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RESEARCH ARTICLE

ONLINE DIGITAL CHEQUE CLEARANCE AND VERIFICATION SYSTEM USING ETHERUM BLOCKCHAIN

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Abstract

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India uses the Cheque Truncation System (CTS), an image-based check clearing system. The semi-manual approach has some drawbacks and can take up to 3 working days in India to clear an inter-bank national check. Due to the shortcomings of this system, commercial banks and cheque users must have access to an effective and secure system that can clear a check in less than 24 hours while maintaining the system's integrity and anonymity. This study presents an automated solution to the aforementioned problems that might be implemented by any commercial bank in India. All banks interested in participating in this framework must connect to the proposed blockchain-based system, which is the foundation of the proposed system.

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Introduction:-

One of the bank reports that is most frequently copied is the cheque. Cheques are the most used non-cash payment method worldwide, worth 96.8 billion USDin 2018 [1]. It takes a lot of effort and time to clear a check. The present check clearing procedure in India is a semi-manual procedure. Through the avoidance of physical delivery and increased system efficiency, the Cheque Imaging and Truncation(CIT) System, which went into operation on May 11, 2006, decreased the amount of time needed for clearing the settlement of cheques.Cheque clearing time was shortened to T+1 with the implementation of the CIT system, where T is the day the clearing house receives the check for clearing and 1 denotes one business day after T, whereas typically it can take up to three working days to complete the procedure. Users of checks and commercial banks need a fast, secure, and efficient method for clearing checks in order to overcome the current lengthy traditional check clearing process.

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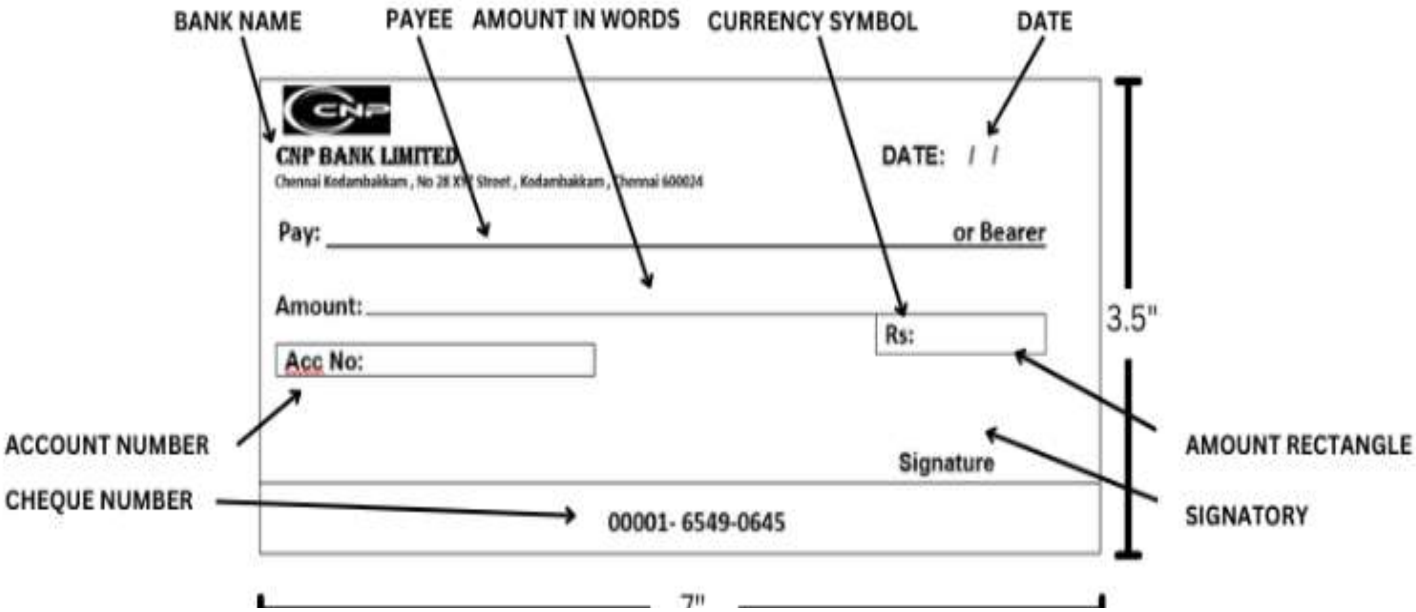

Fig. 1:- Elements of paper Cheque in India

Cheque scams have now become a common occurrence due to technological improvements making them more difficult to detect. In India, dishonest Bank personnel typically differentiate checks using their characteristics. Additionally, many commercial banks make use of hardware instruments based on scanners and software development kits (SDK). These processes are time-consuming and ineffective, making them impossible to implement in any commercial bank.

By creating a secure and efficient system that only requires 5 minutes to clear a check and a mechanism for paper check fraud detection, the proposed system will address the remaining shortcomings of the current CIT-based cheque clearing systems, such as the lengthy process. This has led to the emergence of block chain as a revolutionary technology, and traditional paper checks will be replaced by digital ones.

This study suggests using the CheckMate system to speed up India's commercial banks' check clearing procedures. The system primarily has the following features:

1. A web-based and mobile application for handling the process of detecting fraud and clearing checks.
2. An 80% accurate prediction method for the likelihood and causes of check rejection.
3. A cutting-edge method for validating the handwritten signature and magnetic ink character recognition (MICR) field data on a paper cheque.
4. One-time password (OTP) to validate the person who issued the check.

Background And Litreature Survey

Cheque Clearing Process in India

Once the transaction has been completed, the checks should be cleared. The Indian Cheque Imagine and Truncation System (CITS) was introduced in 2006[2] as depicted in Fig. 2. With the investment of a few partner banks, specifically Hatton National Bank, Commercial Bank, Cargills Bank, Standard Chartered Bank, and NDB, LankaClear Pvt Ltd (LCPL) replaced the previous cumbersome physical cheque clearing framework with an image-based framework, shortening the clearing cycle to the following business day (T+ 1 clearing)

The image-based CITS framework for clearing checks[2] replaced the physical check with electronic data that streamed throughout the clearing operation. LankaClear (Pvt) Ltd uses CITS as part of its connection with the Central Bank of India (CBSL) to expedite the clearance of checks[2]. The purpose of CITS is to recognise the submission of physical checks on CD-ROMs or through direct electronic exchange, along with their pictures and MICR data. In September 2017, LankaClear (Pvt) Ltd[2] gave the interest bank the authority to present the images and MICR data of actual physical checks as a part of improving the security of cheque images during transmission and enhancing the effectiveness of the clearing cycle.With the help of this electronic system, banks are able to immediately begin their clearing and transfer massive quantities of checks.

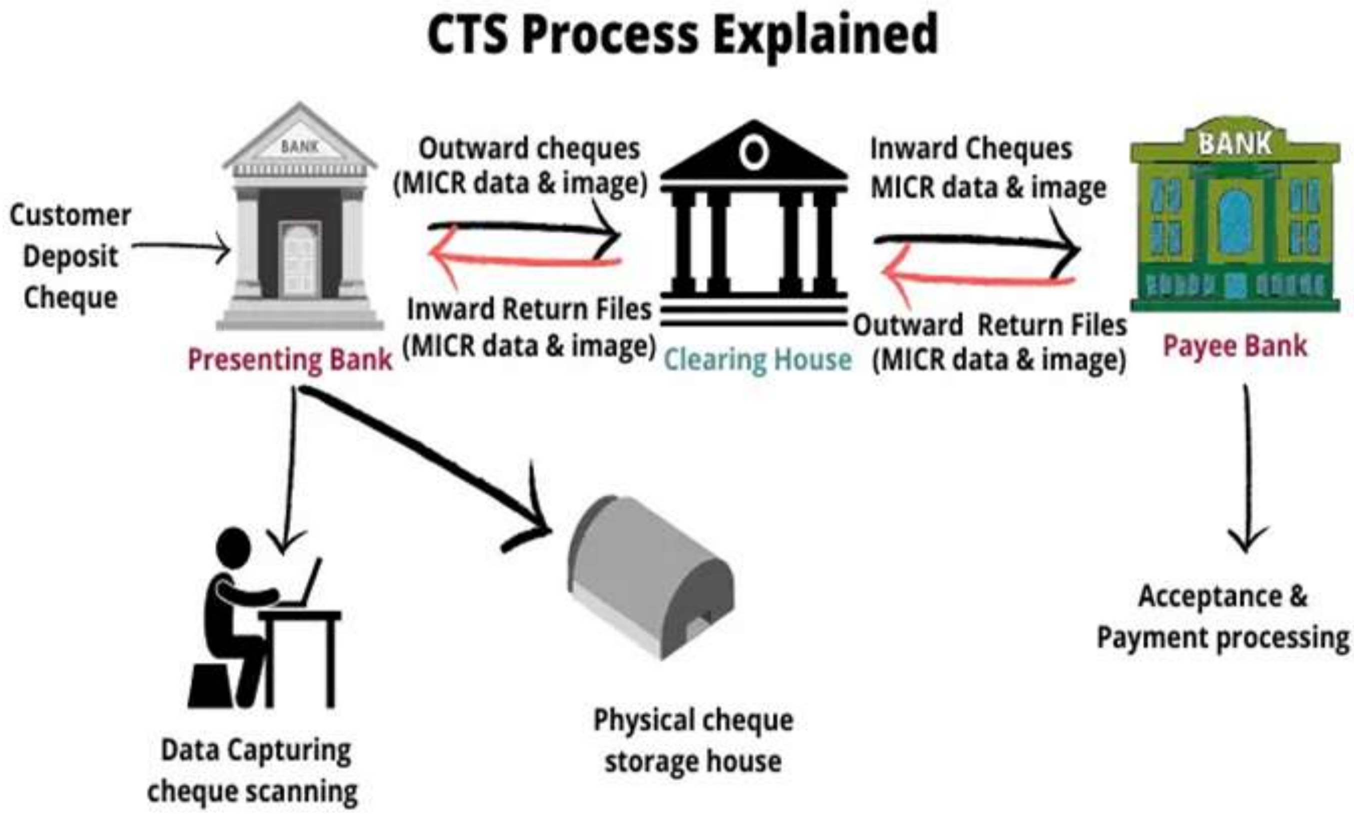

Fig. 2:- Current CITS based Cheque clearing system.

Drawbacks in the current Cheque Clearing Process

The functionality of traditional CITS, which focus on watermarks, ultraviolet (UV) rays, pantographic images, and various microscopic features on the scanned copy of the manual check, is limited. These CITS use magnetic ink character recognition (MICR) and optical character recognition (OCR) technologies. Therefore, irregularities in the name and amount, the duplication of features using picture editing software, the use of invisible ink, and damaged photographs may result in security violations and ultimately result in the creation of a fake paper cheque. This fake check may get through the clearing house's image authentication processing mechanism, which would result in the bank paying the wrong person.The drawee commercial bank finds and reports the majority of check frauds.bank. Less frequently, the collecting commercial bank—where the check is deposited—discovers and reports these frauds. Manual identification is frequently used to distinguish these fraudulent checks. Without a doubt, manual identification is the least effective method of preventing check fraud. Staff must be able to recognise false checks based on visual characteristics such as security highlights.Furthermore, OCR won't be able to recognise the paper check if it is damaged.Consequently, it needs to be manually cleansed by a person. In that case, the automated procedure will fail. Additionally, the current CITS-based paper cheque clearance process takes at least one day and maybe up to three working days to clear a check. Additionally, the user must travel to the bank to deposit a check, which takes time and money.

Related Work

Numerous studies have been conducted in the field, the majority of which did not offer a realistic implementation in the real world. Even though more people and businesses are using checks compared to other payment methods, there aren't many cheque clearing solutions on the market that are expressly designed to speed up the human clearing process while enhancing security. The majority of automated check clearing systems on the market and various platforms created as a result of research focus primarily on digital checks and totally do away with paper checks.

Table 1 compares the shortcomings of current systems with the advantages of the suggested strategy.

Approach	Published Year	Overview	Drawbacks
[1]	2022	It mainly focuses on Cheque transaction securing process.	Ethereum which is a publicly available blockchain may lead for

			certain privacy and slowness issues than private or a federated blockchain.
[2]	2021	The system which will automatically generate certificates as well as validates them. The data will be authenticated, reliable and unchangeable	The person who validates the certificate is not authorised by any agency.
[3]	2019	Hybrid auction system encompasses two blockchains - a private blockchain and a public blockchain, and three types of actors participating in the auction.These actors manage the blockchain network	Single blockchains hosting leads to lack privacy when private, public and consortium blockchains are combined.
[4]	2020	An intelligent cheque number recognition with an artificial neural network for automatic Cheque processing.	It gives accuracy about 70%
[5]	2018	It use geometrical and structural features like stroke width, direction, inter character space, and so on.	It does not support automatic detection of handwritten forgery in legal documents.
[6]	2022	This paper presents a detailed review of blockchain technology, the critical challenges faced, and its applications in different fields.	It provides detailed process of blockchain technology
[7]	2022	One possible method of preserving privacy is by adding cryptography in the smart contracts, which are a medium of transacting data between distinct parties. Privacy preserving smart contracts have been introduced in the Hawk paper,which talks about a blockchain model of cryptography and transactional privacy.	Current research in this space focuses on using advanced cryptography, which may be computationally expensive.

Table 1:- Related works.

Objectives Of The Proposed Approach

The primary goal of the suggested solution is to use the CheckMate automated cheque clearing system to speed up cheque clearing and improve the security of cheque transactions. Customers could receive a 24-hour service from the suggested solution. Additionally, the technology based on mobile devices enables users to quickly issue and pass both digital and paper checks using a straightforward mobile application loaded on their devices. Before the checks are converted into a digital format, the system enables the user (cheque holder) to validate the documents. The prediction algorithm will assist in identifying patterns of check rejection based on specific fields and will orderly validate the relevant fields.Additionally, the method offers a successful, adaptable method for identifying bank check frauds.

Methodology:-

The entire system is implemented over the course of four primary phases:

1. Process for clearing paper checks and an algorithm for predicting errors
2. Process for detecting paper checks fraud
3. Process for clearing and issuing digital checks using block chain and (iv) Process used to secure cheque transactions.The methodology and approaches utilised for the four stages are explained separately in sections B, C, D,

and E since different approaches were employed for constructing the full system and to better understand the system flow. The data sets used by the system are discussed in Section A.

Using an Android mobile device, the sample tests were scanned at a resolution of 600 dpi. The system is compatible with Android Lollipop 5.0 through 5.1.1 and API Level 21 through 22 and newer versions. Because it is the industry norm, scanning was done at a resolution of 600 dpi. The user is urged to correctly modify the paper check at the beginning of the operation. For cheque, predefined edges were created so that the required highlights may be eliminated in a useful manner.

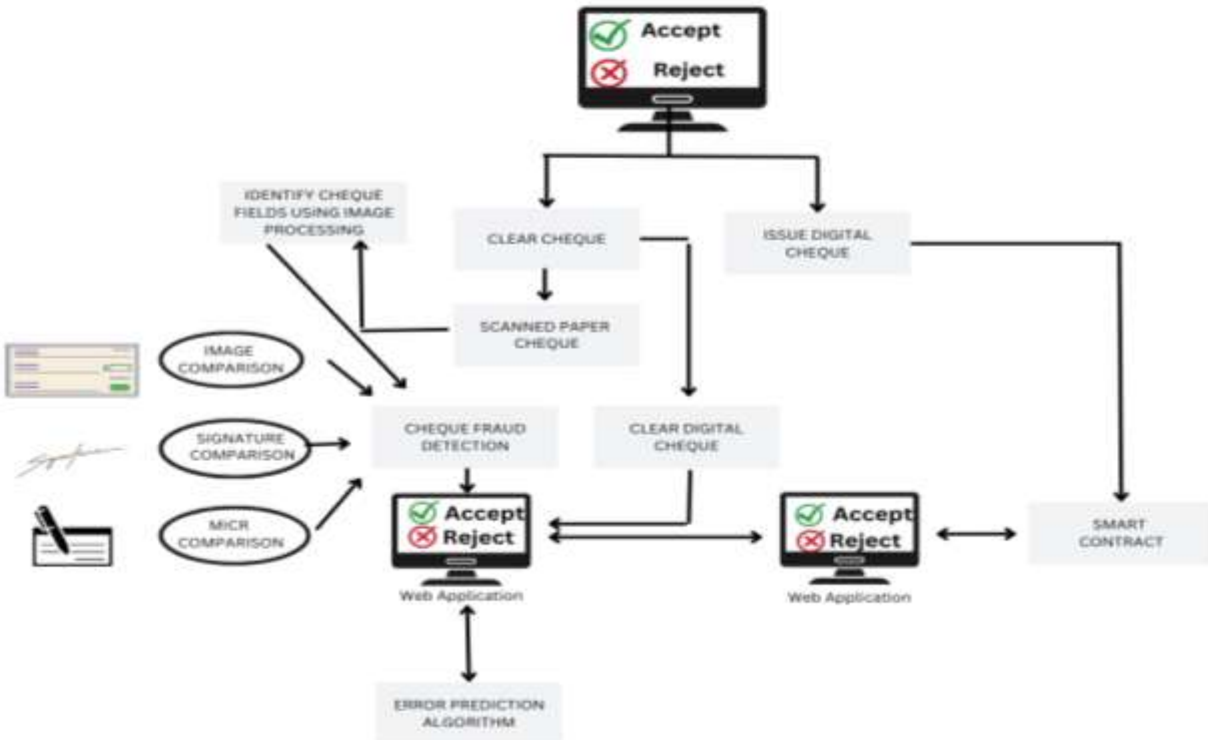

Fig. 3:- Cheque mate system overview diagram.

Based on information gathered from experts and the supporting literature, the modified control samples utilised in the trials of the paper cheque fraud detection procedure were constructed. The proposed approach's system overview diagram is shown in Fig. 3.

Data Description

Data used includes check records from the previous six months.Interaction between the user and a current account from India's largest public bank, People's Bank. Here, the false data sets used by the bank to test its own systems were applied.Events have a timestamp, a user id, and an event type. There are several categories of events for section B, including rejection due to insufficient account balance, rejection due to the drawer instructing the bank to stop payments, rejection due to omitted or incorrectly written dates, and rejection due to changes to the check that the drawer did not attest to by signing, among others.

Paper cheque clearing process and Error Prediction Algorithm

Image Processing

The field of pattern identification includes character identification. Data preparation, binarization, noise removal, skew detection and correction, character segmentation, thinning, and feature extraction are all parts of the image processing process.

Data pre-processing:

After the data has been collected precisely, pre-processing is still done on it. Pre-processing's main goal is often to arrange content so that character identification is made simpler as a result. In essence, it enhances the visual rendering, making it suitable for segmentation.

Binarization –

Typically, grayscale image binarization techniques fall into two categories: entire threshold, where a single threshold is used throughout the entire image to separate the classes (words and background), and local threshold, where threshold values are determined locally, possibly pixel-by-pixel or region-by-region. Here, it uses equation to locally calculate the threshold Th for each pixel. (1). K is set to 0.5, m is the average of all the pixels in the frame, and M is the smallest image.R is the ideal deviation of grayscale over all frames, and grey degree is the standard deviation of each and every pixel in the frame.

$$Th = (1-k).m + k.\frac{\sigma}{R(m-M)} \qquad (1)$$

Noise removal –

Due to the printing method, print quality, age range of the check, etc., noise is frequently present in scanned paper checks. Thus, noise filtering is crucial before the image is processed.

Skew Detection and Correction –

Once the paper check is fed into the camera of a mobile phone, frequently an unavoidable reclining or skew occurs automatically or manually. The text lines in the computerised image generate an angle with a crosswise direction when viewed from a skewed angle.

Character Segmentation –

The actual text-based content is retrieved once the paper check image has been binarized, the noise removed, and the skew adjusted. The segmentation of characters is guided by this approach. The segmentation algorithms connected component labelling, x-y tree disintegration, operate length smearing, and Hough transform are widely utilised in this direction. The Hough transform was applied here to segment the characters.

Thinning –

When a one-pixel representation or skeleton of an object is thinned, the connection of the object and its end points are preserved. The real thinning procedure reduces the components of the image to their essential information to permit further analysis and identification.

Feature Extraction - The generation of a feature vector that is used in the identification step is the core of every OCR system. The OCR system for English is exactly the same. In particular, qualities that distinguish one area connected to a character from another area associated to characters are what this step is designed to collect from segmented spaces of an image containing characters to be identified. Thus, selecting a set of characteristics or properties that best describe and distinguish the shape of the initial character could be considered feature extraction.

Paper Cheque Digitalization

The required fields on the check should be extracted using image processing, and then the fields should be validated. The handwritten signature's visible portion will be trimmed.A json object will be used to send additional fields to the Checkmate web service without the handwritten signature.

Prediction Algorithm

This entails determining a check user's intention to reject a check based on activities within a business bank account. The banking system can better understand the behaviours of cheque users by monitoring their patterns of cheque clearing and rejection.

In order to capture the simultaneous influence from both time and current account information, the latent context variable is added in the proposed solution's probabilistic generating process, which will be used to model the transaction history of cheque users. The system can forecast which fields should validate first to speed up the process by detecting the cheque user's historical clearing and rejection trends.

The objective is to pinpoint the behaviour patterns of specific check users that result in check rejection and extrapolate these patterns as templates to forecast high likelihood of check rejection for a user. The technique uses the random Forest as its prediction model.

The Random Forest is appropriate for high dimensional data, indicating why it can deal with consistent, all-or-nothing, and binary data as well as missing attributes. There is no compelling reason to prune the trees because Random Forest is sufficiently capable to overcoming the concerns of overfitting because to bootstrapping and outfit conspire. Among well-known machine learning approaches, Random Forest offers exceptionally innovative model interpretability and prediction precision.Due to the employment of statistical methods and random sampling, precise forecasts and improved hypotheses are achieved. The decision tree's data collection process is based on assessments of the quality of the available data. Using the pre-classified data, a decision tree is created. The highlights that best divide the data into classes are chosen for the classification. The assessments of these highlights suggest that the data objects are a component. Recursively, this cycle is applied to each component subset of the data things. The loop comes to an unsettling end since every piece of information in the current subset is grouped under a common class.

Paper Cheque Fraud Detection Mechanism

This investigation sought to identify reliable image processing details from inspected bank checks that could determine whether or not they are authentic. There will be consideration for two highlights:

(i)MICR

(ii) Handwritten Signature.

For cheque, predefined edges were created so that the required highlights may be eliminated in a useful manner. There are two equal blocks in the workflow. A pixel-based algorithmic solution for offline handwritten signature verification is provided in the second block after the first block extracts the symbols and reads the accounting and routing numbers of the MICR field. If both blocks are verified, the check can be executed; otherwise, a notification will be provided to the user and the bank for further inquiry if one or both blocks cannot be verified.

MICR Field Verification

The financial sector invented Magnetic Ink Character Recognition (MICR) as a method of processing documents. The document-type pointer, bank account number, bank code, check amount, check number, and a control indicator are often included in the MICR encoding, also known as the MICR line, which is located at the bottom of a check.

i. MICR text extraction from the image—This is carried out in Section B's image processing stage.

ii. Scale the image to 200 dpi - The front and back photographs are prepared in the same way, but since there is no MICR data to prepare on the back, the scaling is determined from the results of processing the front picture. The outcome is a TIFF image that complies with trade standards.

iii. Following the extraction of the MICR line, the MICR region will be cropped out of the original image by locating the beginning black pixel and the last white pixel, which results in an image that only contains MICR code.

iv. Looks for vertical white spaces; if there are any that are more than a specific edge value, it crops the centre MICR code using those white spaces to produce what would be the necessary MICR code.

v. Using the extricated MICR Number and applying associated component examination while using an edge value for the number of pixels within the associated components to be able to limit by doing away with all of those dabs, human errors, and undesirable characters and giving as if the nine digits.

vi. The extracted images are then scaled to a predetermined number of columns and rows and used for comparison with the formatted digital images by using the 2-dimensional relationship coefficient (r) equation (2) of the layout and the modified image networks. The related factor, abbreviated as r, is used.

$$r = \sum m \sum n \frac{(A_{mn} - \bar{A})(B_{mn} - \bar{B})}{(\sum\sum Amn - \bar{A}nm)2(\sum\sum Bmn - \bar{B}nm)2} \quad (2)$$

Handwritten Signature Verification

This is accomplished by per- forming the pixel comparison and limiting the overall signature. The mobile device or phone's rear camera records the signature. Although there will always be some variations in a person's manually written signature, with time, frequent movement and practise provide consistency that can be recognised as a biometric evidence, allowing for steps to produce a decent quality image. With a resolution of 400 dpi, the camera digitalized the signature, and the images were saved in Joint Photographic Group. (raster format). Data pre-processing, feature extraction, and a signature comparison technique are all part of the examination's guiding principles.

Data Area Cropping, Width Normalization, Skeletonization, and Binarization are the first four processes in the pre-processing stage. Since the signatures were obtained on white sheets of paper, noise reduction is not necessary.

i. Data Area Cropping:

Using the segmentation approach of vertical and horizontal projections, the original 24bit colour image is first separated from the background to remove the white space surrounding the signature.

ii. Width Normalization:

Using bicubic interpolation, the cropped image is scaled to a fixed width while maintaining the aspect ratio.

iii. Binarization –

A histogram-based binarization is used to finalise the 24-bit colour signature once it has been transformed to grayscale.iv. Skeletonization - The approach suggested by is used to decrease data storage without sacrificing the structural information of the image and to make it easier to recover morphological aspects from digitised patterns.

Feature Extraction and Selection –

In optical recognition systems, the selection of highlights is crucial. The selected highlights must be logical for the applied classifier to utilise them. There are two different layouts of highlights for highlight extraction.Incorporating global and grid features, as well as lattice.

i. Global Features - Global features offer details about the signature's overall structure. In this work, the skeletonized signature is used to extract the suggested set of global features by[8]: the signature height, height-to-width ratio, pure width, pure height, image area, maximum horizontal projection, and maximum vertical projection.

ii. Grid Features - As described in [9], grid segmentation is a method used for examination of signature detail. The skeleton image is overlaid with a virtual grid of 12 x 8 segments, and the following features are computed for each section. The system uses the accompanying aspects of Pixels Density, Pixels Distribution, and Predominant Axial Slant.

Algorithm - Fig. 4 depicts the algorithm's flow diagram for carrying out the technique. Each customer's sample signatures must be captured and kept in the database. The removal of a signature from a bank check is a challenging process [7] because the backgrounds of the checks are intricate. The MATLAB tool has been used to implement the technique.

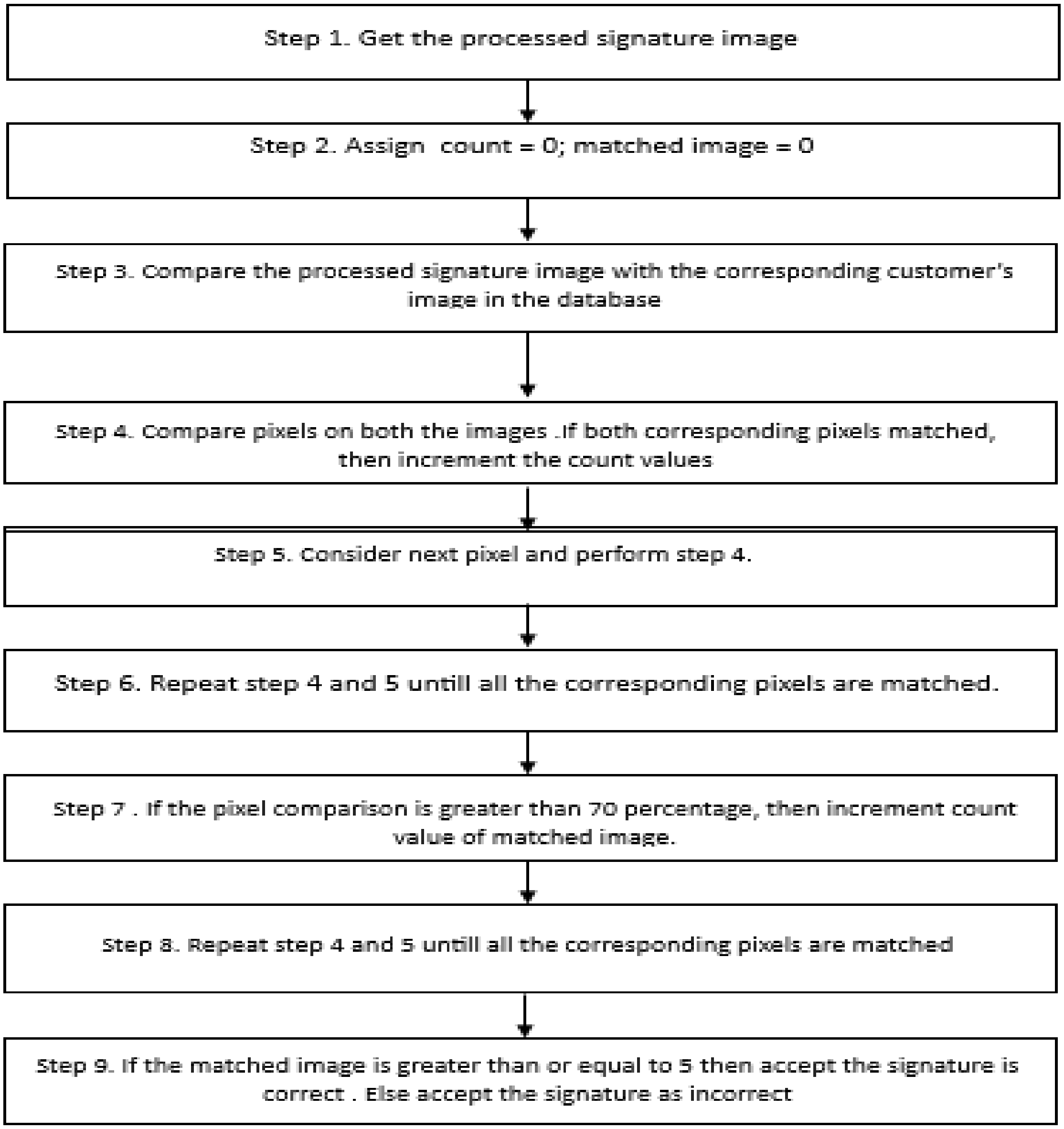

Fig. 4:- Algorithm Process flow for implementation.

D) Digital Cheque Issuing and Clearing Process

The design strategy, which is based on the requirements acquired, explicitly outlines all of the product's architectural modules as well as how they communicate and depict data flow with external and third-party modules[10]. The blockchain-based digital check issuance and clearing process is represented in Fig. 4 as a flowchart.

Development of Smart Contract

Solidity-based smart contracts are implemented in test networks. After a smart contract is deployed, it is not permitted to update or modify any of the code because all of the codes that are written in them are immutable. The smart contract was programmed, compiled, and tested using the Remix online IDE, which gives test account addresses.

Development of Web Application

The CheckMate system has a client-side block chain-related web application for the bank side to manage the procedures of issuing and clearing checks. The primary functions of the CheckMate online programme include digital check issuing, digital check clearing, and paper check clearing. Furthermore, the CheckMate web application must to be able to communicate with the blockchain system. Consequently, it goes beyond being a simple online application. It is a decentralised application that makes it possible to interact with the blockchain. The smart contract serves as the foundational logic for the decentralised application. The interface of the decentralised CheckMate applications is identical to that of any other web application now in use. A web browser is used to communicate with a client-side web application that contains HTML, CSS, and JavaScript files.Web application directories that are tied to the block chain communicate with the block chain rather than the back-end webserver[11].The CheckMate online application was connected to the blockchain network utilising a personal account and an Ethereum wallet in order to interact with it[11].

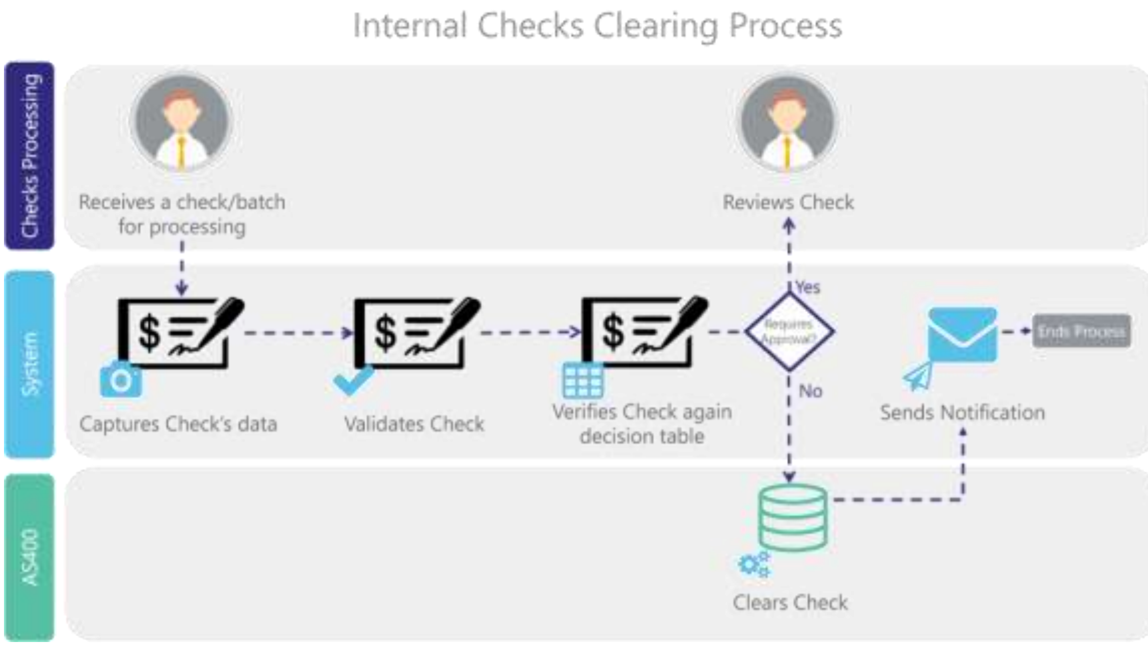

Fig 5:- Process flow diagram of digital cheque issuing and clearing system.

The application was created with the help of the ReactJs web framework. Installed the npm package to make a React application. The smart contract was launched and the MetaMask wallet was accessed using the Web3 Js library collection. The contract was then implemented onto the Ethereum multimode network.

1. Cheque Issuing Request - A RESTful API connected the Cheque Issuing Request sent through the mobile app to the CheckMate web application.
2. Request validation - Using the CheckMate web application, the user's account balance was checked in order to validate the received request.
3. Issue Digital Cheque - If the request is determined to be legitimate, the payee will receive the check. Both the payee and the issuer of the check will receive notice.
4. The results of the mistake prediction algorithm were used to design the cheque clearing procedure, which was based on the smartcontract.
5. Dashboard was created to show a summary of the issued and cleared checks from the bank branch per day.
6. Create a digital cheque template in case a client requests a hardcopy of the electronic check.As a result, a template for a digital check was produced using relevant information.

Following implementation, the system was put into use in a testing environment to ensure that it met quality requirements and served its intended purpose by tackling the research topic. The product's quality was enhanced as a result of this step. It makes an effort to locate system flaws at every level. All found flaws are taken back to the development phase for correction[12].

i. Each component is examined to ensure that it is functioning properly.
(Component testing)
ii. The entire system is tested to ensure that it is operating in accordance with the specification. (Requirement testing)
iii.Present the entire system to a business team so they can test it from a business standpoint. (Acceptance testing)
It is necessary to confirm that the compiled smart contract is operating faultlessly after the smart contract has been implemented and compiled.

Automate the testing and deploy the smart contract in a real network.
When creating a genuine application, an online IDE is insufficient. The smart contract was created using the Truffle framework, which was also used to test it locally and for deployment. With Ganache, which offers 10 sample test accounts with 100 ETH apiece, the local test network was set up.

E) Cheque Transaction Securing Process
1.**Algorithm for Generating One-Time Passwords (OTPs)**
In this step, the procedure for becoming verified and creating an OTP will be covered. The processes that will be taken when a user attempts to issue a digital check following one factor verification are as follows: An OTP will be automatically generated by this OTP creation algorithm and given to the user through SMS. The mobile application's prompt for entering the OTP will appear. The check will be issued if the OTP entered is accurate; else, the check will not be issued. The current date, time, and cheque number serve as the foundation of this algorithm.A six-digit component of digital checks is the cheque number.The relevant bank issues individual check numbers that are hidden between special characters. Here, the check number will be retrieved without those special characters. The hash value of the check number will be created after getting the check number and current date and time. This value will be formatted as a string. This string format will be joined to a string of dates and times. Finally, a hash function will be used to generate a hash value from the resultant value.The OTP is the result of the aforementioned process. This OTP's value was created using a hash function because it has a fixed length. The user will receive the OTP through SMS after it has been generated. Twilio.io's API will be used to accomplish that. The user can receive an OTP that was generated using this API. A popup message requesting the OTP will appear in the mobile application.

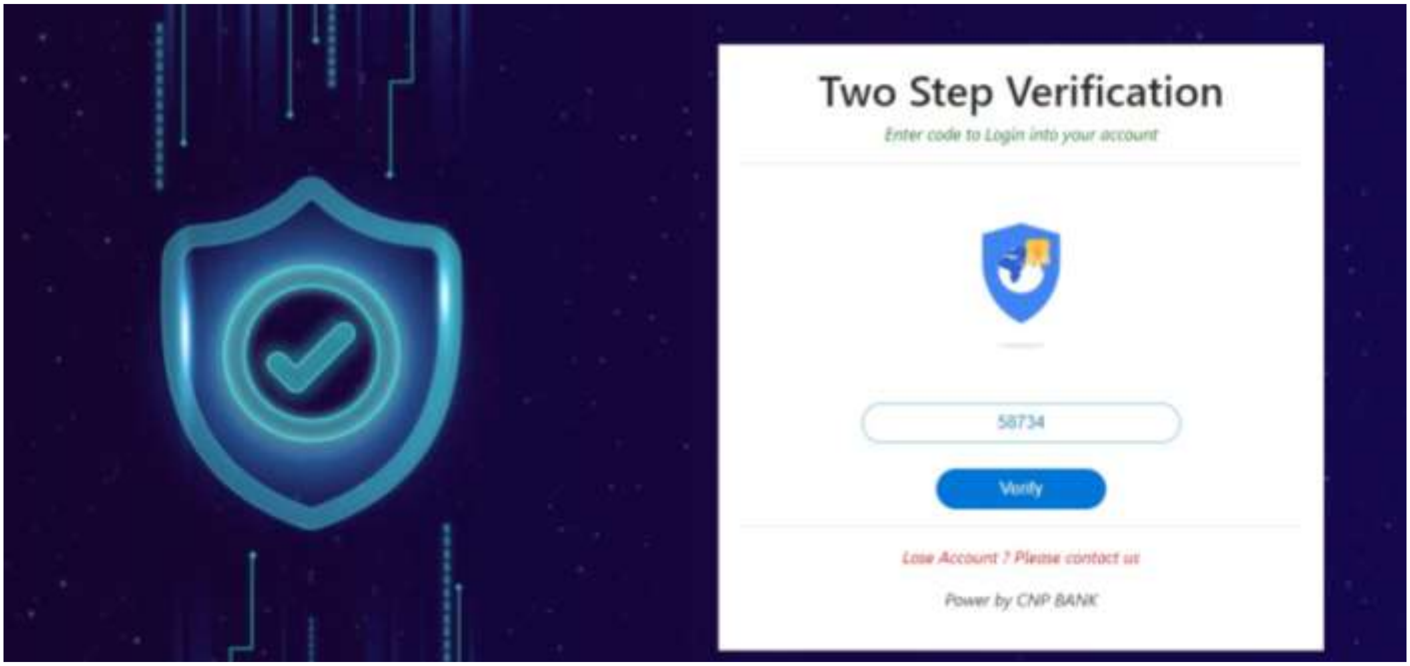

Fig 6:- OTP verification system.

Results and Discussion:-
The advancements in computer and data science enable banks to develop computer-driven acknowledgment and verification systems. In order to prepare for or conduct testing for the investigation and development of such a framework, a sizable database of check images that contains hundreds of check images is typically used. Even though a cheque's colour image includes more data than its greyscale image, handling a colour cheque requires more memory, as well as more storage space. Since checks naturally contain sensitive information, it might be challenging to locate a dataset that is both affordable and simple to licence and is indicative of actual bank cheque images.Since many of these datasets are owned by the banks themselves, working with them is challenging for developers.

In fact, there is no set system for checks in a country. Each bank has a claim standard, therefore the cheques from other banks differ not only in type and placement of the machine-printed and manually written information, but also in some respects in their foundation. In those systems that don't rely on particular check groups, the area of interest should be located first. It is difficult to search an area for checks with poor check quality.

Paper cheque clearing process and Error Prediction Algorithm

The versatility of random forests is probably its strongest suit. Because it frequently yields a good expected outcome with its default hyperparameters, random forest is also a practical approach.It is simple to understand the hyperparameters, and there aren't very many of them. Overfitting is arguably the most important problem in AI, although the random forest classifier generally prevents this from happening. In the unlikely event that the forest contains enough trees, the classifier won't overfit the model. The main difficulty with random forest is that it can become too moderate and incapable of making consistent predictions if there are a large number of trees. Generally speaking, these algorithms prepare quickly but take a long time to make predictions after they are finished. More trees are needed for a more accurate expectation, which results in a slower model. There are a few drawbacks to OCR as it is utilised for image processing. Only printed text and not handwritten text can be read by OCR. The computer needs to learn how to read handwriting.

1)Testing of Identifying Payee Name, Amount in words amount in numbers and Date.

It took a little longer than expected—about 3.5 seconds—to identify the payee name, the amount in words, the amount in numbers, and the date. When we process lite colour printed checks, some letters are recognised more than once because we are using Python Open CV to detect text. To increase the precision of text detection, we employ another Python script, and it can take up to 4 seconds to finish the job.The Python script produces the desired results in the anticipated amount of time, but some delimiters could not be correctly identified. To fix this, we trained our model on a sizable dataset.

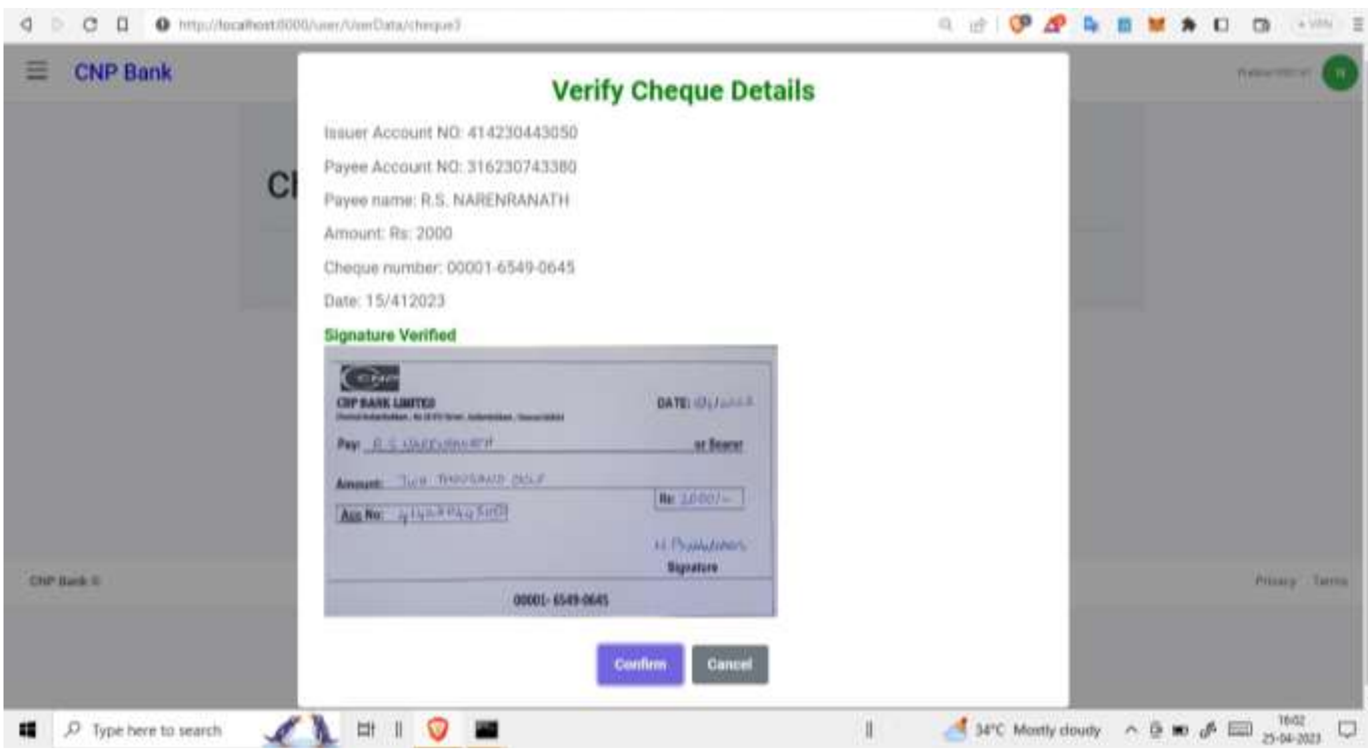

Fig 7:- Cheque Clearance and Verification System.

Paper Cheque Fraud Detection Process

The high degree of variability and susceptibility inside the manually produced signature is one of the most challenging aspects of developing a good check examining framework.A signature scan offers some advantages. Due to the vast amount of data displayed in a signature check format, as well as the The signature scan technology has no issue imitating the behaviour of marking, making it quite safe for faker endeavours.

In any case, there are a few issues with signature-scan.

The purpose of signature-scan is to validate participants using the peculiarities of their unique signature. As a result, people who don't sign their names consistently produce a sequence of signatures that are similar enough for the algorithm to identify a significant portion of the common traits among the enrollment signatures. A sufficient number of features must hold true during affirmation in order to determine with certainty that the authorised user signed. Therefore, those with muscular disorders and those who frequently sign just with their initials may result in a higher False Rejection Rate (FRR), which determines the likelihood that a system will incorrectly reject an authorised user.

For MICR character recognition, the template matching method is not the most reliable approach, especially for real-world images that are likely to be more noisier and more difficult to distinguish. OCRing a bank cheque is far more challenging than OCRing a credit card; this is typically because bank cheque symbols have several components. Although the template matching method performed well on the test image, real-world inputs are likely to be much noisier, making it more difficult to eliminate the digits and symbols using straightforward contour techniques.
1) Testing of MICR Field data and Handwritten signature verification.
Identification of the E-32 font-based MICR field components. The 9 numerals in E-32 format were correctly recognised. Three of the four delimiters displayed in the MICR were successfully identified, however the bank branch delimiter was not.

The signature is considered to be authentic if the pixel match is more than 70%.

Digital Cheque Issuing and Clearing Process
The majority of blockchains are designed as decentralised databases with distributed sophisticated record functionality. Long-term testing has shown the Verification of Work agreement computation to be incredibly effective at securing the Bitcoin blockchain. However, there are a few potential attacks that can be carried out against blockchain networks, and 51% assaults are among the most widely discussed. Such an attack may occur if one substance manages to hold more than 50% of the hashing control for the arrangement, which would inevitably allow them to disrupt the arrangement by purposefully preventing or changing the request for transactions.

Blockchain may be a system that needs hubs to function properly. The blockchain's quality is determined by the hubs' quality. For instance, Bitcoin's blockchain is reliable and encourages the hubs to participate in the organisation. However, a blockchain organisation that does not reward the nodes cannot claim the same. This suggests that it isn't a distributed computing system where the setup depends on the cooperation and assistance of the hubs. In contrast, a distributed computing architecture ensures that the exchanges are confirmed to be in compliance with the rules, that they are recorded, and that they also have the value-based history for each transaction. While each of these actions is equivalent to those of blockchain, they all require cooperative energy, shared assistance, and paralleling. Blockchain is undoubtedly a distributed network, but it lacks the characteristics that make distributed computing systems so advantageous to businesses.

Testing of Issuing and clearing digital cheques using blockchain.
Add a digital check to a private blockchain you create using Ethereum. To determine the accuracy of the system, test it multiple times. Test the system to see if the web application can access the blockchain while the check is being cleared.Transaction accuracy for smart contracts was 85%.

Conclusion:-

The research project's results include a block chain-based procedure for issuing and clearing checks. It will assist in enhancing and accelerating the automated process as well as the features of the check. Additionally, the costs associated with both the paper and digital cheques will be reduced. The blockchain-based smart contact used in this study component will strengthen the security of the check truncation mechanism. Additionally, by replacing paper checks with digital ones, paper waste and labour costs will be reduced.

There are certain limitations to the suggested system. When clearing, the technique merely examines the three sorts of cheques: order cheques, cash cheques, and dated cheques. For now, the CheckMate mobile and web applications only support English. Since Ethereum is a publicly accessible blockchain, it may experience more speed and privacy difficulties than a private or federated blockchain. The main limitation is that the techniques must adhere to certain bank cheque layouts, including colour schemes from different banks, including private and public banks. Future studies on the method will address additional drawbacks, such as how to handle cheques that are torn or defective, background art, and multicoloured ink signatures.

The main objective of this research is to improve the efficiency, convenience, and security of financial transactions through digital checks by accelerating the clearing process, enhancing the legitimacy and security of checks, enhancing the digitalization process, increasing the integrity, and lowering frauds. This system offers extra insights so a business can rely on the correctness, reliability, and integrity of its data and transactions to make quick and secure judgments, making it an interesting subject of research from both a scientific and commercial perspective.

This suggested solution is incredibly reliable, providing exact recognition that ensures the users are securely protected against check fraud. CheckMate highlights a chance for banks to increase pertinence with their clients, enhance engagement and communication, and maintain their leadership in the versatile application in today's commercial environment where basic versatile keeping money usefulness is quickly becoming standard.

Type	**No of Days for Cheque clearance**
Existing system	3
Proposed system	1

Table 2:-

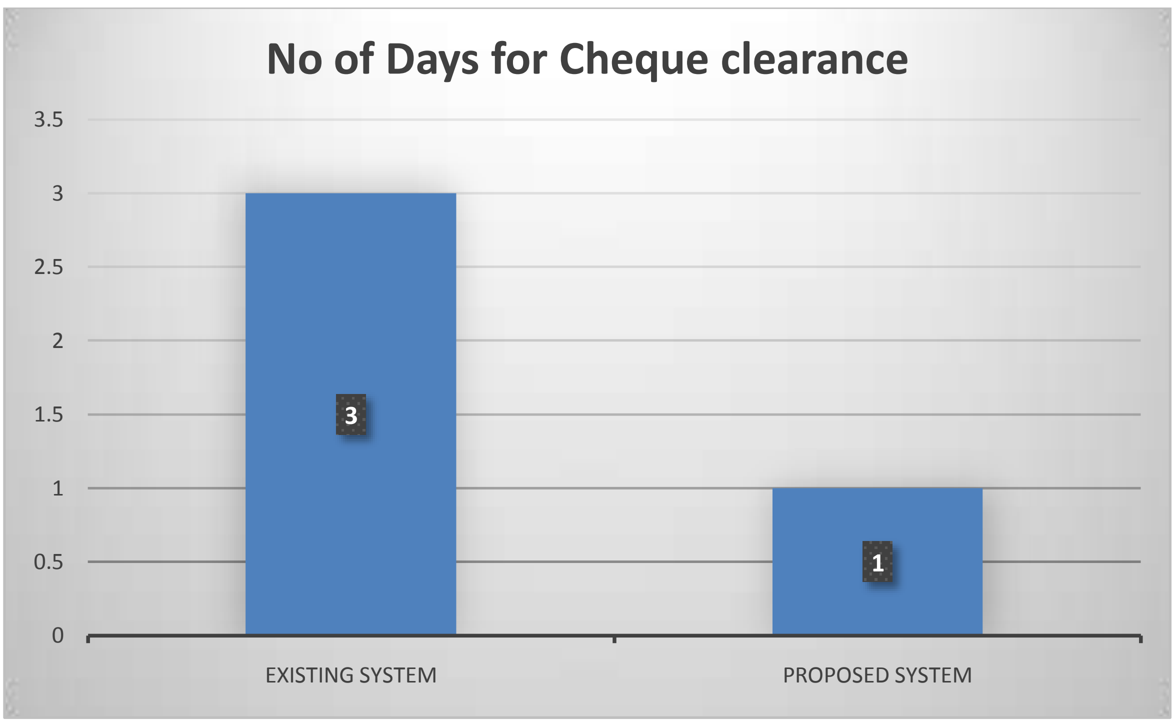

Fig:-

Last but not least, when compared to current systems, the suggested approach—the CheckMate system—stands out because it offers the following distinctive features:

1. Support both paper and digital checks simultaneously.
2. Utilize digital checks built on a blockchain platform.
3. Enable the block chain platform's digital check approval mechanism.
4. Using a mobile application to transact with checks;
5. Using a mobile application to identify paper check fraud.

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