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AN INTELLIGENT SYSTEM FOR DOCUMENT-BASED BANKING PROCESSES

BELGE TABANLI BANKACILIK SÜREÇLERİ İÇİN AKILLI SİSTEM TASARIMI

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ABSTRACT

Business process automation has been helping companies by eliminating mundane and repetitive tasks. Automation tools have been used in many sectors, providing high full-time employee (FTE) savings and low error rates to the companies. Banks have been utilizing the automation tools for core banking and branch operations. In addition, banks receive hundreds of notice documents from courts, municipalities and third parties; which usually contain private and time-sensitive information about their customers. Automated document processing requires special solutions such as optical character recognition (OCR), natural language processing (NLP) and taxonomy; and modern process automation tools can utilize these solutions to provide end-to-end automation. This paper discusses how the notice documents such as account closure, payment blockage in Turkey can be automated. It also shows how automation can efficiently and effectively process the documents by providing experimental results for each document type.

Keywords: Process management and automation, document understanding and processing, document-based banking processes

ÖZET

İş süreci otomasyonu, sıradan ve tekrarlayan görevleri ortadan kaldırarak şirketlere yardımcı olmaktadır. Otomasyon araçları birçok sektörde kullanılmakta olup, şirketlere yüksek tam zamanlı çalışan (FTE) tasarrufu ve düşük hata oranları sağlamaktadır. Bankalar, ana bankacılık ve şube operasyonları için otomasyon araçlarını kullanmaktadırlar. Ayrıca her gün bankalara mahkemelerden, belediyelerden ve üçüncü şahıslardan yüzlerce ihbar belgesi gelir; ve bu belgeler genellikle müşteriler hakkında özel ve zamana duyarlı bilgiler içerir. Bu belgelerin otomatik işlenmesi prosedürü, optik karakter tanıma (OCR), doğal dil işleme (NLP) ve sınıflandırma gibi özel çözümler gerektirir; ve modern süreç otomasyon araçları, uçtan uca otomasyon sağlamak için bu çözümleri kullanabilir. Bu makale, Türkiye'de hesap kapatma, ödeme blokajı gibi bildirim belgelerinin nasıl otomatikleştirilebileceğini tartışmaktadır.

Anahtar Kelimeler: Süreç yönetimi ve otomasyonu, belge anlama ve işleme, belge tabanlı bankacılık süreçleri

INTRODUCTION

Business process automation has been used for replacing the monotonous, rule-based chores and tasks that are done by humans otherwise. Automation solutions can perform tasks with a certain working order. They not only reduce human effort, but also provide additional time advantage to processes that cannot be fully automated. Process automation enables organizations to create automated actions for repetitive tasks. It is also inexpensive and easy to integrate (Kelemen, 2019).

Companies have been processing various types of documents manually on a regular basis, consuming a lot of time and effort of the employees (How Digital Labor Can Drive Efficiency in Oil and Gas, 2019). Also, human errors in processing sensitive documents such as money transfers and accounting operations can be quite costly for the companies. Whereas integrating automation tools with document processing saves time and effort and drastically reduces the error rates. This study discusses the advantages of automation in document processing and how it can save time and avoid errors to provide clear and hassle-free information for the banks in Turkey.

HISTORY OF DOCUMENT PROCESSING

Processing Traditional Notices

Banks receive hundreds of notices from courts, municipalities, and third parties every day. These notices contain sensitive and private information about the customers that need to be carefully handled. Also, the notices are time-sensitive, therefore banks must allocate substantial amounts of resources for the processing of the notices every day to prevent backlogs. Processing the notice papers requires following the three steps:

- Quality Assurance - Generally, documents need to be verified to review the completeness and accuracy of each Foreclosure notice.
- Obtaining Approvals - Additionally, documents will be approved by senior management prior to posting. Every step (the whole process) needs to be followed so that delays are minimal.
- Accounting - Accounts Payable team must record all activities in the company's general ledger. Then all notices are moved to archives for storage. Stored documents can be retrieved anytime as needed (Kroll et al., 2016).

Difficulties in Processing Notice Papers

Capturing, matching, and validating account and customer data may be problematic when done manually. For example, manually entering data from a foreclosure notice into the system is time-consuming. The repetitive and intense nature of these processes lead to human errors. Such errors may result in a bank making multiple payments for the same services, sending the wrong amount or getting it to the wrong people. Improper or poor transfer between banks and borrower can generate errors in banks systems, causing confusion and manual intervention. There may be inconsistencies or disagreements may arise over prices on an invoice or the quantity received. All this is ultimately a waste of both parties' time. If there is inconsistency with the supplier in the approval process, the supplier may assume that the invoice is lost somewhere, decide to send it again, and then the debtor company may have to pay both invoices once, according to the notice (Doguc, 2019; Kaya et al., 2019).

Automation of Document Classification

Automated document interpretation means that all manual components of PDF reading, matching and validation are fully automated, streamlined and error-free business processes. Automated systems not only do a day's work in seconds, but they are also very cost effective and efficient and can therefore be used where manpower is more important than doing this type of work (Willcocks et al., 2015).

Primitives of Document Automation

Process automation tools provide pre-defined solutions for document understanding and automation. For example, UiPath provides many plugins dedicated for document digitization, classification and processing. It allows creation of process automation that retrieves document data from a scanned or computerized document using intelligent OCR, and Content Indication can be documented in this way. The following steps are involved in the development of this type of automation:

- Step 1: Document Classification: Classify the type of the document (e.g., invoice, letter, receipt etc.) based on keywords and/or document template.

Step 2: Data Extraction: Extract the document context either through screen capture (computer vision) or special OCR technology. Some of the OCR tools extract text only, while others can also extract tables and preserve document format.

Step 3: Data Validation: Validate the extracted data based on rules and/or through a human operator. This step is usually optional and needed when classification and extraction accuracies are low (Asatiani, 2016).

AUTOMATION TECHNOLOGIES

Business process automation is a combination of artificial intelligence, machine learning, computer vision and their related technologies. These new technologies shaped the structure of the process automation solutions and became the framework for these tools. The automation software work by explicitly mimicking the activities currently undertaken by today's workforce, such as working with desktop applications, generating reports, sending/receiving emails, using websites, creating documents etc. Generally speaking, automation of business processes involve tasks of working with multiple data sources, such as spreadsheets and PDFs, interpreting and coinciling them, entering data into core systems such as Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) and creating outputs such as reports and notifications (Kukreja and Nervaiya, 2016).

Autonomous Computing

Autonomous computing has been used in numerous areas in the IT industry since it was first introduced by IBM in 2001. In the early 2000s, it was realized that the main obstacle to the progress of the IT industry was the complexity of the software, and that autonomous computing systems had to be used to manage this complexity. In this context, an autonomous information system should have the following characteristics:

- It should be aware of what it's inputs and outputs are and how it is dependent on these resources.
- It can adjust its configuration based on the changes surrounding it.
- It can optimize performance to provide the most efficient computing process.
- It can solve problems encountered by self-repairing or adjusting its functions.
- It can detect various types of attacks and try to defend itself to maintain system security.
- It can adapt to environmental changes, interact with neighboring systems.
- It can predict the demand for its resources and take precautionary measures (Singh and Kumar, 2016).

Machine Learning

Learning is the process of collecting information, which consist of different but interrelated dimensions such as obtaining data, analyzing data, establishing interrelationships and knowledge creation, and developing motor and cognitive skills using application and post-application analysis, and which constitute the same applicable knowledge. Machine learning is the transformation of the learning process into a machine using computers (Sun and Wu, 2022). In other words, similar to human learning it includes the ability of computers to collect data by observation, to capture various patterns with the help of self-learning algorithms, and to create correlations.

OCR and NLP

OCR (optical character recognition) is the technology to used for resolving characters in printed and handwritten text. OCR uses the computer vision techniques to identify characters from files that are usually in image format (Sahu and Sonkusare, 2017). Different than the generic computer vision solutions, which are also used for face and image recognition, OCR uses a smaller working space of alphanumeric characters that include letters, number and punctuation marks. Despite this, letters and numbers that have similar interpretations (e.g. 1 and I, 0 and O, 5 and S, etc.) are often confused by OCR solutions.

OCR provides more accurate results, when supported by natural language processing (NLP). NLP is the study of interpreting text that is written or said in a natural language. NLP provides syntactic and semantic analysis of the words, sentences, and paragraphs, based on the grammatical rules of the language that is used as input (Malik et al., 2022). NLP techniques are used in the literature to improve the OCR results. For example, an NLP engine can correct the words *5study* as *study* and *1940* as *1940* based on the context that they are used.

BENEFITS OF AUTOMATION IN COURT NOTICE PROCESSES

Process automation uses technologies such as computer vision and machine learning to learn and automate routine, mundane, and rule-based tasks that are otherwise done by employees. Automation software frees employees from

these tasks and generate savings for companies by reducing employee costs. Also, automation software handles the well-defined tasks with great accuracy, thus eliminates human errors and the costs related to them. Companies that can efficiently utilize automation align their human resources to more effective working environments, through reducing working hours and promoting remote work. These companies benefit from automation for effective and strategic human resource management.

High Accuracy and Increased Efficiency

Automation provides precise results with accuracy in monotonous tasks such as copying files, entering data into forms, creating reports, etc. The use of RPA increases the overall efficiency of the company by relocating human workers to higher value business functions.

Cost Savings

Automation helps with cost savings ranging from 20% to 60% of the FTE costs (Laurent et al., 2019). For example, in 2017 a Japanese bank reduced its annual hours by 650,000 in 200 operations just months after implementing moving them to automation. In total, 1.1 million hours of work were automated at the company, which reduced costs by 10 billion Yen (75 million USD).

Compliance and Audit

Process automation relies on well-defined rules, and it is programmed to meet all specified standards as each step is handled in the process. The automation software would execute every step in precise detail with no errors, thus reducing the audit risk greatly.

Reliability and Improved Customer Experience

Automated processes operate 365 days a year without any breaks, sick leave or leave for other reasons. They provide improved customer service by reducing errors in manual processing and the time to return to the customer inquiries.

AUTOMATED INTERPRETATION OF THE NOTICE DOCUMENTS

There are five types of notices that are sent to the banks from various sources. These notices are usually for blocking an account, payment or closing all accounts for an individual or a company.

- Payment Blockage
- Foreclosure
- Protection
- Account Blockage
- Bankruptcy

Each notice has its own specific functions and document templates. This section discusses how these documents can be automatically interpreted and automated by an intelligent system. An intelligent system can be built in combination with OCR (optical character recognition), NLP (natural language processing) and automation techniques.

What is a Payment Blockage?

The check contract provides temporary legal assurance in order not to be victimized due to the relationship with the bank with which it is signed. The authority to impose a payment prohibition is defined only as the issuance and signing of the check or policy, and this check in the payment order is shown to the drawee and given to the person whose name is written on the check or the person holding it. The request is made to the bank where the checking account is located. The prohibition of payment to the addressee shall not be an obstacle for the persons holding the damaged check to exercise their legal rights. The validity of the document regarding the payment prohibition request is not conditional. The payment prohibition directive must be provided within the period of the check. Despite the prohibition of payment, the bank paying the amount on this check is liable to the person whose name is written on the check or to the person holding it.

Figure 1 shows the overall workflow of processing notice documents. The automation tool reads the PDF documents from a document library and classifies them first. Based on the document type, the tool extracts the document context, identifies the customer information, and finally takes the required actions, such as blocking accounts, stopping payments, closing accounts etc.

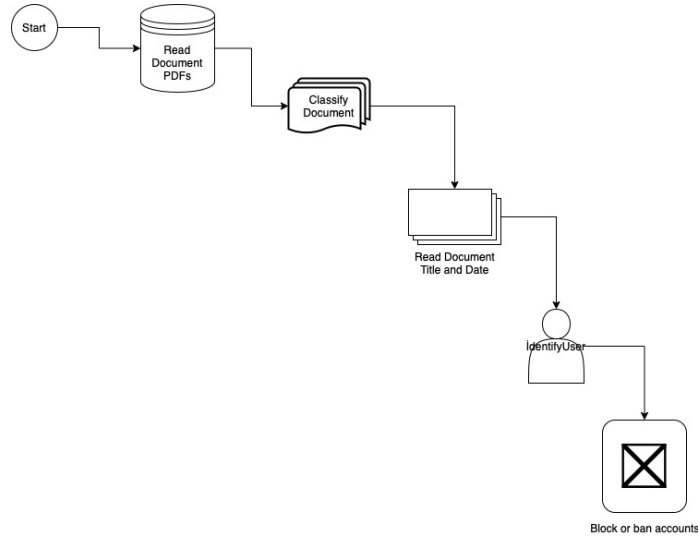


Figure 1. Flowchart for Automated Processing of the Notice Letters

Figure 2 shows a sample course notice document about payment blockage. The document includes the required information for banks to execute the blockage process. Through the help of an OCR tool such as Tensorflow or Microsoft OCR, the scanned document is converted into plain text.



Figure 2. Sample Payment Block Notice

Next, the document type should be identified. They keywords “Ödeme Yasağı” in the document title clearly indicates that the document shown in Figure 2 is for payment blockage.

As a next step, information that is required for payment blockage should be extracted from the OCR output. In order to process the payment block notices, the automation flow should be designed as follows:

- 1- Read the issue number of the document; “Sayı: 2020/195 Esas” reads the main code of the document.
- 2- Interpret that there is a payment ban notice from the heading “Payment Ban Decision xxx Bankası Avcılar Branch”.
- 3- “04/05/2020” gets the document date.
- 4- Personal information such as the person's name, surname, identity is taken for the payment ban process.

Finally, the automation system enters the extracted information in the bank’s internal system and proceeds with the payment blockage process.

This framework is followed in the other document types that will be discussed in the rest of this paper.

What is a Lien?

It occurs when the debtor's property is declared from the third party and the claimant claims it. Upon the debtor's declaration of the receivable from the third party to the debtor, the Executive Director announces the seizure order, records the seizure of the goods or money in the report, and the receivable is seized.

Örnek No: 20**

T.C.
ANKARA
20. İCRA DAİRESİ
2016/20694 ESAS

30/10/2019

BİRİNCİ HACİZ İHBARNAMESİ

1. Üçüncü şahsın adı, soyadı ve adresi : AKBANK TÜRK ANONİM ŞİRKETİ, ALBARAKA TÜRK KATILIM BANKASI ANONİM ŞİRKETİ, BURGAN BANK ANONİM ŞİRKETİ, DENİZBANK ANONİM ŞİRKETİ, FIBABANKA ANONİM ŞİRKETİ, HSBC BANK ANONİM ŞİRKETİ, ING BANK ANONİM ŞİRKETİ, KUVEYT TÜRK KATILIM BANKASI ANONİM ŞİRKETİ, QNB FİNANSBANK ANONİM ŞİRKETİ, ŞEKERBANK TÜRK ANONİM ŞİRKETİ, TÜRK EKONOMİ BANKASI ANONİM ŞİRKETİ, TÜRKİYE CUMHURİYETİ ZİRAAT BANKASI ANONİM ŞİRKETİ, TÜRKİYE FİNANS KATILIM BANKASI ANONİM ŞİRKETİ, TÜRKİYE GARANTİ BANKASI ANONİM ŞİRKETİ, TÜRKİYE HALK BANKASI ANONİM ŞİRKETİ GENEL MÜDÜRLÜĞÜ, TÜRKİYE İŞ BANKASI ANONİM ŞİRKETİ, TÜRKİYE VAKIFLAR BANKASI TÜRK ANONİM ORTAKLIĞI, VAKIF KATILIM BANKASI ANONİM ŞİRKETİ, YAPI VE KREDİ BANKASI ANONİM ŞİRKETİ, ZİRAAT KATILIM BANKASI ANONİM ŞİRKETİ

2. Alacaklının ve varsa vekilinin adı, soyadı ve adresi : [REDACTED]
Av. Zeynep Demiryürek

3. Borçlunun ve varsa vekilinin adı, soyadı ve adresi : [REDACTED]

4. Haczin neye ilişkin olduğu, hangi miktar için yapıldığı : Vadesiz Türk Parası Hesabı, Yatırım Hesabı Serbest Bakiye, Vadesiz Yabancı Para Hesabı, Kıymetli Maden Hesabı (Vadesiz Altın Hesabı Dahil), B Tipi Yatırım Fonu(B Tipi Likit ve Kısa Vadeli Tahvil-Bono Fonu), Hazine Bonusu & Devlet Tahvili(TL), Repo, Diğer Fonlar ve A Tipi Yatırım Fonu, Vadeli Türk Parası Hesabı, Vadeli Yabancı Para Hesabı, Kıymetli Maden Hesabı (Vadeli Altın Hesabı dahil), Anapara Koruma Amaçlı ve Anapara Garantili Fonlar, Hisse Senedi, Diğer (Hazine Bonusu & Devlet Tahvili/YP), Eurobond, VOB, Özel Sektör Tahvili v.b. menkul kıymetler), Alış Satış Emri Olan Kıymetler (Nitelikli Değişebilir Varlıklar)-Doğmuş Hak ve Alacaklar Doğacak Hak ve Alacaklar - MAAŞ HESABI HARİÇ

** - Bu örnek, bu Yönetmelikten önceki uygulamada kullanılan Örnek 59'a karşılık gelmektedir.
UYAP Bilgin Sistemindeki bu dokümana <http://vatandas.syap.gov.tr> adresinden AâkeZP6 - CSZSYK - eGİZTmX1 - zDRArMS= ile erişebilirsiniz.

Figure 3. Sample Lien Notification Document

And the flow for automated processing of the lien documents is given below:

- 1- The process automation tool reads from the letter "T.C Ankara 20. Enforcement Office 2016/20694 Principle" that it is an execution letter.
- 2- It reads "Document date" from the top right.
- 3- For the classification process, he reads the "First Seizure Notice" and understands that it is a lien notice.
- 4- "1. The names of the banks that the notice is sent to."
- 5- "2. The name, surname and address of the creditor and his representative, if any."
- 6- "3. The debtor's name, surname and address" The personal information of the debtor is extracted.
- 7- "4. The information "What the lien is about and for what amount" is read. At this stage, the tool blocks bank transactions up to the point where it says "-PAYMENT ACCOUNT". The only exception to the blockage is the debtor's salary accounts.
- 8- The amount is taken from the information "Number of receivables and interest expenses".
- 9- "Execution Office Account Information" Bank name, IBAN no, Tax office number information is taken for the blocking process.

What is an Injunction?

In cases of dispute, such as in cases where the receivable is difficult to obtain, the receivable is impossible, it requires avoidance due to delay, and at the same time it is feared that it will incur losses, the injunction decision is applied. If the pledge is not paid in cases such as foreclosure, precaution, payment prohibition, the bank is not obliged to pay the legal amount. Finding money in the account that meets the amount; Failure to use this money on the face of foreclosure and pledge is equivalent to not having money in the account.

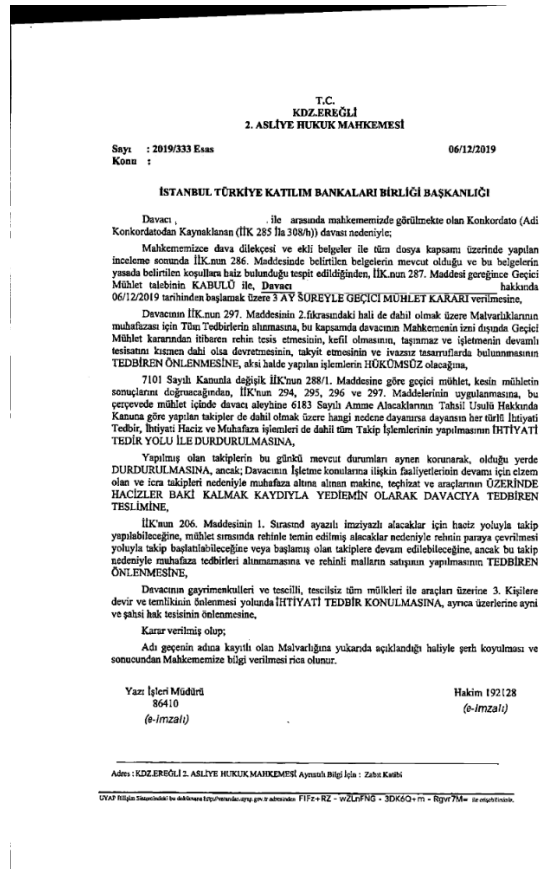


Figure 4. Sample Injunction Notice Letter


The process for automated processing of the injunction letters is given below:

- 1- "T.C. K.D.Z. The title "Ereğli 2nd Civil Court of First Instance" is read and it is interpreted that it is a letter of first instance.
- 2- "Number: 2019/333 Esas" is used to extract the document number.
- 3- The document date is read from the top right.

- 4- The automation tool detects the owner of the certificate from the title “Istanbul Turkey Participation Banks Association Banks”.
- 5- The “Plaintiff name-surname” information in the text is read.
- 6- The other text in the text reads, “To give a Temporary Delay for 3 Months, starting from 06/12/2019, about the Plaintiff”. Precautions will be taken according to this period.
- 7- The tool interprets that the continuation of the lien will be ensured by reading the text “To the Precautionary Delivery of the Trustee to the Plaintiff with the Remaining of the Seizure on him”.
- 8- By reading the article “Prevention of the Sale of Goods”, the automation tool also learns this information in order to act as a precaution in the case of the sale of the goods and property on the defendant without payment to the plaintiff.
- 9- Finally, the defendant is given a cautionary decision by reading the text “To Take Interim Injunction”.

What is an Account Blockage?

If there is a foreclosure process applied, the bank applies the blocking process so that the money in the account is not used. In other words, the bank confiscates your money in the account. The most important reason for the implementation of the blocked transactions placed on bank accounts is the non-payment of these debts to the state and any bank in the past. The biggest gain of the blocking transaction put into the account is to obtain the cash to be obtained from the debtors without any problems from the cash in the bank accounts by applying the blocking process to each account in the bank. The more the person owes, the more money the bank withdraws from the person's current account in each blocking transaction. Users who want to remove the blocking process placed on the account must pay each debt and take the document showing that they have paid these debts to the bank or tax office and apply for the blocking cancellation process. For the block to be withdrawn, the customer must pay all his debts and reduce the debt balance to zero, and also obtain the receipt or receipt indicating that he has made this debt settlement.


T.C.
TRABZON BÜYÜKŞEHİR BELEDİYE BAŞKANLIĞI
Mali Hizmetler Dairesi Başkanlığı
İcra Takip Şube Müdürlüğü

ACELE
12/03/2020

Sayı :
Konu : Haciz Konulması (Amme Alacağı)

GENEL MÜDÜRLÜĞÜNE
(Saray Mah. Dr. Adnan Büyükdüz Cad. No:10 Ümraniye/İSTANBUL)

un belediyemize 228,00 TL zabita para cezası borcu bulunduğundan 6183 Sayılı Kanuna göre yapılan icra takibinde;

Türkiye'de bulunan tüm şube kayıtlarımızın tetkiki ile borçlu adına kayıtlı Vadesiz Türk parası Hesabı, Yatırım Hesabı Serbest Bakiye, Vadesiz Yabancı Para Hesabı, Kıymetli Maden Fonu (Vadesiz Altın Hesabı dahil) B Tipi Yatırım Fonu (B tipi Likit ve Kısa Vadeli Tahvil - Bono Fonu), Hazine Fonu & Devlet Tahvili (TL), Repo, Diğe: Fonlar ve A Tipi Yatırım Fonu, Vadeli Türk Lirası Hesabı, Vadeli Yabancı Para Hesabı, Kıymetli Maden Hesabı (Vadeli Altın Hesabı dahil), Anapara Koruma Amaçlı ve Anapara Garantili Fonlar, Hisse Senedi, Diğer (Hazine Bonusu & Devlet Tahvili / YP), Eurobond, VOB, Özel Sektör Tahvili vb. Menkul Kıymetler, Alış Satış Emri Olan Kıymetler (Niteligi Değişebilen Varlıklar) ve mevcut diğer tüm hesaplarda bulunan paralarına borç miktarı kadar haciz ve bloke konulmasına karar verilmiştir.

Haciz ve bloke konulan hesaplardaki paraların Belediyemizin Vakıflar Bankası Trabzon Merkez Şubesi'nin numaralı hesabına borçlu adı ve T.C. kimlik numarası belirtilmek suretiyle yatırılması, bir adet dekont örneğinin belediyemize gönderilmesi, haczi takip etmeyenler ve gerekli kesintiyi yapmayanlar hakkında hukuki yollara başvurulacağı hususunu bildirir, neticeden tarafımıza bilgi verilmesini rica ederim.

(e-İmzalıdır)

Başkan a.
Genel Sekreter Yardımcısı

Dağıtım :
TÜM BANKALAR

*Bu belge elektronik imzalıdır. İmzalı suretinin ailesi görmek için
<https://uygulama.belediyegov.tr/GenelAcikSoyfilar/Evrak/EvrakDogrulama/EvrakDogrulama.aspx> adresine
girmek (qQESdX-puqy14-S;WqJW-JCPeR0-2Wn01C1R) kodunu yazınız.

Gülbahtaran Mah. Kalamışmarmarış Cad. no:201 Ordubaşı/ Trabzon
Telefon No: (462)224 41 01 Faks No: (462)223 99 41
e-Posta: muh@trabzon.bel.tr İnternet Adresi: <https://www.trabzon.bel.tr/>

Bilgi için:
Veri Hızlı ana ve Kontrol Hizmetleri
Telefon No:

Figure 5. Sample Notice for Block Document

- 1- The sender of the notice is extracted from the title; “Trabzon Metropolitan Municipality”.
- 2- The automation tool reads the document date from the top right.
- 3- It checks whether there is a lien from the "Subject:" information and performs the classification process.
- 4- Extracts the name and surname of the debtor from the text.
- 5- Extracts the debt amount, which is “228.00 TL” in the sample document.
- 6- Finally, extracts the account number and processes the information.

What is Bankruptcy?

Bankruptcy is a follow-up method that provides cash to prepare all the goods and receivables of the debtor whose bankruptcy has been finalized by the Commercial Court of First Instance within the framework of the laws, because he has not paid his debt, and that the receivables are provided to every known creditor with this cash. Contrary to enforcement proceedings, in bankruptcy; it does not matter if the creditor pursues the debtor before the liquidation. Upon notification of the creditors, it is sufficient to write the creditors to the bankruptcy desk. In other words, if the bankruptcy proceedings initiated by the creditors or the bankruptcy case is accepted, each creditor individually benefits from the bankruptcy liquidation.

The cash obtained as a result of the liquidation of the goods, rights and receivables of the debtor at the bankruptcy table, whose bankruptcy has been finalized, is divided among the creditors in proportion to their receivables. There is no need for him to pursue a trace against the person to whom he is indebted, which he indirectly does. The creditor who will go bankrupt as a result of bankruptcy proceedings does not have a priority gain compared to other creditors.

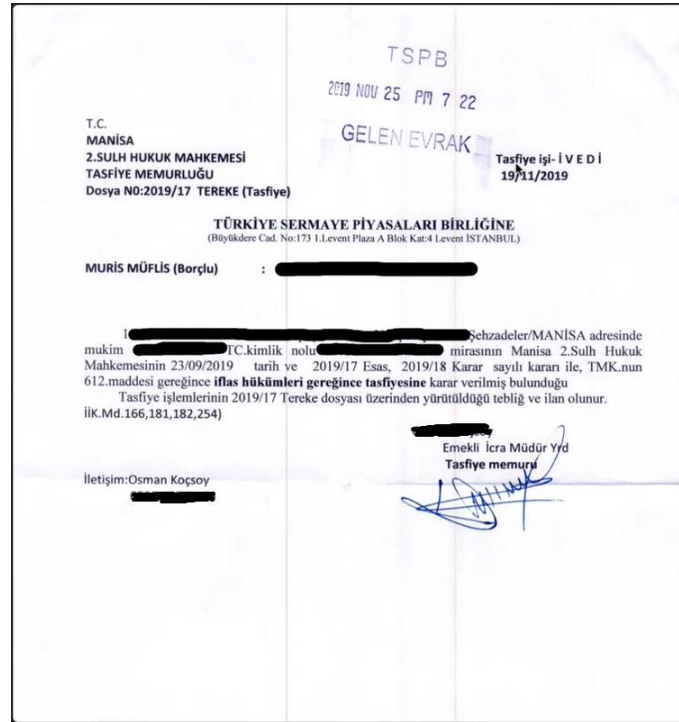


Figure 6. Sample Bankruptcy Notice Document

For document reading, the steps in the Figure 6 document are respectively.

- 1- The document is classified as bankruptcy through its title; “T.C. Manisa 2nd Civil Court of Peace, Liquidation Officer”.
- 2- Extracts the file number (e.g., 2019/17 (Terekke)) in the sample.
- 3- Checks the document date from the Top Right.
- 4- Reads the debtor's information in the “Delegate Bankrupt (Borrower)” field.
- 5- The name of the person and Tc ID number are also extracted from the text.

In line with these interests, the automation tool logs into the system and performs operations on the accounts by searching according to the TCKN.

PROCESSING OF INFORMATION POST DOCUMENT INTERPRETATION

Automation Process

This section discusses how an automation tool executes the filling in the document information as "Foreclosure Blocking Application" and pre-investigating and blocking by the system based on the lien letters coming from various institutions, in which the bank is a 3rd party.

Haciz & Araştırma Talep Bilgileri	Ekler	Tarihçe
Kurum:		
Kurumun İli:	BDDK	
Kurum Şube Adı: *	Belediye	
Kurum Şube Adı 2:	Defterdarlık	
Kaçıncı Haciz:	İcra Müdürlüğü	
Blg. Yazı / Dosya	Mahkeme	
Numarası: *	SGK	
	Vergi Dairesi	
	-	

Kurum: The institution to which the document is sent is selected first. If the institution the letter came from is not among the ready options, the “-” sign is picked automatically.

*For the letters sent from the municipalities in the electronic environment, the "Send Cap" option is selected in order to choose "Municipality" and additionally, the answer can be sent to the institution electronically, and the relevant Municipality is selected from the Kep Address box.

Kep Gönder:	<input checked="" type="checkbox"/>	Kep Adres:	
			Adapazarı Belediye Başkanlığı
			Aksu Belediye Başkanlığı
			Akyazı Belediye Başkanlığı

İmza Ritelleri

Kurumun İli:	
Kurum Şube Adı: *	001 :ADANA
Kurum Şube Adı 2:	002 :ADIYAMAN
Kaçıncı Haciz:	003 :AFYONKARAHİSAR
Blg. Yazı / Dosya	004 :AĞRI
Numarası: *	005 :AMASYA
İhbarname Tarihi: *	006 :ANKARA
Talep Tutarı: *	007 :ANTALYA
AÇIKLAMA:	008 :ARTVİN
Kaçıncı Haciz:	009 :AYDIN
Blg. Yazı / Dosya	010 :BALIKESİR
Numarası: *	
İhbarname Tarihi: *	
Talep Tutarı: *	
	88/1
	88/2
	88/3
	İht. Hac.
	Hac. Müz.

Kurumun İli: The city where the document is sent from. The automation tool picks it from the list.

Kurum Şube Adı: The tool extracts the branch name (if any) and picks it from the menu.

Kaçıncı Haciz: The tool checks the number of bankruptcy letters that has been sent to the same recipient. This is extracted from the document.

Blg. Yazı / Dosya

Numarası: *



Blg.Yazı / Dosya Numarası: The automation tool fills this field with the document that that it extracts from the notice letters.

İhbarname Tarihi: *



the previous step.

İhbarname Tarihi: Similar to the document number, this field is filled by the document date that is extracted in

T.C.
BALIKESİR
1. İCRA DAİRESİ
2021/696 ESAS
Document Number
11/03/2021
Document Date
BİRİNCİ HACİZ İHBARNAMESİ
1. Üçüncü şahsın adı, soyadı ve adresi
: QNB FINANSBANK ANONİM ŞİRKETİ, TÜRKİYE
GARANTI BANKASI ANONİM ŞİRKETİ, TÜRKİYE
VAKIFLAR BANKASI TÜRK ANONİM ORTAKLIĞI,
DENİZBANK ANONİM ŞİRKETİ, TÜRK EKONOMİ

T.C.
BURHANİYE BELEDİYE BAŞKANLIĞI
Mali Hizmetler Müdürlüğü
Sayı : E-70250786-190.15-1903 Document Number
Konu : Haciz Şerhinin Konulması
DAĞITIMLI
10.02.2021
Document Date
DAĞITIM YERLERİNE

Figure 7. Document Number and Date

Talep Tutarı: *



Talep Tutarı: This the amount for which the recipient is responsible for. The bank is asked to block transactions or stop payments up to this amount. In some cases, the amount is not displayed on the notice, where the automation tool checks the previous notices for the same individual or company. This is a very lengthy process for employees and automating this case provides significant time and effort savings.

Kimlik Bilgileri

KPS TCKN/VKN: KPS/VRGI Sorgula
KPS Adı: KPS Soneç:
KPS Soyadı:
TCKN/VKN Ad Soyad TCKN/VKN ÇIĞAR
No results found. TCKN/VKN:

Kimlik Bilgileri: This is the area where the automation tool enters the recipient's information. This is generally done through the search boxes, that can search for detailed information about the individual and companies in the bank's database through citizen ID or tax ID.

Foreclosure Removal Process

It is the process of entering the lien removal letters from various institutions into the system as "Removal of Foreclosure Block". The process involves searching for the debtor or debtors who have been removed, investigating whether there are any blocks in the relevant file, and in the explanation field of the blockages of the file. After filling all required information, the automation tool submits the file for approval by a human.

Similar to the blockage process, the removal process requires the tool to enter the information about the sender, such as name, location. Also, the tool searches for the recipient through citizen and tax IDs. It also makes sure that the accounts that had blockage are found; otherwise, the tool warns the management about it. In the transactions coming from the branch, the transactions are canceled only with the cancellation option, the reason for the cancellation is written in the explanation in a way that the branch can understand, and the operation staff of the branch is informed via e-mail, and the task is completed.

If the missing documents or documents cannot be read in the transactions coming from the branch, or if they belong to a different unit, the "Cancel" option is selected and indicated in the explanation. And the operation personnel of the branch are informed by e-mail.

RESULTS

For this study, a total of 1000 notice documents (200 from each type) were analyzed, and the defined automation solution is applied. Results of the solution are evaluated in two aspects: Efficiency and accuracy. For efficiency, processing times for each notice type are measured and compared. And for accuracy, correctness of the results are assessed at document, field and character levels.

As explained in the previous section, each document type has different number of fields that are needed to be extracted and then used for the banking process. The automation solution defined in this paper requires each field to be defined first. Field types used in the notice documents are text, date and number. In order to optimize the processing time and increase accuracy, constraints such as maximum text length (e.g. 11 for TCKN), date format (e.g. DD/MM/YYYY) and number format (e.g. xxx.xx) are provided to the solution. Next, as shown in Figure 1, OCR engine is used for extracting the fields from the documents.

Table 1 shows the number of fields that are extracted from each notice type.

Table 1. Notice Documents That Are Used In This Study

Notice Type	Number of Fields to be Extracted
Payment Blockage	11
Lien	13
Injunction	8
Account Blockage	11
Bankruptcy	9

Processing Time Results

Processing time for each notice document is dependent on two factors: Number of fields to be extracted, and the scan quality. Quality of the scan directly impacts the performance of automation, as the OCR software requires more processing time to identify the blurred characters (Asad et al., 2016). For this study, the scanned documents are required to have a resolution of at least 300 dpi (dots per inch) to improve processing efficiency. The documents are also categorized by their scan quality as *good quality* and *bad quality*. The quality of a scan is expressed in term of legibility of the document. If a document is not fully legible due to blurry text, obstructions such as stamps and signatures, folds, etc. it is categorized as bad quality. For all notice types, nearly 30% of the documents have bad scan qualities.

For this study, the notice documents were processed on a Windows 10 PC, with Intel Core i7 generation-11 processor, 16 GB RAM and 512 GB SSD. Table 2 below shows processing times for each notice type (200 documents per notice type). In the table, the results are shown based on the scan qualities as well. The last column shows the difference in the average processing times between good and bad quality documents.

Table 2. Processing Times for Each Notice Type

Notice Type	Good Quality		Bad Quality		Impact of Scan Quality
	Average Processing Time per Document (sec)	Average Processing Time per Field (sec)	Average Processing Time per Document (sec)	Average Processing Time per Field (sec)	
Payment Blockage	23.38	2.12	34.98	3.16	1.5x
Lien	31.11	2.39	38.48	2.96	1.23x
Injunction	18.3	2.28	33.09	4.13	1.9x
Account Blockage	24.32	2.21	36.7	3.33	1.5x
Bankruptcy	15.72	1.75	31.14	3.46	1.97x

As can be seen in the processing times in Table 2, the scan quality effects the results up to 2x. Regardless of the scan quality or the number of fields, the automation bots can process each document in less than 40 seconds on average.

On the other hand, it takes about 4-5 minutes for employees to read and extract the fields that are required for each notice type. As a result, automation provides 6x-7x faster processing compared to the human operators.

Accuracy Results

Another important metric for document processing results is accuracy. Accuracy of an automation solution can be expressed in a few ways:

1. Percentage of the documents that are processed correctly
2. Percentage of the fields that are processed correctly
3. Percentage of the characters (digits, letters, punctuation) that are processed correctly

The first definition implies that an automation solution is considered as accurate, only if it doesn't require any human intervention. In other words, all required fields in a notice document should be extracted correctly. This definition usually applies to the scenarios with digital input types (e.g. Excel, Word, digital PDFs, etc.); where documents are not scanned and OCR is not needed. In these cases, the automation solution uses integrations (i.e. SDKs and APIs) to read the digital text and process it.

However, with non-digital input types (scanned documents, photos, fax documents etc.) accuracy is dependent on the scan quality. For those cases, second definition is used to define the accuracy of the automation solution, as some of the fields the documents may not be readable due to bad scan quality. Finally in some cases, the automation solution focuses on a few fields in the document, where all digits are critical for the successful execution of the process (e.g. ID number, SSN, IBAN etc.). The third definition for accuracy is used for those cases.

Table 3 below shows the accuracy results for each notice type. The results are shown as per all definitions of accuracy. For the third definition, commonly used fields are considered. The following are the most commonly extracted fields in all notice types discussed in this study.

- TCKN (Turkish ID number)
- Name / Surname
- Date

Table 3. Accuracy Results for Each Notice Type

Notice Type	Definition #1	Definition #2	TCKN	Definition #3 Name / Surname	Date
Payment Blockage	32%	78.3%	92.32%	83.8%	96.46%
Lien	28%	73.55%	93.13%	80.75%	94.46%
Injunction	23%	82.16%	91.58%	78.32%	96.71%
Account Blockage	32%	80.33%	92.73%	78.56%	96.3%
Bankruptcy	38%	84.55%	93.48%	81.45%	97.05%

The results show that on average, the automation solution can accurately process around 30% of the entire notice documents without any human intervention. Also, for the remaining 70% of the documents, the field-based accuracy is as high as 80%. In other words, the automation solution can accurately extract most of the fields, even when it cannot extract the entire document correctly. This is very common case for scanned documents, as the scan quality may vary inside the same document. Some parts of the document can be more legible than the others.

This benefit also provides significant assistance to the human operator, as the operator needs to work on only for remaining 20% of the fields in the document. In addition, the accuracy results are even higher for the most frequently used fields. The human operator needs to intervene only for 4% of the date results and less than 10% of the TCKN fields.

BENEFITS AND CONCLUSION

This paper introduces an intelligent system that can automatically process court notice letters in Turkey through combination of OCR, NLP and process automation. These letters contain required information for the banks to execute processes such as payment blockage, injunction, and bankruptcy. The notice letters often contain sensitive information about the banks' customers that need to be processed carefully. Also, the letters need to be processed in time, to comply with banks' regulations.

Approximately 1,500 notification letters are received by the banks every day. A total of 7,500 notifications are received separately for each notice, namely for payment prohibition notice, foreclosure notice, injunction notice, blocked notice, and bankruptcy notice. It takes about 5 minutes for a person to read a notice letter, interpret it, enter the data in the system and process it. So, the process requires 125 hours of employee time every day, that is equivalent of more than 15 full-time employees, based on 8-hour workdays.

This study showed that the automation solution can process the notice documents with 80% accuracy on average, and therefore reduce the required manual effort to 20%. The accuracy of the results is dependent on the scan quality, so performance of the automation solution increases further as the scan quality improves. If the robot encounters a system-related error while processing the interpreted information, it notices this error and stops the process by preventing it from going wrong and notify the relevant authorities of this error by e-mail.

In addition, automation solutions have capability to work in tandem with the human operators, which is called as the human in the loop (HITL) approach. HITL allows the human operators easily validate the automation output and correct mistakes as needed. By spending only 20% of the time before automation, the HITL approach offers complete, 100% correct and fast document processing solutions for the financial institutions.

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