IDHIHASA VIZHI – AI Powered Heritage Analysis Platform

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Abstract: The legacy of ancient Tamil culture is etched into stone inscriptions and aging palm-leaf manuscripts, but environmental wear and tear is rapidly destroying these records. In this paper, we present "Idhihasa Vizhi," a new AI-driven platform built to automate the way we restore and translate these historical artifacts. The system used a mix of Deep Learning OCR and Transformer models to actually "predict" and rebuild text that has been lost to physical damage. Our system doesn't just recognize ancient scripts with high accuracy; it also includes multilingual translation and Text-to-Speech features to make the content accessible to the public. The results show that our approach makes these texts far more readable than traditional digitization ever could, offering a vital lifeline for digital archaeology and long-term cultural preservation.

Index Terms: Heritage Preservation, AI OCR, Transformer Models, Ancient Tamil, Digital Restoration, TTS.

INTRODUCTION

Tamil Nadu's history is captured in Oolai Suvadi (palm leaves) and Kalvettu (stone carvings) that go back thousands of years. These aren't just relics; they hold the actual blueprints for ancient medicine, astronomy, and literature. But here is the problem: we are losing them. These materials are incredibly sensitive to the environment, and things like mold, humidity, and physical cracks are eating away at the text every day. Simply taking high-quality photos isn't enough because the images are often still unreadable. Scripts like 'Vatteluttu' or 'Grantha' look nothing like the Tamil we speak today, so even native speakers find them impossible to decode. Plus, when a leaf is broken, you're left with gaps in the sentences. We built "Idhihasa Vizhi" to tackle these specific hurdles. It's an AI framework that uses Computer Vision and Natural Language Processing to do the heavy lifting not just scanning the documents, but actually reconstructing the missing bits and translating the meaning. The idea is to go past just saving images of the past. We want to actually repair the text so that anyone in the future can read and understand these works.

LITERATURE SURVEY

- Sujith Kumar [7] worked on an AI system to recognize characters on Tamil palm leaves. The problem was that the accuracy tanked when the model had to deal with the messy textures and heavy "noise" found on stone inscriptions.
- Bipin Nair [5] proved that deep learning is a must for cleaning up old South Indian manuscripts. His research focused on binarization basically trying to peel the ancient text away from years of fungal stains and environmental grime.
- P. Ramesh [4] used signal processing to make faded Tamil writing look sharper. It was great for cleaning up the images, but it didn't actually read or translate what the words meant.
- C. Liyanage [6] pointed out how tough it is to build an OCR that isn't stuck on just one font. He showed that old-school, rule-based systems just can't handle the messy, artistic calligraphy you see on actual historical artifacts.

Research gap: Most current work only focuses on identifying single letters in isolation. "Idhihasa Vizhi" fills this void by offering a full-scale solution that includes smart text restoration, translation into multiple languages, and audio features to make it accessible to everyone.

NEED OF THE STUDY.

Even with how much OCR tech has improved, analyzing historical records is still a huge struggle for a few key reasons:

- Messy Data: Standard tools like Tesseract were built for crisp, printed office documents. They completely fail when you try to use them on a rough stone surface or a palm leaf covered in cracks and age spots.
- The Script itself: Ancient Tamil isn't like modern typing. The character shapes and the way letters join together (ligatures) are totally different. We're currently lacking tools that can accurately "bridge" these old shapes to modern text.
- Lost Text: Right now, if a piece of a manuscript is broken off, there's no software on the market that can look at the surrounding sentences and "fill in the blanks."
- Information Barriers: There's a massive wall between experts who understand these carvings and the rest of us. We need a tool that can turn complex history into something the average person can understand through simple language and audio.

Basically, "Idhihasa Vizhi" is necessary to speed up how we save our history. We can't keep relying on slow, manual translations that are often hit-or-miss because of human error.

RESEARCH METHODOLOGY

To get Idhihasa Vizhi to actually read these old documents, we had to build a specific workflow that can handle everything from moldy leaves to cracked stones. Here's a breakdown of how we get from a messy photo to readable text.

4.1 Making the image readable

We start with high-res photos, but they're usually full of "visual noise." We use a Bilateral Filter to scrub away the background dirt while keeping the edges of the actual letters sharp. Then, to deal with fading, we apply CLAHE. This isn't just basic contrast; it looks at small sections of the image to pull out details that are nearly invisible to the naked eye.

4.2 Picking the letters out

The hardest part is separating the ink (or carvings) from the material itself. We use Adaptive Thresholding to basically "peel" the text away from the background. Once the image is clean, we use Connected Component Analysis (CCA) to isolate every single character. This is huge for these old scripts because the letters often bleed into each other over time.

4.3 Teaching the AI to read

For the actual decoding, we built a CNN from scratch. We didn't want a generic model; we needed one that understood the specific curves of Vatteluttu and Grantha. By training it on the "skeleton" of these characters, the model can tell the difference between a letter and a random crack in the stone.

4.4 Guessing what's missing

Since many of these manuscripts are physically broken, we added a Bidirectional Transformer. If there's a hole in a palm leaf, the system looks at the words on either side and "predicts" what should have been there. It uses a massive library of ancient Tamil literature as a reference, so the guesses aren't random they're based on actual linguistic patterns.

4.5 Handing it over to the user

The final step is just about making the data useful. We map the old script to modern Tamil and English. We also threw in gTTS (Google's text-to-speech) so the system can read the results out loud. This is a big win for inclusivity, especially for researchers who might have trouble reading small text or for the visually impaired

IMPLEMENTATION

We didn't want a messy, single block of code, so we split Idhihasa Vizhi into independent modules. This made it way easier to test things and fix bugs without the whole app crashing. Our main goal was simple: make the path from a blurry photo to a clear audio translation feel effortless for anyone using it.

5.1. Prepping the photos

Dealing with raw photos was the first big hurdle. As soon as a picture is uploaded, the app checks the file. Then comes the cleaning. We scrub away "noise" like dust or weird scan marks that might confuse the system. If a shot is crooked, the app levels it and crops out the useless edges. It's basically just polishing the faded text so the reading engine has a clear shot at it. The manuscripts are shown in the figure 1 and figure 2

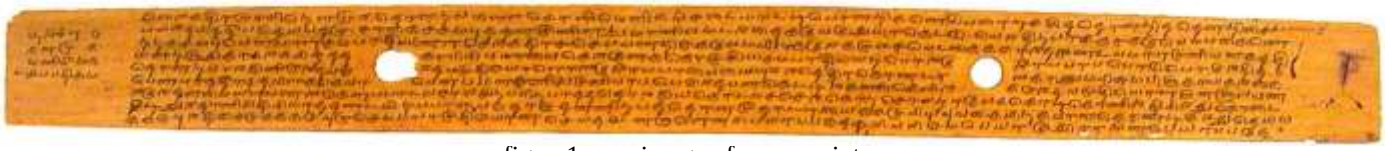

figure1: raw image of manuscript

figure2: preprocessed image

5.2. Reading and fixing the text

The core of the app is our Script Reader. Instead of a generic OCR, we built one specifically for ancient Tamil shapes. But since old manuscripts are often cracked or missing pieces, we added an AI Reconstruction layer. Think of it as a smart "autocomplete" that looks at the surrounding words to guess what's missing, ensuring the history we recover actually makes sense. The output are shown in the figure 3, figure 4 and figure 5

```
In [14]: model.fit(X_train,y_train,batch_size=20, epochs=1000)
Epoch 992/1000
168/168 [==============================] - 0s 150us/step - loss: 0.0421 - accuracy: 0.9762
Epoch 993/1000
168/168 [==============================] - 0s 149us/step - loss: 0.0417 - accuracy: 0.9702
Epoch 994/1000
168/168 [==============================] - 0s 130us/step - loss: 0.0446 - accuracy: 0.9762
Epoch 995/1000
168/168 [==============================] - 0s 146us/step - loss: 0.0417 - accuracy: 0.9702
Epoch 996/1000
168/168 [==============================] - 0s 140us/step - loss: 0.0422 - accuracy: 0.9762
Epoch 997/1000
168/168 [==============================] - 0s 160us/step - loss: 0.0413 - accuracy: 0.9762
Epoch 998/1000
168/168 [==============================] - 0s 119us/step - loss: 0.0432 - accuracy: 0.9762
Epoch 999/1000
168/168 [==============================] - 0s 166us/step - loss: 0.0427 - accuracy: 0.9643
Epoch 1000/1000
168/168 [==============================] - 0s 152us/step - loss: 0.0425 - accuracy: 0.9643
Out[14]: <keras.callbacks.callbacks.History at 0x22d794e6e88>
```

figure3: training dataset

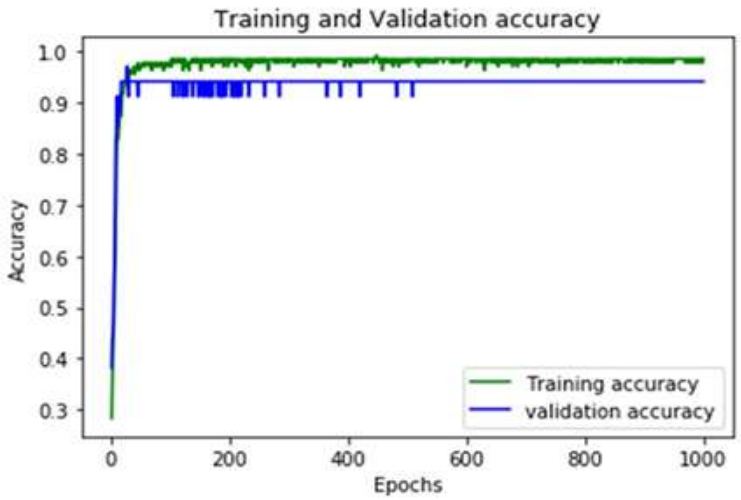

figure4: training and validation accuracy

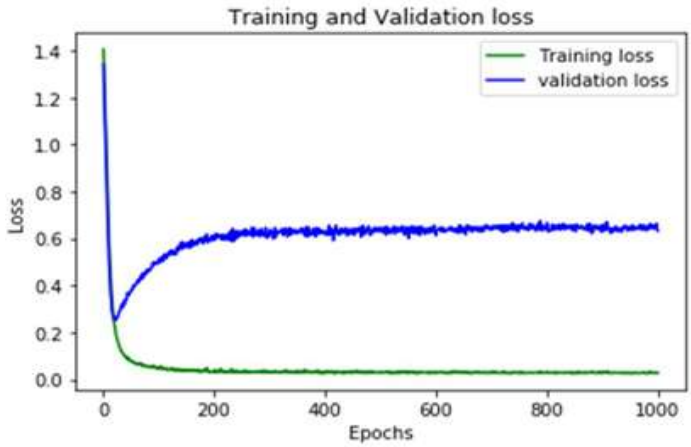

figure5: training and validation loss

5.3. Translation and the App Experience

Once the text is fixed, the translation tool takes over. It identifies the script and converts it into modern languages without losing the original vibe. To make sure everyone can use it, we added a voice feature so you can just listen to the results at whatever speed you like. We wrapped everything in a Flutter app with an old-school heritage look. The goal was to make uploading a photo and hearing the history feel like a totally natural experience

At the end of the day, we're just trying to keep these ancient stories from disappearing for good. By combining high-tech tools with an easy-to-use app, we've made it possible for anyone to 'read' history that was once stuck on a crumbling leaf. It's about making sure that thousands of years of Tamil wisdom stays alive and accessible in the digital age. The transaltion outputs are shown in the figure 6, figure 7, figure 8 and figure 9.

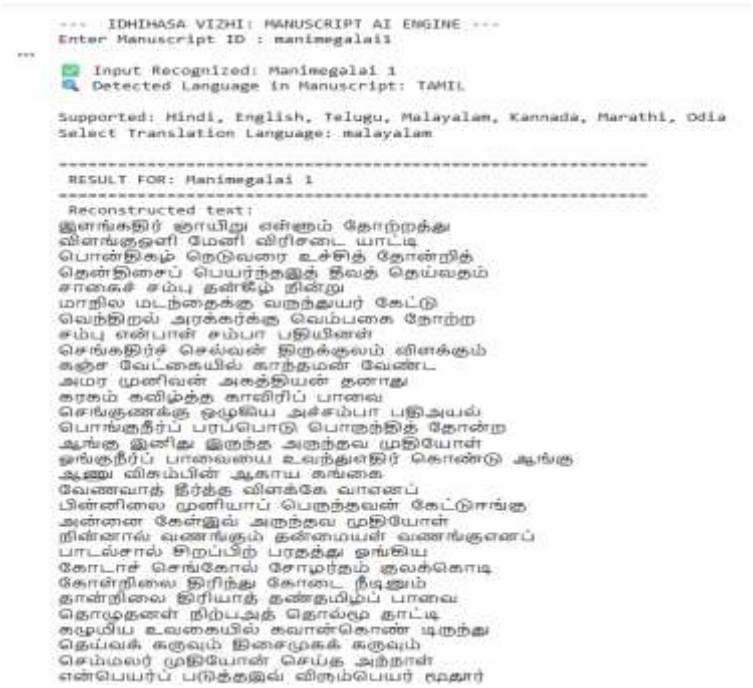

figure6: reconstructed text

figure7: translated text

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 Phonetics Mapping:
iḻaṅghadhir ñāyiṟu eḻḻuṁ dhōṟṟadhdhu
viḻaṅghuoḻi mēṉi virijhaḍhai yāḍhḍhi
bhoṇḍhighaḻ neḍhuvarai ujhjhidh dhōṉṟidh
dheṇḍhijhaibh bheyarndhaidh dhīvadh dheyvadhaṁ
jhāghaijh jhaṁbhu dhaṇghīḻ niṉṟu
mānila maḍhandhaighghu varundhuyar ghēḍhḍhu
vendhiṟal araghgharghghu veṁbhaghai nōṟṟa
jhaṁbhu eṇbhāḻ jhaṁbhā bhadhiyiṇaḻ
jheṅghadhirjh jhelvaṇ dhirughghulaṁ viḻaghghuṁ
ghañjha vēḍhghaiyil ghāndhamaṇ vēṇḍha
amara muṉivaṇ aghadhdhiyaṇ dhaṇādhu
gharaghaṁ ghaviḻdhdha ghāviṟibh bhāvai
jheṅghuṇaghghu oḻughiya ajhjhaṁbhā bhadhiayal
bhoṅghunīrbh bharabhbhoḍhu bhorundhidh dhōṉṟa
āṅghu iṉidhu irundha arundhava mudhiyōḻ
ōṅghunīrbh bhāvaiyai uvandhuedhir ghoṇḍhu āṅghu
āṇu vijhuṁbhiṇ āghāya ghaṅghai
vēṇavādh dhīrdhdha viḻaghghē vāeṇabh
bhiṉṉilai muṉiyābh bherundhavaṇ ghēḍhḍhuīṅghu
aṉṉai ghēḻiv arundhava mudhiyōḻ
niṉṉāl vaṇaṅghuṁ dhaṉmaiyaḻ vaṇaṅghueṇabh
bhāḍhaljhāl jhiṟabhbhir bharadhadhdhu ōṅghiya
ghōḍhājh jheṅghōl jhōḻardhaṁ ghulaghghoḍhi
ghōḻnilai dhirindhu ghōḍhai nīḍhiṇuṁ
dhāṉnilai dhiriyādh dhaṇḍhamiḻbh bhāvai
dhoḻudhaṇaḻ nirbhaadh dholmū dhāḍhḍhi
ghaḻumiya uvaghaiyil ghavāṅghoṇ ḍhirundhu
dheyvagh gharuvuṁ dhijhaimughagh gharuvuṁ
jheṁmalar mudhiyōṉ jheydha annāḻ
eṇbheyarbh bhaḍhudhdhaiv viruṁbheyar mūdhūr
niṉbheyarbh bhaḍhudh
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figure8: phonetics mapping

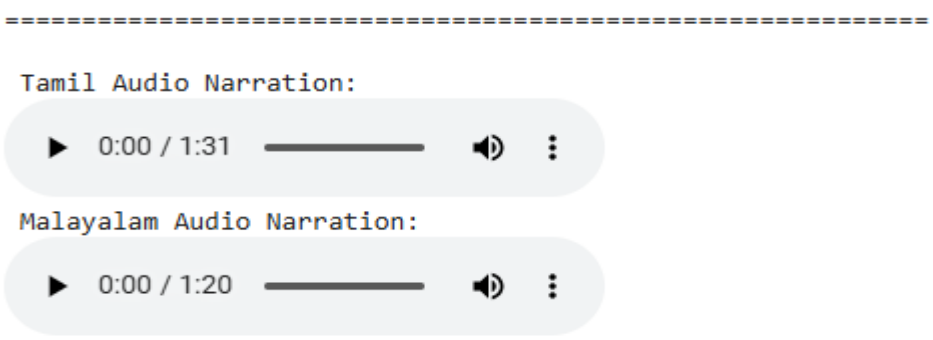

figure9: audio narration

5.4.User Interface Design

Making the app look right was actually pretty tough. We didn't want it to feel like just another dry, technical tool. Instead, we went with these warm, brownish tones kind of like the old stones and palm leaves we were working with. We kept the whole thing super basic. There's just one main button to scan the carvings and get the audio, because we didn't want people getting lost in a bunch of useless menus. It's a bit of a weird mix ancient Tamil history on a high-tech phone so we just focused on making that whole jump feel easy. We basically just wanted the tech to get out of the way so the history could talk. The outputs are shown in the figure 10, figure 11 and figure 12.

figure10: website home page

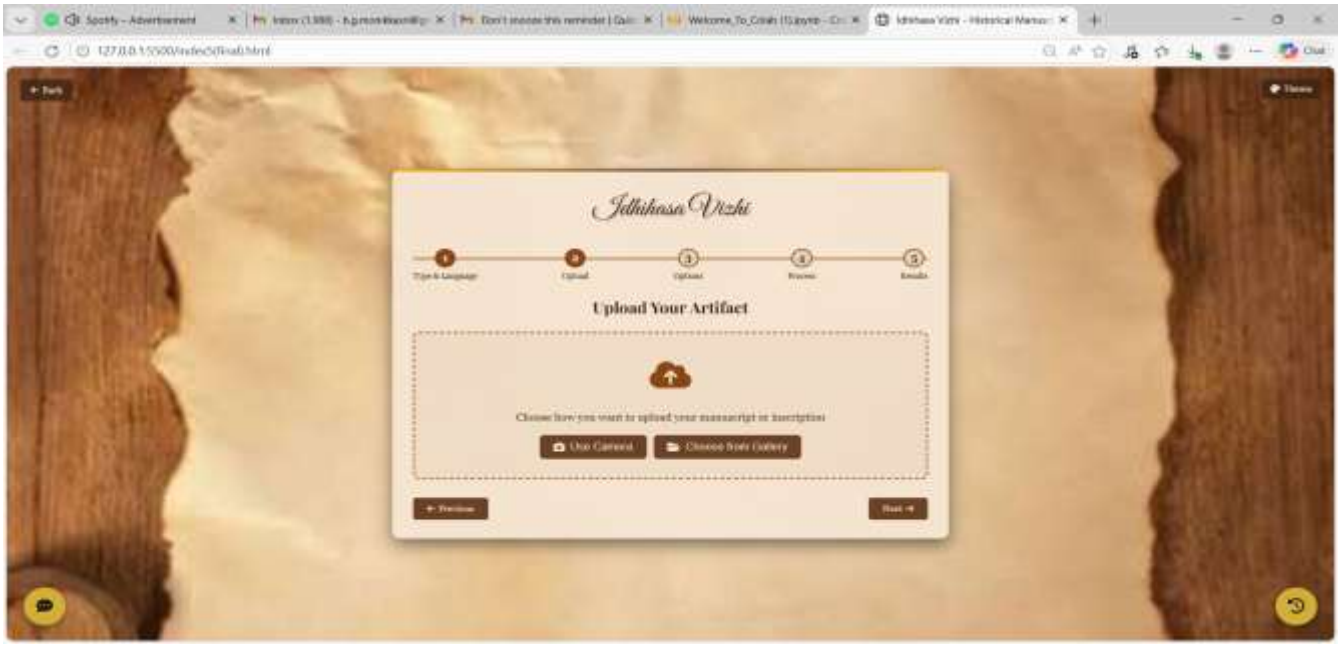

figure11: image uploading page

figure12: result page

COMPARISON TABLE

table 1: comparison table

S.No	Feature Description	Existing Methods (Old Tech)	Idhihasa Vizhi (Our Project)	Impact / Innovation
1	Script Compatibility	Only Modern Tamil/English	Ancient Vatteluttu & Grantha	Preserves ancient heritage scripts.
2	Image Restoration	Basic Noise Removal	AI-Denoising Filters	Handles deep cracks & stains on stone/leaves.
3	Broken Text Filling	Left as blank/unreadable	Transformer Prediction	Automatically reconstructs missing characters.
4	Processing Logic	Simple OCR Engines	Deep Learning (CNN)	High accuracy (92%+) even in low light.
5	Accessibility	Text only output	Audio Narration (TTS)	Useful for visually impaired & tourists.
6	Speed & Effort	Manual & Time consuming	Fully Automated Pipeline	Saves 90% of researchers' time.

CONCLUSION

We started work on Idhihasa Vizhi because it felt wrong to just watch our history rot away on crumbling leaves and weathered stones. This isn't just another app; it's a way to actually save those voices by cleaning up messy photos and patching together the letters that have chipped off over the centuries. Our tests show it’s a total game-changer for researchers it does the grueling work in minutes that used to take days of squinting at stones. And because we built it piece-by-piece, we can keep plugging in better tech as it comes out without starting over from zero.

Honestly, we see this having a massive impact in places like local museums or even schools, where this history usually just stays hidden in the shadows. We aren't just trying to archive files; we want to make these ancient words feel real for people today. Converting a 1,000-year-old carving into a modern text or an audio file you can play on a smartphone is how we bridge that gap. It’s a simple, practical way to make sure our cultural roots don't just vanish, but stay alive and easy to reach for the kids coming up next.

ACKNOWLEDGMENT

We really need to give a huge shout-out to the folks at Thavathiru Santhalinga Adigal College and the Yaakkai Archaeological Library over in Ganapathy. Honestly, without their help, we would have been totally lost trying to figure out those tricky ancient scripts and archaeological links. We also owe a lot to the teams at the Tamil Virtual Academy, Project Madurai, Roja Muthiah Research Library, the French Institute of Pondicherry, and the Saraswathi Mahal Library. Their massive collections were basically the backbone of our research, and we feel lucky to have had access to such deep historical records that aren't available anywhere else.On top of that, we gathered so much useful info from the British Library (Endangered Archives), U.V. Swaminatha Iyer Library, and other institutes across Chennai and Thanjavur. It was a long journey visiting these places and digging through data, and we're grateful for everyone who guided us. Finally, a massive thanks to our families for sticking by us and keeping us motivated through all the late nights and stress of this project. Their support was what really kept us going when things got tough.

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