NFTrig: Using Blockchain Technologies for Math Education

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NFTrig is a web-based application created for use as an educational tool to teach trigonometry and block chain technology. Creation of the application includes front and back end development as well as integration with other outside sources including MetaMask and OpenSea. The primary development languages include HTML, CSS (Bootstrap 5), and JavaScript as well as Solidity for smart contract creation. The application itself is hosted on Moralis utilizing their Web3 API. This technical report describes how the application was created, what the application requires, and smart contract design with security considerations in mind. The NFTrig application has underwent significant testing and validation prior to and after deployment. Future suggestions and recommendations for further development, maintenance, and use in other fields for education are also described.

CCS Concepts: • **Computer systems organization** → *Redundancy*; Robotics; • **Networks** → Network reliability.

Additional Key Words and Phrases: Matic, Metamask, polygon, bootstrap5, Solidity

1 INTRODUCTION

The purpose of this report is to describe the technical details involved in the development of the NFTrig application. This includes both the front end website design, the back end smart contract, and NFT creation. It will mainly focus on the technical details of the project outlining software requirements, design through programming languages, client and server side interactions, and validation testing. This allows the reader to undertake further development, fixes, or maintenance of the software, as this forms part of the documentation for the software.

The NFTrig project is based around the creation of a web-based game application that allows interaction of NFTs (non-fungible token) with trigonometric function designs. NFts are digital assets, for example a picture, that has a unique identification and can generally be freely traded with cryptocurrency [33]. Through this application, users are able to purchase digital artwork of many different trigonometric functions and combine them using mathematical operations. Current supported operations include multiplication and division of the trigonometry functions, and the output of each operation is a new NFT card that would be the result of an operation. The old cards will then be removed from the user's possession and burned using the smart contact. For example, if a user combined the two cards Sin(x) and Cos(x) using multiplication, they would lose their two old cards and receive the new card Tan(x). Further, the NFT cards are assigned one of the following rarity levels: common, uncommon, rare, and legendary. The probability of each of these levels is defined later in this report.

The application also allows a user to connect to MetaMask, a digital wallet capable of storing a user's cryptocurrency and NFTs as well as a way to connect to block chain. The NFTrig application

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