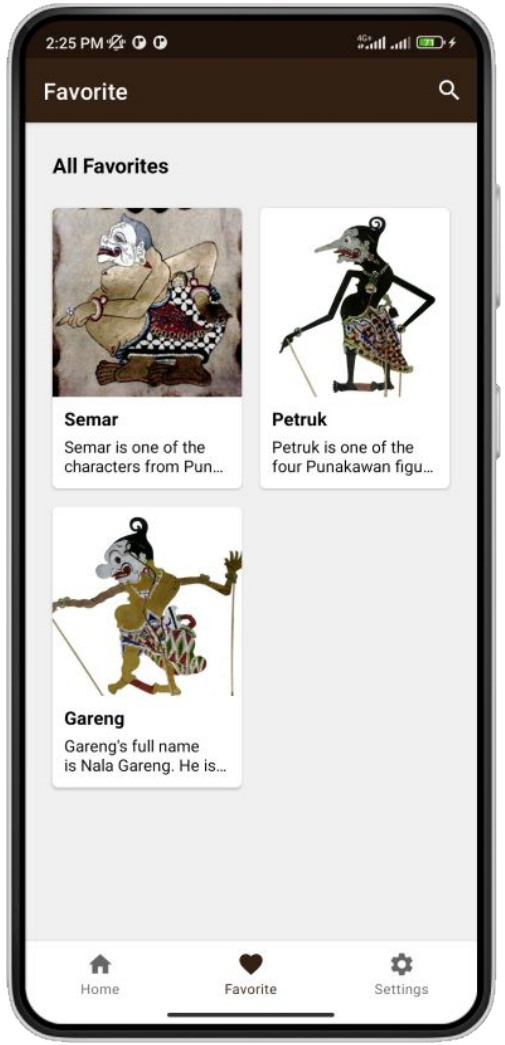


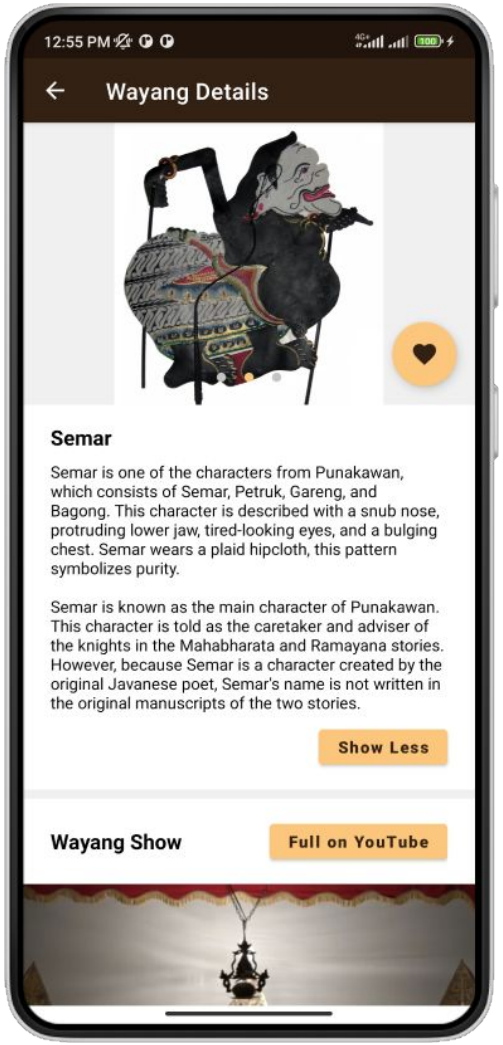
Search by Text or Just Scan

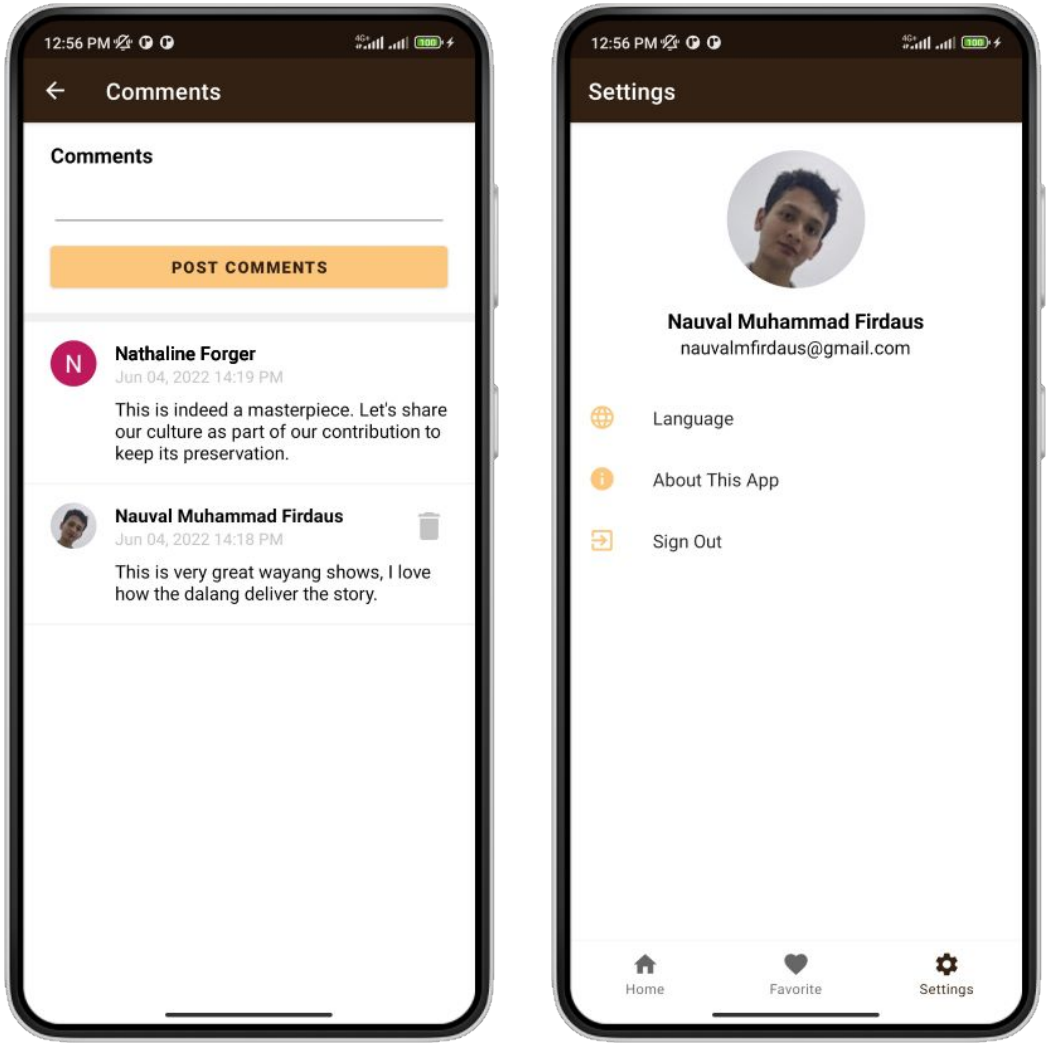
Wacayang make it easy for user to find their wayang by inputting keyword on search bar, or just take a image of wayang and Wacayang will find it for them.

Love It?
Add It to Favorites

Wacayang provides personalization for users to add or remove specific wayang to their own favorite wayangs library.







Share Thoughts Through Comments

Wacayang provide comments section for all wayangs so users can share their thoughts and knowledge. Simply a place to share to and learn from others.

Core Technologies

1

Android Studio

Build native Android application using official Android Studio IDE. Main programming language used is Kotlin.

2

Google Cloud Platform

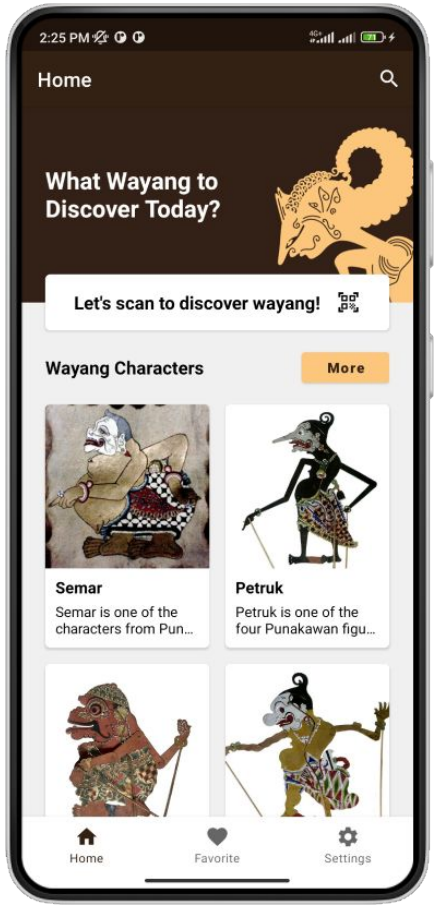
Deploy Node.JS and Flask application as REST API and its required database instance on Google Cloud Platform.

3

Tensorflow, Keras

Train machine learning model using tensorflow and deploy it as .h5 Keras model.

Integration Methods



Retrofit

Network Request ->

<- **JSON** Literals

Google

Cloud Run

(*Firebase Auth Required*)

Query Statement ->

<- Record **Result**

Image File ->

<- **Prediction**

Google

SQL Database

Instance

Keras .h5

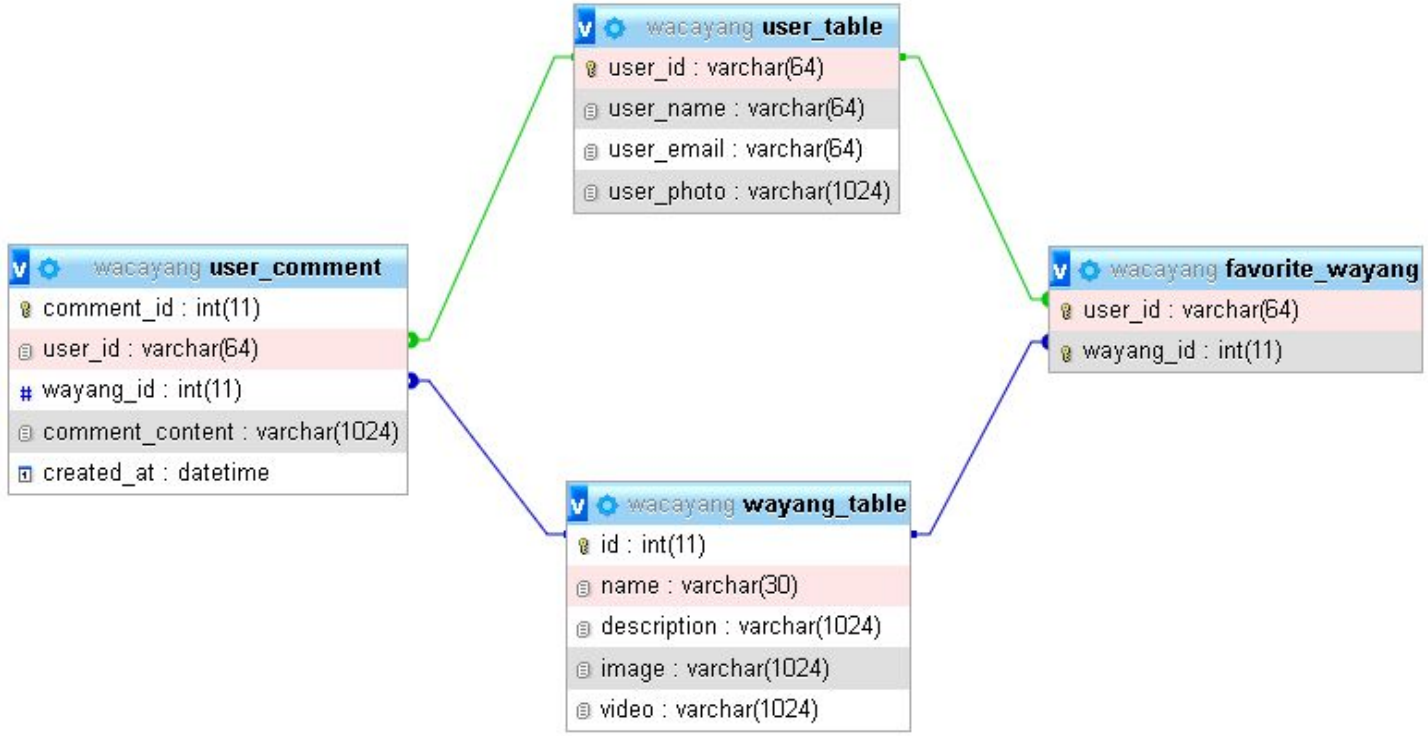
Machine Learning

Model

Cloud Computing

API creation using Node.js and Flask with MySql / SQL database storage. Application deployment using the GCP platform, Cloud Run.

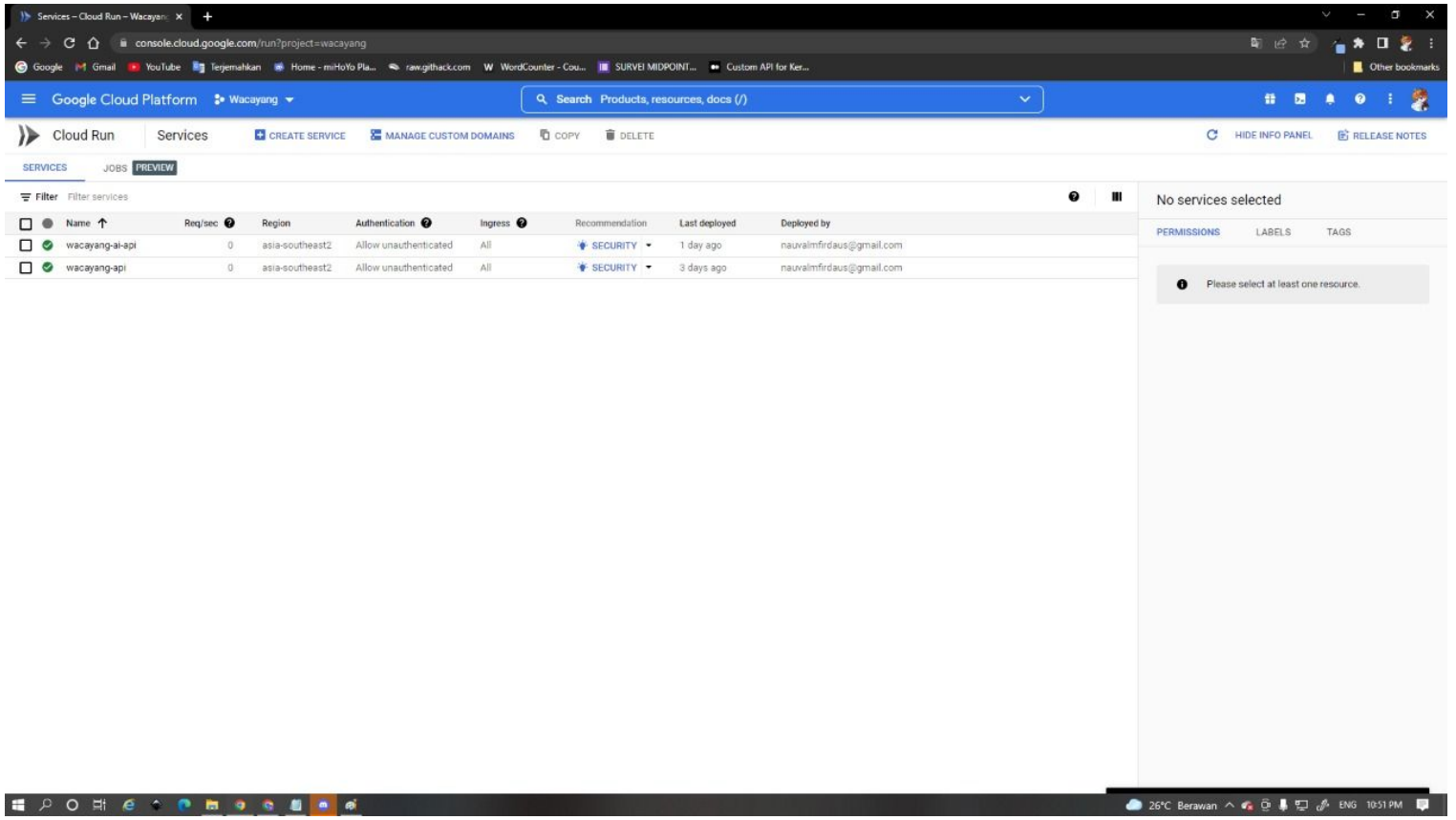
Relational table in database SQL



Cloud Computing

API creation using Node.js and Flask with MySql / SQL database storage. Application deployment using the GCP platform, Cloud Run.

Cloud Run in GCP

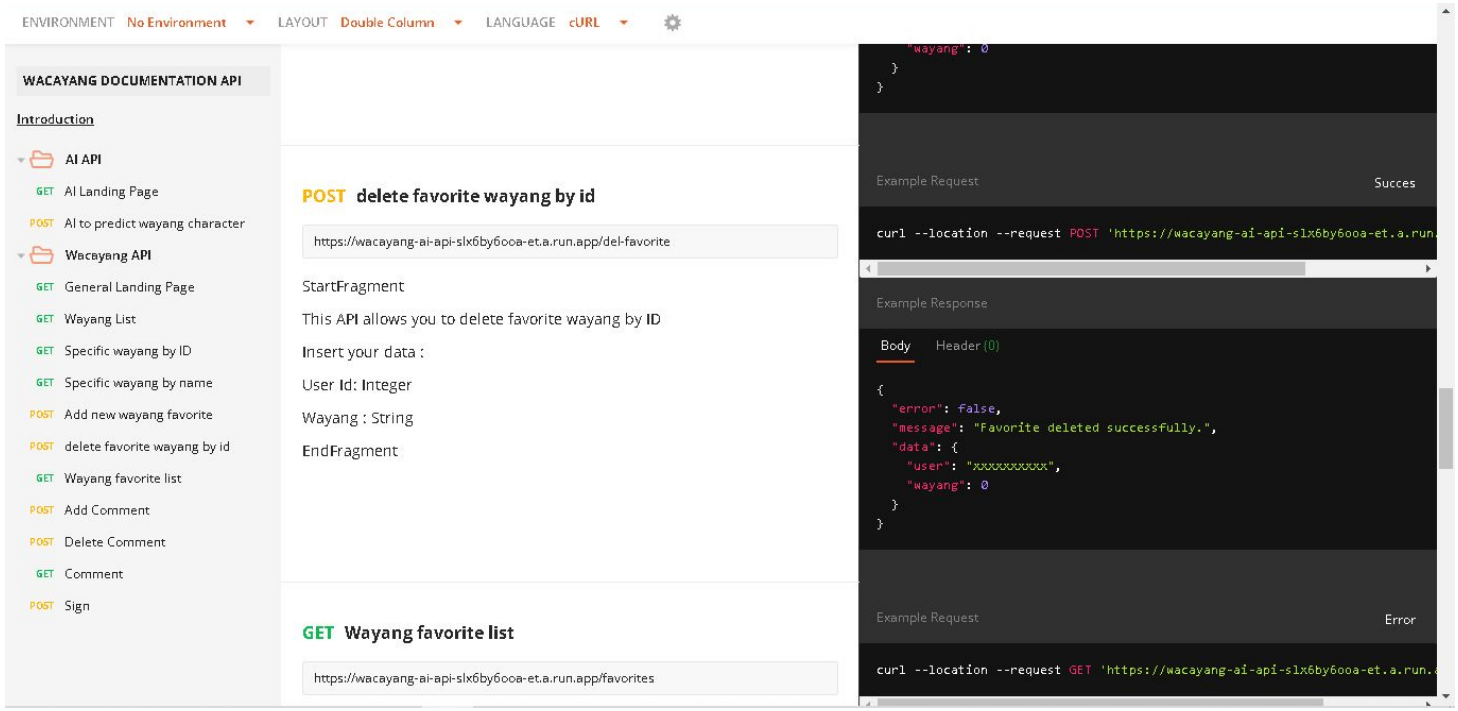


Cloud Computing

API documentation is made using POSTMAN, documentation to make it easier for developers to manage or use the API.

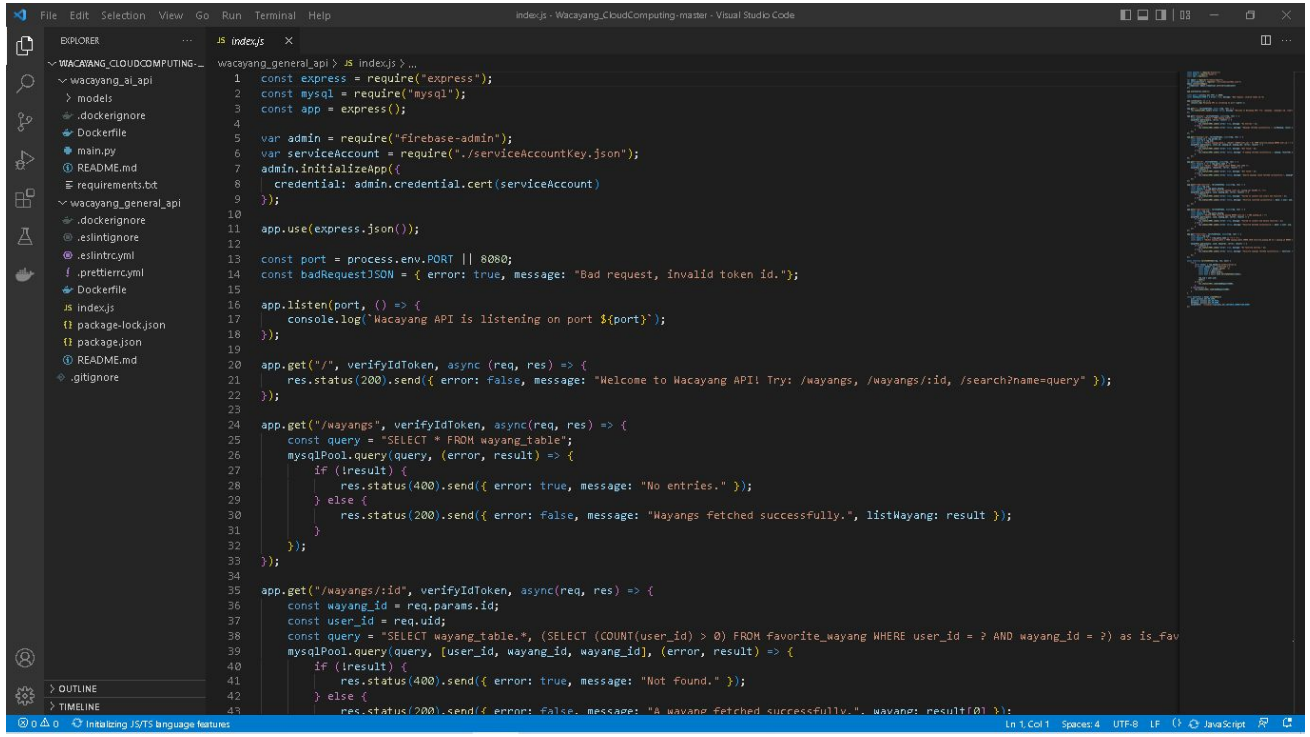
Link access documentation

https://documenter.getpostman.com/view/20994859/UyxqDPV6



Cloud Computing

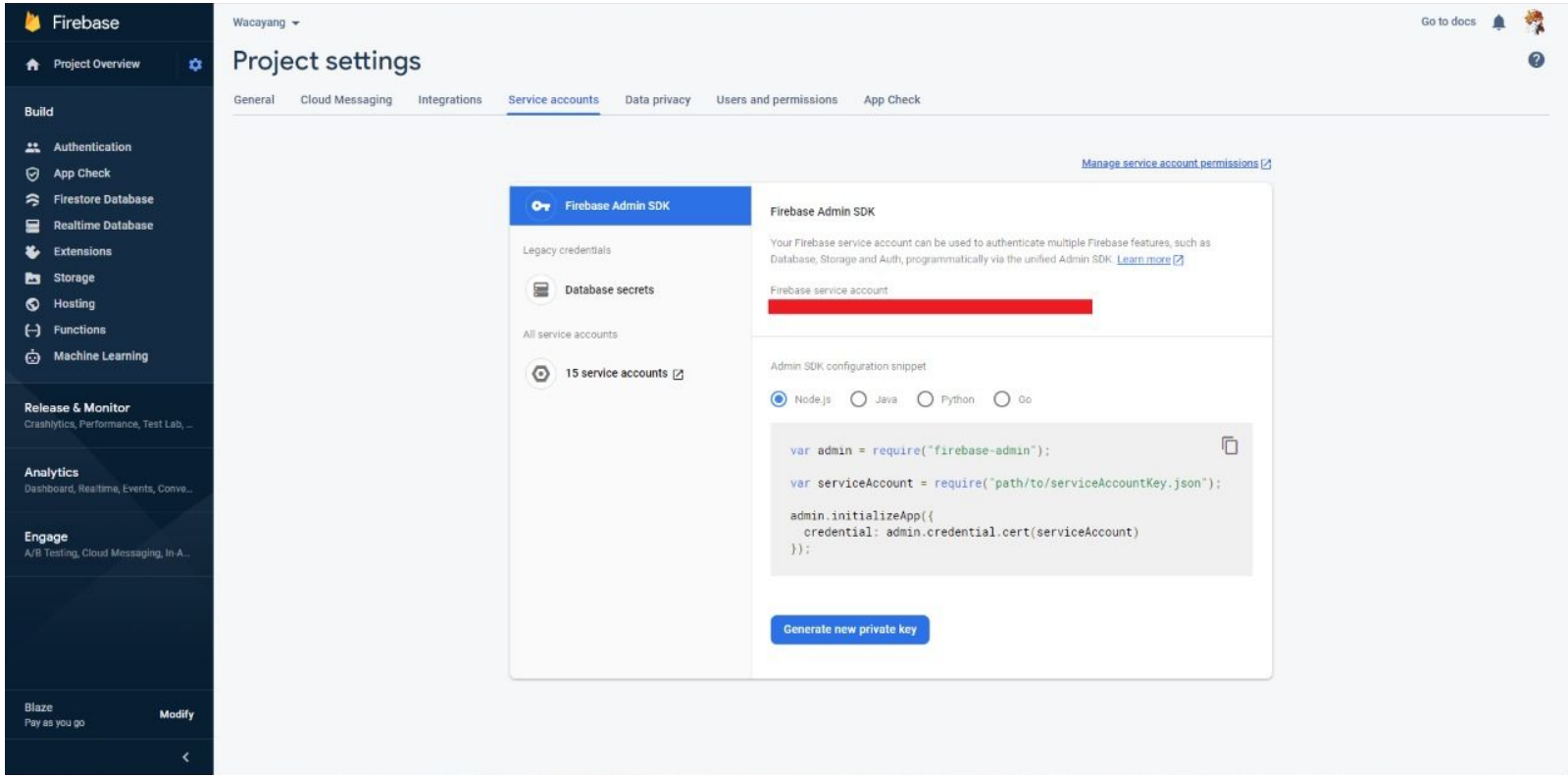
Struktur code in text editor, Visual Studio Code.



Cloud Computing

As for the authentication required in this application using JWT in firebase

Configuration Auth in firebase for Node.Js



Google Cloud Platform Pricing

Name	Qty	Region	Service ID	SKU	Product Description	Unit Price	Total Price
Cloud Run Wacayang-API Deployment Service	0	asia-southeast2	152E-C115-5142	Look up for SKU https://cloud.google.com/skus/?currency=USD&filter=152E-C115-5142	CP-CLOUD-RUN-GENERAL	0 USD	0 USD
Cloud Run Wacayang-AI-API Deployment Service	0	asia-southeast2	152E-C115-5142	Look up for SKU https://cloud.google.com/skus/?currency=USD&filter=152E-C115-5142	CP-CLOUD-RUN-GENERAL	0 USD	0 USD
Cloud SQL for MySQL: Zonal - vCPU in Jakarta	365	asia-southeast2	9662-B51E-5089	9318-73FC-60C5	CP-DB-CUSTOM-1-3.75	0.0537 USD	19.6005 USD
Cloud SQL for MySQL: Zonal - RAM in Jakarta	1368.75	asia-southeast2	9662-B51E-5089	3491-8FE0-9709	CP-DB-CUSTOM-1-3.75	0.0091 USD	12.455625 USD
Cloud SQL for MySQL: Zonal - Standard storage in Jakarta	10	asia-southeast2	9662-B51E-5089	E969-FD43-DE2D	CP-DB-CUSTOM-1-3.75	0.221 USD	2.21 USD
Monthly Total Price							34.266125 USD

Machine Learning

Build a model capable of classifying various type of wayang

Model created with TensorFlow using Convolutional Neural Network (CNN). Transfer learning is also used to increase model performance, such as DenseNet121, InceptionV3, and ResNet152V2. The model saved in keras model format (.h5) for the purpose of deployment.

Dataset

Wayang Dataset

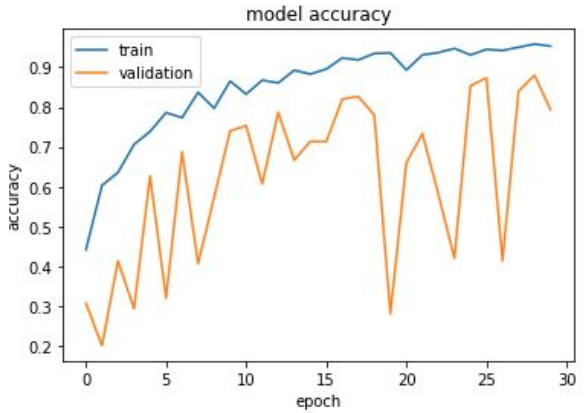
This dataset contain 1650 wayang images divided into train (1350), validation (150), and test (150) file. This dataset has five wayang classes, namely Bagong, Cepot, Gareng, Petruk, and Semar.

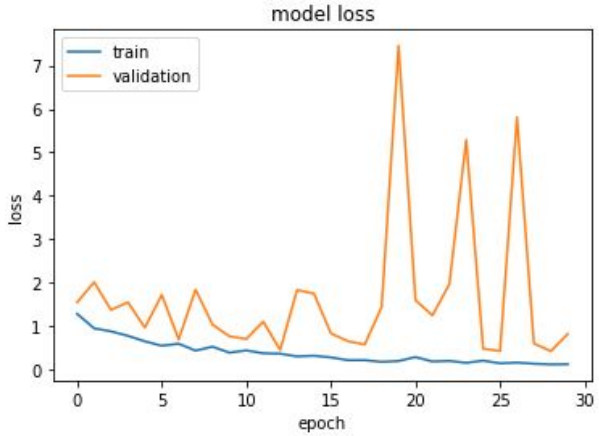
Link: https://www.kaggle.com/datasets/bayuokta/wayang-bagong-cepot-gareng-petruk-semar

Model Improvements

Baseline Model (Simple Convolutional Neural Network)

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 298, 298, 16)      448

 max_pooling2d (MaxPooling2D  (None, 149, 149, 16)     0
 )

 conv2d_1 (Conv2D)           (None, 147, 147, 16)      2320

 max_pooling2d_1 (MaxPooling  (None, 73, 73, 16)       0
 2D)

 conv2d_2 (Conv2D)           (None, 71, 71, 32)        4640

 max_pooling2d_2 (MaxPooling  (None, 35, 35, 32)       0
 2D)

 conv2d_3 (Conv2D)           (None, 33, 33, 32)        9248

 max_pooling2d_3 (MaxPooling  (None, 16, 16, 32)       0
 2D)

 conv2d_4 (Conv2D)           (None, 14, 14, 64)        18496

 max_pooling2d_4 (MaxPooling  (None, 7, 7, 64)         0
 2D)

 batch_normalization (BatchN  (None, 7, 7, 64)         256
 ormalization)

 flatten (Flatten)           (None, 3136)              0

 dense (Dense)               (None, 256)               803072

 dense_1 (Dense)             (None, 128)               32896

 dense_2 (Dense)             (None, 5)                 645

=================================================================
Total params: 872,021
Trainable params: 871,893
Non-trainable params: 128
_________________________________________________________________
```





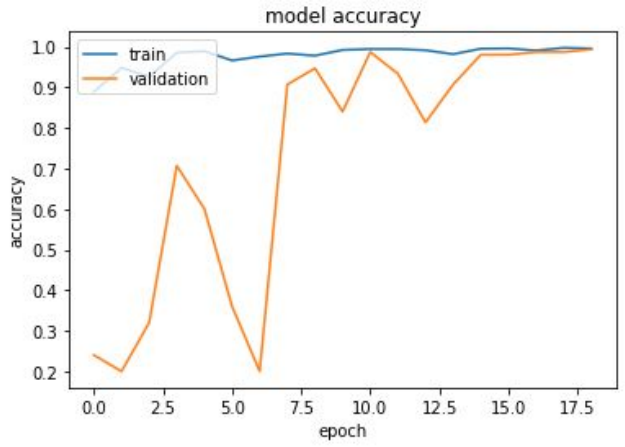
Test Accuracy: 0.8600000143051147

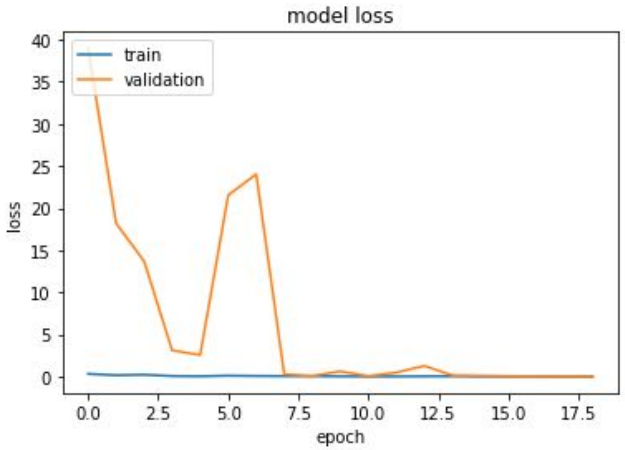
Test Loss: 0.447418272495269 8

Model Improvements

Transfer Learning (DenseNet121)

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 densenet121 (Functional)    (None, 9, 9, 1024)        7037504

 global_average_pooling2d (G  (None, 1024)             0
 lobalAveragePooling2D)

 dense (Dense)               (None, 5)                 5125

=================================================================
Total params: 7,042,629
Trainable params: 6,958,981
Non-trainable params: 83,648
_________________________________________________________________
```





Test Accuracy: 0.9866666793823242

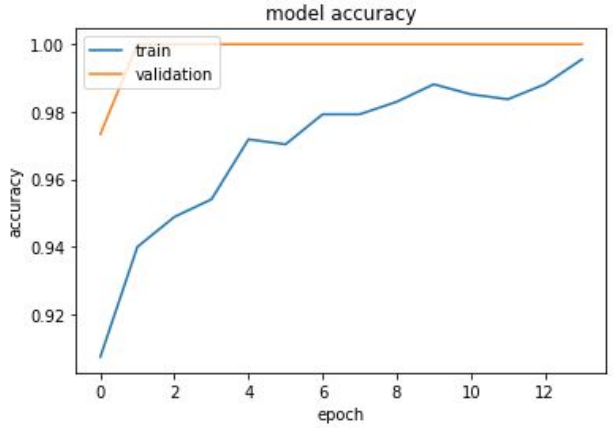
Test Loss: 0.018745819106698036

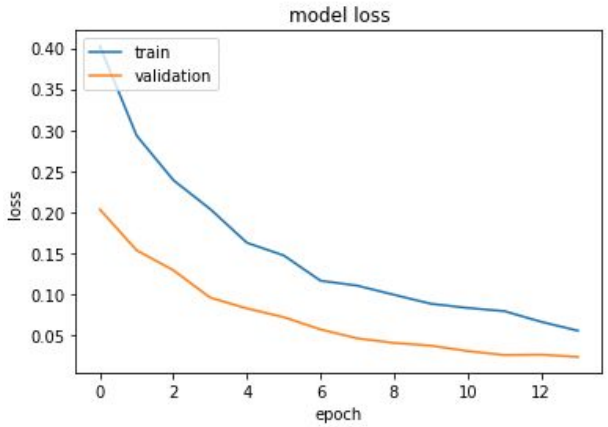
Model Improvements

Transfer Learning (InceptionV3)

Model: "inception_v3"

Layer (type)	Output Shape	Param #	Connected to
input_7 (InputLayer)	[(None, 150, 150, 3)]	0	[]
conv2d_564 (Conv2D)	(None, 74, 74, 32)	864	['input_7[0][0]']
batch_normalization_564 (Batch Normalization)	(None, 74, 74, 32)	96	['conv2d_564[0][0]']
activation_564 (Activation)	(None, 74, 74, 32)	0	['batch_normalization_564[0][0]']
conv2d_565 (Conv2D)	(None, 72, 72, 32)	9216	['activation_564[0][0]']
batch_normalization_565 (Batch Normalization)	(None, 72, 72, 32)	96	['conv2d_565[0][0]']
activation_565 (Activation)	(None, 72, 72, 32)	0	['batch_normalization_565[0][0]']
conv2d_566 (Conv2D)	(None, 72, 72, 64)	18432	['activation_565[0][0]']
batch_normalization_566 (Batch Normalization)	(None, 72, 72, 64)	192	['conv2d_566[0][0]']
activation_566 (Activation)	(None, 72, 72, 64)	0	['batch_normalization_566[0][0]']
max_pooling2d_24 (MaxPooling2D)	(None, 35, 35, 64)	0	['activation_566[0][0]']
conv2d_567 (Conv2D)	(None, 35, 35, 80)	5120	['max_pooling2d_24[0][0]']
batch_normalization_567 (Batch Normalization)	(None, 35, 35, 80)	240	['conv2d_567[0][0]']
activation_567 (Activation)	(None, 35, 35, 80)	0	['batch_normalization_567[0][0]']
conv2d_568 (Conv2D)	(None, 33, 33, 192)	138240	['activation_567[0][0]']
batch_normalization_568 (Batch Normalization)	(None, 33, 33, 192)	576	['conv2d_568[0][0]']





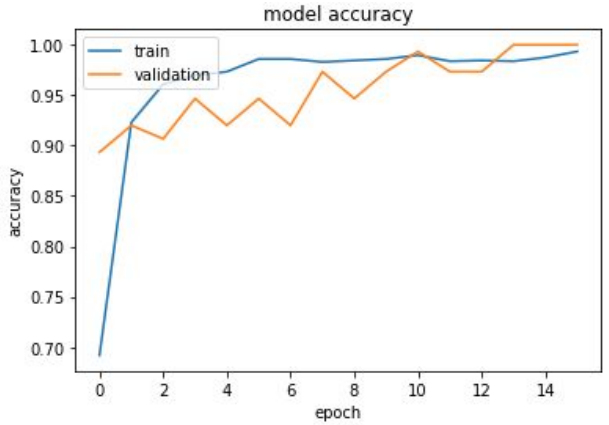
Test Accuracy: 0.9933333396911621

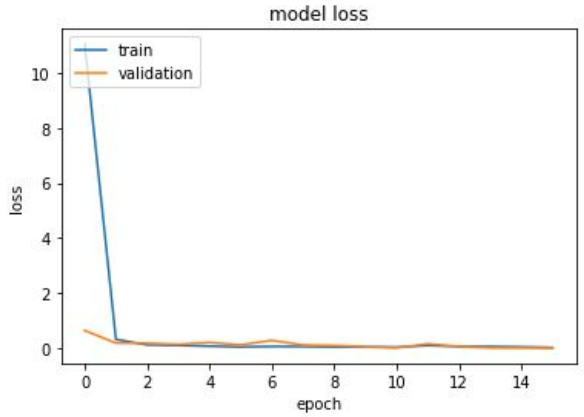
Test Loss: 0.1550531834363937 4

Model Improvements

Transfer Learning (ResNet152V2)

```
Model: "sequential_4"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 resnet152v2 (Functional)    (None, 10, 10, 2048)      58331648

 flatten_1 (Flatten)         (None, 204800)            0

 dense_10 (Dense)            (None, 128)               26214528

 dense_11 (Dense)            (None, 5)                 645

=================================================================
Total params: 84,546,821
Trainable params: 26,215,173
Non-trainable params: 58,331,648
_________________________________________________________________
```





Test Accuracy: 1.0

Test Loss: 0.0004123643157072365 3

Wacayang
Documentation

How to replicate our steps:

1. Copy the app from our Android Studio project.
2. Connect Android Studio project to Firebase auth.
3. Create SQL instance and create required tables.
4. Use our ML model .h5 or train your own model.
5. Deploy ML model and the REST API to Cloud Run.
6. Build released Android app from Android Studio project.

GitHub:
https://github.com/Wacayang-Bangkit-2022

README.md (also in GitHub):
https://github.com/Wacayang-Bangkit-2022/Wacayang-Documentation/blob/main/README.md

WACAYANG

GO TO MARKET PROPOSAL

C22-PC383

DIMAS AJI PERMADI

CC Cohort - C2152F1678

Sekolah Tinggi Teknologi Bandung

FAHRIZZA IRHAM TAUFANY

ML Cohort - M2116L1465

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MUHAMMAD IZZAH ALFATIH

ML Cohort - M2012F1299

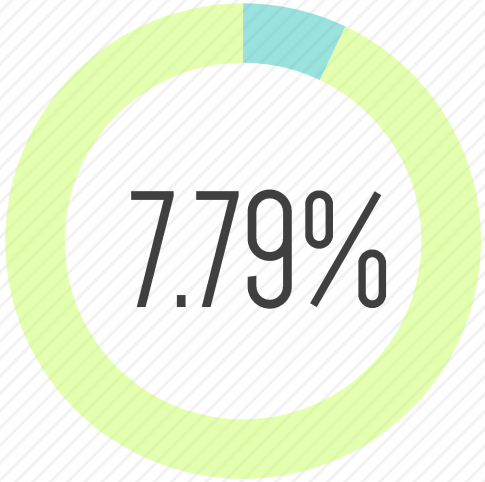
Universitas Telkom

NAUVAL MUHAMMAD FIRDAUS

MD Cohort - A2005F0453

Universitas Bina Nusantara

WAYANG SHOW STATISTICS



Based on Badan Pusat Statistik, in 2018, BPS recorded only 7.79% of Indonesian population aged 5 years and over watched wayang theater and puppet shows

BACKGROUNDER

WHAT WE'RE TRYING TO SOLVE

Wayang is a traditional Indonesian performing art that developed on the islands of Java and Bali. However, this art has lost its existence over time and has difficulty competing with modern entertainment. This is due to the lack of people's knowledge about wayang.

Based on that problem, our team want to improve the “wayang exploration” experience by developing wacayang app. In this app we use image recognition to provide user information about wayang kulit. Personalization, post comment, and dual language support also available to increase user experience

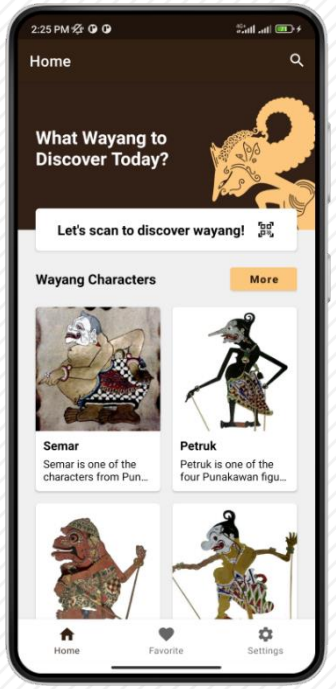
INTRODUCTION

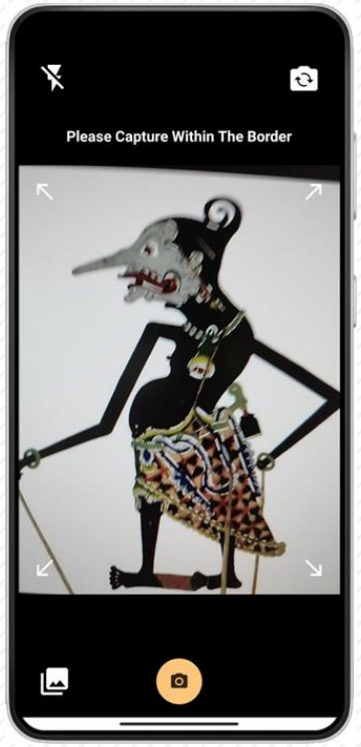
IMPROVE ENGAGEMENT ON WAYANG

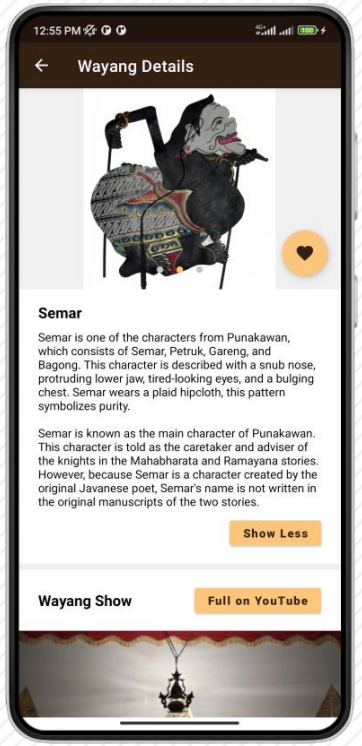
Wayang is designated by UNESCO as a Masterpiece of Oral and Intangible Heritage of Humanity. But most of the people nowdays don't give too much attention on wayang and its story, so we want to maintain its preservation by improving people engagement with wayang through this app.

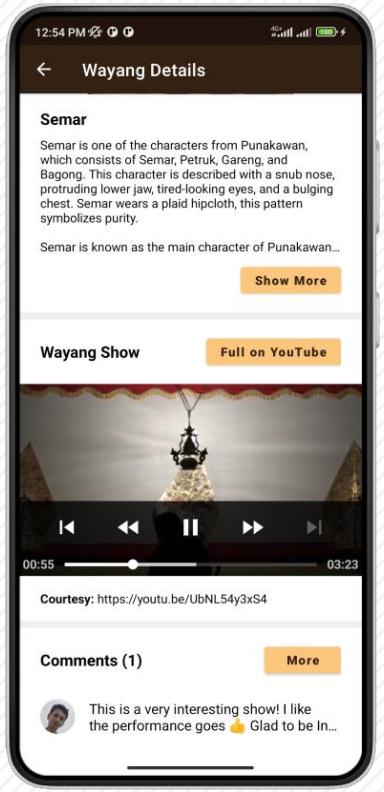
WACAYANG ADVANTAGE

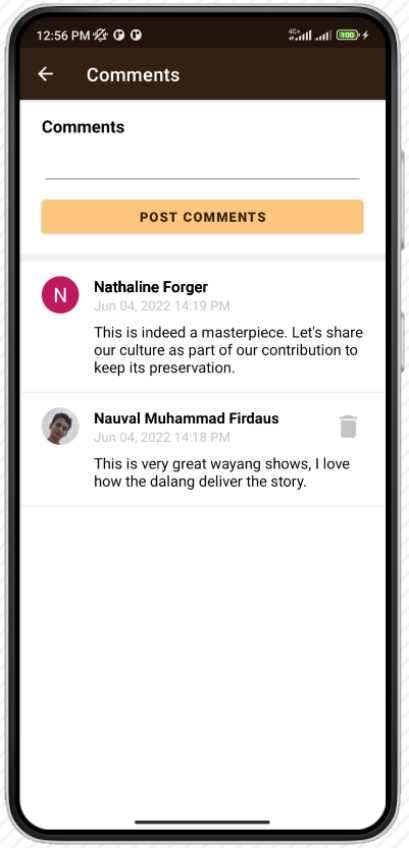
Wacayang provide information to let user easily get to know about the wayang through image classification, they can see wayang image, story literature, and relevant wayang shows from local Indonesian wayang puppeteer.

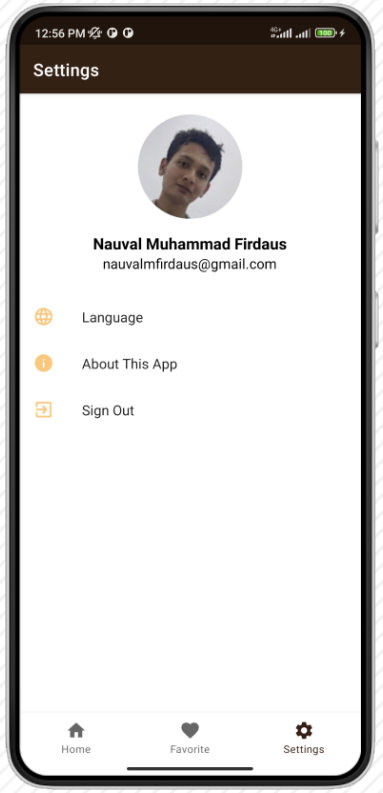












SCREENSHOT WACAYANG APP

TARGET MARKET

AGE

6 – 64 YEARS OLD

PROFESSION

ALL PROFESSION

ROLES

- ANDROID USER
- TOURIST

TARGET MARKET NEEDS

Purpose-driven	Data-driven	Government reasoning	Relevant Stakeholder
To make people easily recognize wayang characters.	Well documenting wayang kulit information	Improve tourism gained	Government
Popularize wayang as part to maintain its preservation.		Help preserving one of Indonesia's cultural art form	Indonesian People
Popularize puppeteer and their wayang shows.			Wayang Tourism Indostries

ROADMAP

	Commercial Value	Business Oportunity	Demand and Supplies	Technology Advantage
Q1 & Q2 (month 1-6)	- Make a model that able to Classify certain wayang kulit	- Finding business owner or company to further develop the app - Adding advertisement to app - Conducting market research to understand user demand	- Increase server quota for daily active user - Adding more wayang kulit variant to the database - Advertising product around local pagelaran wayang spot	- Improving apps based on user feedback
Q3 & Q4 (month 7-12)	- Make a model that able to classify most of wayang kulit that exist	- Create in app marketplace to buy or sell wayang	- Further increase server quota for daily active user - Further expand marketing to reach a larger audience	- Further develop machine learning model to be able to self learn from user image input -

ROADMAP

	Science Breakthroughs	Tackling Bigger Problems	Benefits for long term	Indirect Effect
Q1 & Q2 (month 1-6)	- Creating machine learning based classification model	- Expanding classification model to be able to classify all of the wayang kulit character - Research on making more secure app	- Improving UI/UX quality - Create a IT risk management plan to identify potential risk in the future	- Improving tourism quality especially in wayang kulit theatre
Q3 & Q4 (month 7-12)	- Developing advance model for more complex environment	- Expanding classification model to be able to classify other type of wayang	- Create a plan to further expand classification limit - Researching on a potential technology to help increase app efficiency	- Increase public knowledge about wayang

POSSIBLE PILOT ON THE NEXT 6 MONTHS

TIMELINE	BUDGETING	ROLES
July	$1.500 / Rp 21.000.000	**IT Developer, Marketing, Manager**
August	$831 / Rp 12.000.000	
september	$1.250 / Rp 17.500.000	
October	$500 / Rp 7.000.000	
November	$346 / Rp 5.000.000	
December	$693 / Rp 10.000.000	
Total	$5120 / Rp 72.500.000	

PROJECT MILESTONE FOR 2022

JULY

- Deploying product
- Monitoring for issue on the product
- Market research
- Promoting newly released product

AUGUST

- Fixing any issue found post deployment
- Promoting product to reach larger audience
- Measure customer satisfaction through app review feedback

SEPTEMBER

- Improving UI/UX based on feedback to increase user satisfaction
- Adding revenue stream

OCTOBER

- Create MOU with relevant company and/or organization

DECEMBER

- End year performance review
- Adding more resources such as infrastructure and human resource
- Reach 10.000 app users

Budgeting - USD 5k / IDR 70m

Category	Proportions (max)	Budget (max) in USD
Team Salary	25%	$1.250 / Rp 17.500.000
Research / Operational 1.Google Cloud Platform 2.Legality, Copyright Registration 3.Data Gathering 4.Research and Development 5.Validation and Evaluation 6.MSME Segment Profilling 7.Other Expanses/Tax	75%	$3.750 / Rp 52.500.000
Total		$5.000 / Rp 70.000.000

Budgeting - USD 10k / IDR 140m

Category	Proportions (max)	Budget (max) in USD
Infrastructure	40%	$4.000 / Rp 56.000.000
Additional Budget for Team Salary	25%	$2.500 / Rp 35.000.000
Additional Budget for Research/Ops	10%	$1.000 / Rp 14.000.000
Market research and competitive analysis	5%	$500 / Rp 7.000.000
Future Development / R&D	15%	$1.500 / Rp 21.000.000
Other Expenses (taxes, reserves)	10%	$1.000 / Rp 7.000.000
Total		$10.000 / Rp 140.000.000

SUSTAINABILITY

Sources of Income

1. In app advertising.
2. Donation.
3. Funding ($5.000)

Efficiency Priority

This list is sorted by highest to lowest priority :

1. Running with bare-minimum operations.
2. Find appropriate services and third-party vendors for the project scale.
3. Marketing campaign for product through social media.
4. Improving user experience through research and development.

BUDGETING EXPECTATION

5K Funding

- Expected Runway: 6 Months
- Expected Headcount: 5 People
- Market Positioning : Differentiation
- Assets:
  - Mobile apps
  - Knowledge/ Trained person
  - Intelectual Property
  - Data

10K Funding

- Expected Runway: 1 Year
- Expected Headcount: 7 People
- Market Positioning : Differentiation
- Assets:
  - Mobile Apps
  - Coworking Space
  - Knowledge/ trained person
  - Intelectual Property
  - Data

Thank You

C22-PC383

GitHub:

https://github.com/Wacayang-Bangkit-2022