

# Use of Block Chain and Artificial Intelligence in Trading of Cars

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**Abstract:** People have trouble trading because of the rise in demand for purchasing and selling second hand cars. Therefore, it is necessary to remove the middleman from the process and make it simpler by developing a virtual interface. There are occasions when purchasing a used car falls short of our expectations in terms of price, color, model, personalization, etc. In addition to calculating the price of vehicles being sold, this research paper presents an outline of how such an interface will allow people to satisfy the aforementioned expectations. The suggested study integrates artificial intelligence and blockchain technologies.. The dataset was used, which included variables like selling price, driving distance, mileage, etc. During data processing, redundant and missing values are eliminated. The model is trained using the supervised learning method K-Nearest Neighbours, and it predicts the vehicle's selling price with an accuracy of about 95%. Here, data security is crucial, hence the suggested solution implements Block chain to guarantee it while also maintaining data openness. Data dependability is improved because of something akin to an immutable ledger.

**Keywords:** Artificial Intelligence, Machine Learning, Natural Language Processing, Block chain, Meta Mask, Nearest-Neighbours, Cosine, React JS, Flask, React-Router, Cors, Hardhat, Ethers, Solidity, Smart Contracts, Web3, Remix-IDE, Visual Studio Code, Jupyter Notebook, Python, Tailwind CSS, Chat bot, Sentiment Analysis, IPFS.

## I. INTRODUCTION

People in today's thriving period obtain support in carrying out a variety of daily complex and time-consuming duties thanks to the introduction of numerous technologies like Artificial Intelligence, Machine Learning, Block chain, etc. Numerous industries, including healthcare, education, defence, automation, finance, etc. are implementing these technologies. The aforementioned technologies can be applied to these industries as well as others to address a number of issues arising in the used automobile trading industry. The automobile sector, which is continually changing and has a large impact on the world economy. This industry is expanding as a result of rising vehicle demand as well as improvements in automobile production and design technology. The distribution and exchange of vehicles between manufacturers, dealers, and consumers is made possible through the trading of vehicles, which is a critical component of the automotive industry. Due to an overabundance of dealerships and websites that provide comparable services across numerous markets, the car trading industry currently faces a problem of oversaturation. Due to the fierce competition that has resulted, many businesses in the industry are no longer profitable. The goal of this research study is to examine the present trends, obstacles, and opportunities in the car trade business. The report will also look at how changes in technology and other external factors have affected the market for trading in vehicles.

This research paper will offer important insights into the automobile trading business and its possible future developments through a careful analysis of the available literature and data. The primary goal is to combine the aforementioned technologies in a way that facilitates vehicle trading and makes solutions more durable and scalable.

## II. RELATED WORK AND COMPARISON

Due to the growth of online marketplaces like Car Dekho, Quikr, Car wale, and Cars24, it is now necessary for both the buyer and the seller to have a better understanding of the trends and patterns that determine the value of used cars on the market.

The AI and Blockchain technologies have been used in a variety of ways. Price Prediction System, Sentiment Analysis, and Recommendation System are a few examples of AI applications. The price prediction model is typically implemented using supervised machine learning techniques like linear regression, KNN, Random Forest, XG boost, and Decision trees [1], but in the proposed research, artificial neural networks are used to implement the price prediction, which will help to increase its accuracy. The combination of the aforementioned implementations, which were created utilizing various technologies, sets the suggested solution apart from others already available on the market. Similar to this, the Blockchain technology offers a number of applications for offering data and transaction security. Additionally, the data on the blockchain is unalterable and transparent. The data and transactions can be tracked through an ever-expanding chain of blocks that also includes the timestamp of each interaction with that particular block. Only crucial info is kept on it. The network does not contain a central database where information about everyone can be accessed. Everyone has the right to own their data.

**III. IMPLEMENTATION**

From the user's point of view, this project can be divided into three sections: buy, sell, and customize. Any user accessing the web interface for the first time must log in using one of the authentication options. Any of the various authentication methods, such as Meta Mask, can be employed in this situation because blockchain technology is being used in this project. Meta Mask is to be connected to the web interface by users to perform various operations related to transactions.

In addition to the fact that blockchain is a new and rapidly developing technology, a chatbot has been deployed to improve the user experience and make it easier for users to navigate the website. It is a convenient way to access the functionalities that the website or the web interface is providing.

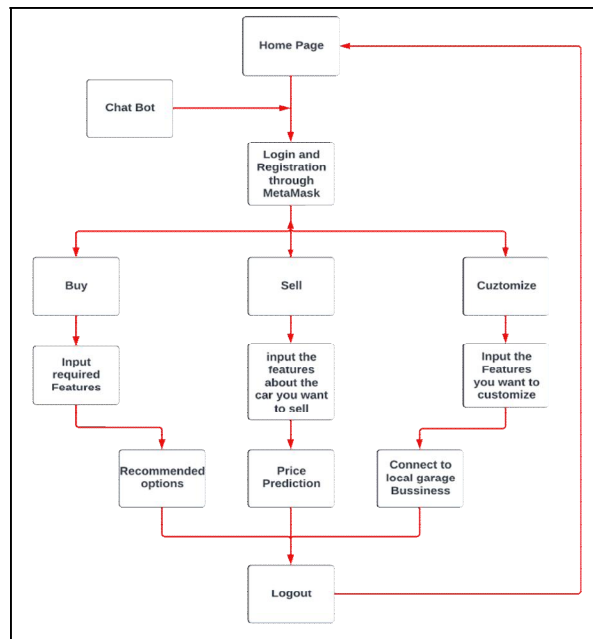


Fig. 1. Structured flow of the proposed project

- Buy: When a user chooses to buy a vehicle, he or she can add characteristics that meet their requirements. Content-based recommendation systems provide car recommendations to users based on the qualities they have entered. The content-based recommendation system is implemented using the technique of nearest neighbors with cosine distance. The sentiment analysis is used for the automated process of understanding the sentiment or opinion from the review of customers. NLP is used for the analysis of sentiments from reviews.

- **Sell:** When a user chooses the option to sell an automobile, the user is allowed to add characteristics, and the price of the car is estimated based on those features. In this study, the artificial neural networks with higher than 95% prediction accuracy are used to perform price prediction of the car with particular specifications

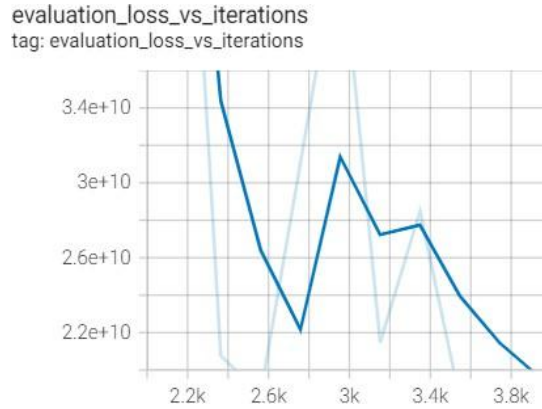


Fig. 2. Evaluation loss vs iteration graph for price prediction

Figure 2 represents the plot between the evaluation loss and iteration in neural networks used for prediction of price.

- **Customize:** When a user selects the option to personalize a vehicle, the user is free to tell the application whatever characteristics he or she wants to add to the vehicle. Based on the user's location the application creates a connection between the user and the nearby garage company for customizations based on his/her need.
- **ChatBot:** A chatbot powered by artificial intelligence can be made available on the user interface to assist them. By simulating human conversation, it can assist in comprehending customers' inquiries and providing appropriate responses [6]. The chatbot can respond to frequent queries posed by users based on an intent and target-based text file.

As was previously mentioned, the proposed project can be broken up into three sections: Blockchain, Web Interface, and Artificial Intelligence.

implemented the transferring functionality to transfer the ownership of the car (in short to sell). Navbar, Footer and other UI components are implemented to provide the seamless user experience to the user.

In addition to React JS, we are using Flask as an independent framework to connect our various AI models to frontend, allowing us to integrate machine learning and deep learning capabilities into our platform. Which helps to provide personalized recommendation, predictions based on user inputs, making it easier to find a perfect car for them.

As shown in Fig.3, this project integrates several technologies, including AI/ML, blockchain, and web technologies, to increase the efficiency of the car trading market.

**Web Interface:** The ability to interact with software and other content running through a web browser is provided by a web user interface. A point of contact between human users and the computer system itself is the interface. The adoption of cutting-edge technologies such as React JS, Flask, and Blockchain is revolutionizing the way we develop online interfaces. Our ground-breaking platform makes use of React JS (React is a component based UI framework used to build seamless user interfaces in java script.) as the frontend framework to deliver a seamless user experience that is both intuitive and captivating, keeping users engaged and improving their experience. The frontend is finished using a variety of npm packages or dependencies, including react-router, axios, cors, etc. In react we are dividing the app into different components which are integrated into a single component. The components are divided based on their functionality and data, like Navbar, Buy functionality, Sell functionality, Footer and other UI components etc. And again these components are further divided into sub-components to make the components reusable

In Buy functionality has a separate route where Recommendation System is implemented to recommend the cars based on the user specifications. Additionally, the individual car information is also linked with the recommended cars where it will provide complete information about that specific car (including image).

Sell functionality also has a dedicated route where Price Prediction System is implemented to predict the price of a specific car based on its specifications. It accurately predicts the on road price of the car specified. Here we also have Flask is an excellent framework for building web applications and APIs that require integration with machine learning models. Our platform leverages Flask to connect our recommendation and price prediction systems to the frontend, providing a seamless user experience that offers personalized recommendations and accurate pricing information.

Our recommendation system uses advanced machine learning algorithms to analyze user data and provide tailored recommendations for cars that match their preferences and needs. Flask allows us to integrate this recommendation system with the frontend, making it easy for users to access and use.

In addition, Flask also connects our price prediction system to the frontend, which uses historical data and deep learning models to accurately predict the price of a car based on its features, condition, and other factors. This provides users with valuable pricing information, allowing them to make informed decisions about buying and selling cars.

The integration of these systems using Flask is seamless, reliable, and efficient. Flask's flexibility and scalability make it an ideal choice for connecting complex deep learning models and the frontend, providing users with an exceptional experience that is both personalized and accurate.

Our platform is built on the blockchain technology, which is used in backend, which provides unmatched security and transparency. By using blockchain as backend we can ensure that all user data and transaction are safe, secure and immutable

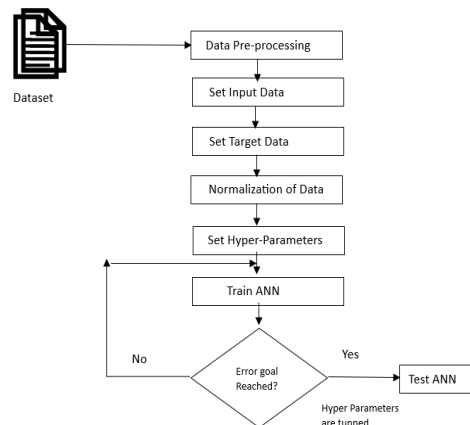
Artificial Intelligence: The price prediction model can be developed by using the technology of artificial neural networks so that the prediction of the car price can be done more accurately [3]. The creation of ANN model for the prediction of price is as shown in the figure 3.

For the recommendation system there are many approaches to build a system according to one's need like Collaborative Filtering, Content based Recommendation Systems, Hybrid Systems, Artificial Neural Networks, Swarm Intelligence, Evolutionary Computing, Fuzzy Sets, etc. [4]

nearest neighbor technique where the nearest distance can be calculated by various ways like Euclidean Distance, Manhattan distance, Minkowski Distance, etc

To build a content-based recommendation system for car trading, you can follow these steps:

1. Data Collection: Collect data on cars for sale, including make, model, year, mileage, price, fuel type, transmission, body type, engine size, and other relevant features.
2. Data Preprocessing: It involves dealing with missing values, outliers, and category variables. To make numerical properties similar, they can also be normalized or standardized.
3. Feature Extraction: Extract relevant features from the data that can be used to represent each car, such as brand, model, year, body type, fuel type, engine size, and transmission.
4. Similarity Calculation: Calculate the similarity between each pair of cars based on their features.
5. Recommendation Generation: For each car, recommend other cars that are most similar based on their features.



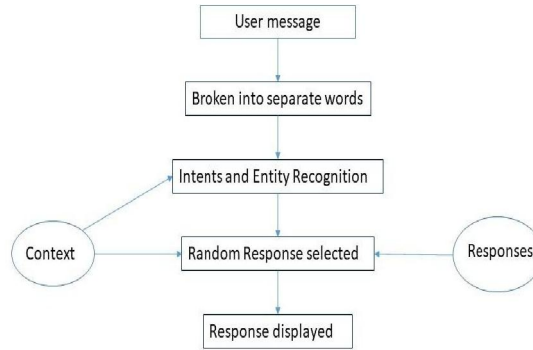


Fig. 4. ANN model for price prediction

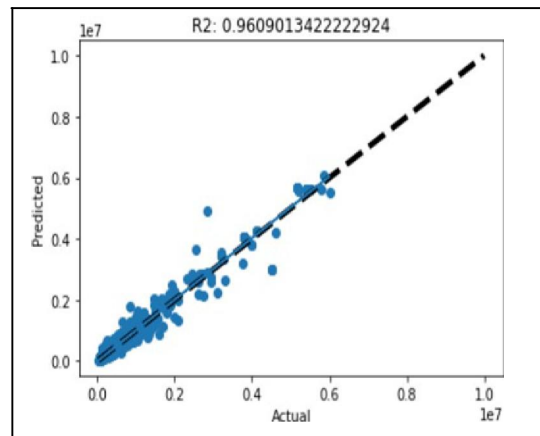


Fig. 5. R2 Plot for price prediction model

Figure 5 represents the R2 score for price prediction model where X-axis represents Actual values and Y-Axis represents the Predicted values. R-squared (R2) is a statistical measure that represents the proportion of variance in the dependent variable that is explained by the independent variables in a regression model.

For this proposed project the content based recommendation technique will be used which can be implemented by the independent variables in a regression model.

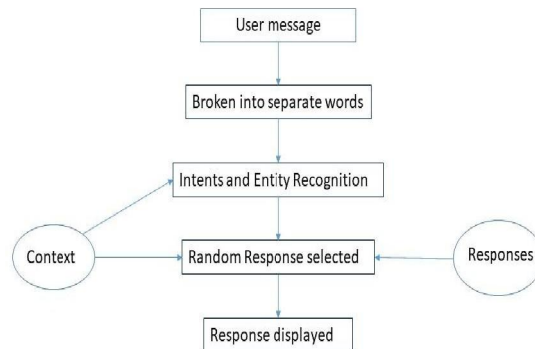


Fig. 6. Flowchart of Chatbot

There can be Artificial Intelligence based chatbot on interface as a support to the user. It can help to understand customer questions and automate responses to them, simulating human conversation [5]. There can be a text file based on which the chatbot answers the common questions asked by the users. The chatbot basically reads the roots of the words using wordNet lemmatizer from the text file. The text file contains the probable questions(patterns) which can be asked by the user and the answers(responses) to those questions. The chatbot model is trained to determine the root

word and to pick the random answers from the text file according to the patterns of questions. Thus the common questions of the user can be answered [10].

AI-based sentiment analysis can be highly beneficial for a car trading website as it can help in understanding the sentiment of the customers towards the different cars and services offered on the website. The sentiment analysis can be done by using the Machine Learning and Natural Language Processing techniques. It can be done by using pre-trained sentiment analysis model or train a custom model on the pre-processed data. Sentiment analysis models use machine learning algorithms to classify the text as positive, negative, or neutral. It involves training a model to automatically classify text data as positive, negative, or neutral. The goal is to identify the sentiment of users towards the car trading platform, its features, and overall experience.

Blockchain: Blockchain is a decentralized, unchangeable ledger that makes it easier to track assets and record transactions in a corporate network. An asset might be tangible (a house, car, money, or piece of land) or intangible (patents, copyrights, branding, and intellectual property). On a blockchain network, practically anything of value may be recorded and traded, lowering risk and increasing efficiency for all parties. The use of blockchain can be divided into two categories: one for data storage, and the other for security and authentication. As was previously mentioned, only specific vital data is maintained on blockchain; therefore, user information is stored so that the past history of used automobiles is retained throughout and is accessible as needed. This aids in lowering fraudulent activities involving the trading of vehicles during transfers. Second, smart contracts are created to make the purchasing and selling of vehicles more efficient. A unique programming language called Solidity is used to create smart contracts [7].

For a seamless functionality of the proposed system, a Vehicle Management Contract is made which includes structure data type, some mappings and various functions that facilitate the working. This smart contract once deployed cannot be altered. This smart contract includes various function which can either set or return the values. The contract also includes a mapping to keep track of the token balances of each address, as well as a mapping to keep track of which addresses are allowed to spend tokens on behalf of other addresses. The contract's functions permit the exchange of tokens between addresses and the authorization of other addresses to spend tokens on behalf of the sender. Additionally, the functions check that the approved addresses are legitimate and that the sender has enough tokens to transfer or approve. Some functions are payable functions. Elaborating this, Payable functions in Solidity are those whose execution includes the handling of ether, the crypto currency used by the Ethereum network. The payable keyword is used in the function signature to declare payable functions. A payment function may accept ether as one of its input parameters when it is invoked. The logic of the function can then make use of this ether to update a contract's state or move it to other accounts, for example.

It's crucial to remember that in order to invoke a payable function, the sender must include a specified quantity of ether in the transaction. The transaction will fail if the sender sends too little or too much ether. Some of the functions include

**add Vehicle:** The owner of the smart contract can add a new vehicle to the inventory using the add Vehicle function. The function collects the vehicle's information, including the make, year, km driven, car number, power, mileage, power etc and stores it in a mapping of the contract owner's vehicles

**Display Vehicles Owned:** With this feature, the smart contract owner can see every car they currently own. All of the vehicles owned by the contract owner are returned in an array by the function.

**Get Balance:** This function allows the users to get the balance of the smart contract in ethers.

**Set Vehicle Price:** This function allows the owner of vehicle to set the price of a vehicle. The function takes in the Vehicle identification number of the vehicle and the price in ethers, and stores it in a mapping of vehicle prices

**Register:** By supplying their name and address, users can register with the smart contract using this method. The function keeps track of the user's information in a mapping of signed-up users.

**Get User Details:** This function allows anyone to get the details of a registered user by providing their address. The function returns the name and address of the user

**Buy Vehicle:** This feature enables users to purchase vehicles directly from contract owners. The function receives the vehicle's identification number and the purchaser's address, transfers ownership of the vehicle to the purchaser, and pays the contract owner.

**Get Vehicles With Price Set:** Anyone can obtain a list of all the vehicles whose prices have been set by the contract owner using the function `get Vehicles With Price Set`. All of these vehicles' identification numbers are returned in an array by the function.

**Transfer Vehicle:** The existing owner of a vehicle may transfer ownership to another user using the `transfer Vehicle` function. The function updates the car's ownership history while transferring ownership after receiving the identification number of the vehicle and the new owner's address.

**Get Vehicle Owner History:** Using this function, anyone can obtain a vehicle's ownership history by entering the identification number. The function provides an array listing every address that has previously owned the car in chronological order.

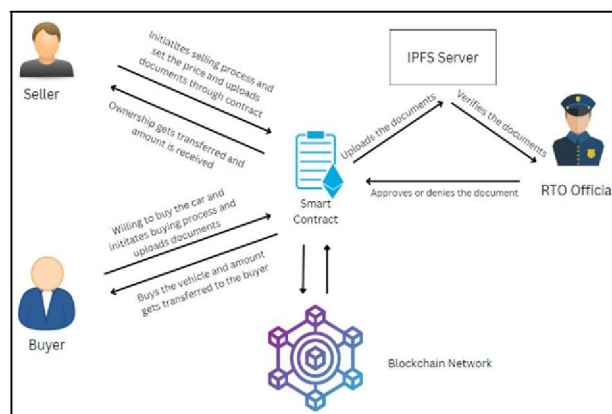
These are some of the fundamental features that must be included in the proposed project in order to ensure that the contract runs well.

Besides these, in order to run the blockchain network, there is a need for some development environment. For the proposed project, we have used Hard Hat as the ethereum development environment. Hardhat is an Ethereum development environment that enables programmers to create, test, and deploy smart contracts on the Ethereum network. It is an open-source programme that gives users a complete environment for creating, evaluating, and implementing smart contracts as well as communicating with the blockchain.

A popular option for Ethereum development, Hardhat offers a number of advantages. Its essential characteristics include:

- **Ethereum Network Management:** Hardhat enables connections to the main net, test nets, and regional test networks for developers.
- **Hardhat offers a strong testing framework** that enables developers to create unit and integration tests for their smart contracts. It has built-in assistance for well-liked testing libraries like Mocha and Chai [8].
- **Several debugging tools**, including a built-in console and a debugger that enables developers to step through their code and analyze variables, are provided by Hardhat for the purpose of examining smart contracts.
- **Management and Deployment:** Hardhat makes it easier to introduce smart contracts into the Ethereum network. Additionally, it offers resources for controlling contract updates and communicating with deployed contracts.

Hardhat comes with a Solidity compiler that lets programmers compile their contracts and produce ABI and byte code.



**Fig. 7 Architecture of Car Trading through Blockchain**

For the proposed project we have used hardhat to locally develop an ethereum network. Firstly the solidity code is compiled and executed. After that the code is deployed to the local blockchain network and hence the contract address is used to carry out various operations.

**Listing the vehicle for sale:** The vehicle owner creates a listing for the vehicle they intend to sell. This includes details about the car's make, model, year, and condition, as well as images and any applicable documentation, such as service records or ownership documents.

**Document Verification:** The RTO verifies the car owner's ownership documentation, which can be done digitally utilizing blockchain technology. The RTO verifies the documentation and generates a digital certificate confirming the car's ownership.

**Smart contract creation:** Once the ownership documents are verified, the car owner creates a smart contract using Hardhat, a development environment for Ethereum. The smart contract contains the sale terms, such as the purchase price, payment periods, and ownership transfer circumstances.

**Storage of the automobile listing:** The car listing is then saved on an IPFS server, which is a distributed file storage system. This ensures that the listing is safely stored and cannot be altered.

**Potential buyer selection:** Potential buyers can then examine the car listing and indicate interest in acquiring the vehicle. To proceed with the purchase, the buyer must meet the conditions specified in the smart contract.

**Smart contract execution:** If a buyer is located and agrees to the terms of the transaction, the smart contract is performed, and monies are transferred from the buyer's account to the seller's account.

**RTO Transfer:** The RTO transfer process can commence once the payment has been confirmed. The smart contract is used to conduct the ownership transfer, which automatically updates the ownership information on the blockchain. Using the previously created digital certificate, the RTO can validate the transfer of ownership.

**Delivery:** The car is finally delivered to the new owner, and the transaction is complete. Because of the utilization of blockchain technology, an IPFS server, and RTO document verification, the entire process is transparent, secure, and immutable. The use of RTO document verification ensures that the car's ownership is legally validated and lowers the possibility of fraud or disputes.

#### **IV. EXPERIMENTAL RESULTS AND ANALYSIS**

The proposed research is divided into three parts i.e. Artificial Intelligence, Blockchain, and Web Interface.

The price prediction using the technology of ANN is trained and tested with the accuracy of 96% which is nearly accurate. The NLP based Chatbot is trained by using a json file. After the performance evaluation of chatbot it seems that chatbot is answering the most of the questions of the user. After the evaluation of the Recommendation system with various ways like Euclidean Distance, Manhattan distance, Minkowski Distance, etc. it is observed that Euclidean distance gives more accurate content based recommendation of cars based on expectations of customers. This research has the potential to be implemented in government systems because a Blockchain-based system for trading cars is necessary for government operations.

#### **V. CONCLUSION**

The need for the manufacture of vehicles rises as the automobile industry expands. Therefore, trade (distribution of vehicles) of automobiles is crucial. Due to the convenience, flexibility, and assurance it provides, online car trading has risen dramatically over the years. The use of artificial intelligence and blockchain can make it simpler for buyers and sellers to research various vehicle varieties and compare them to other vehicles in the same category, giving them more clarity about the vehicle and ensuring they are purchasing appropriate vehicles for them based on their needs. Additionally, it makes it simpler for people to buy the autos online from the convenience of their own homes. The need for the manufacture of vehicles rises as the automobile industry expands. Therefore, trade (distribution of vehicles) of automobiles is crucial. Due to the convenience, flexibility, and assurance it provides, online car trading has risen dramatically over the years. The use of artificial intelligence and blockchain can make it simpler for buyers and sellers to research various vehicle varieties and compare them to other vehicles in the same category, giving them more clarity about the vehicle and ensuring they are purchasing appropriate vehicles for them based on their needs. Additionally, it makes it simpler for people to buy the autos online from the convenience of their own homes.

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