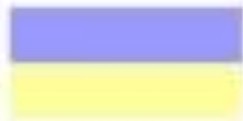# Speeding Freight, Reducing Costs and Pollution

"Creating a Digital Corridor for domestic & International Rail Freight Transport"

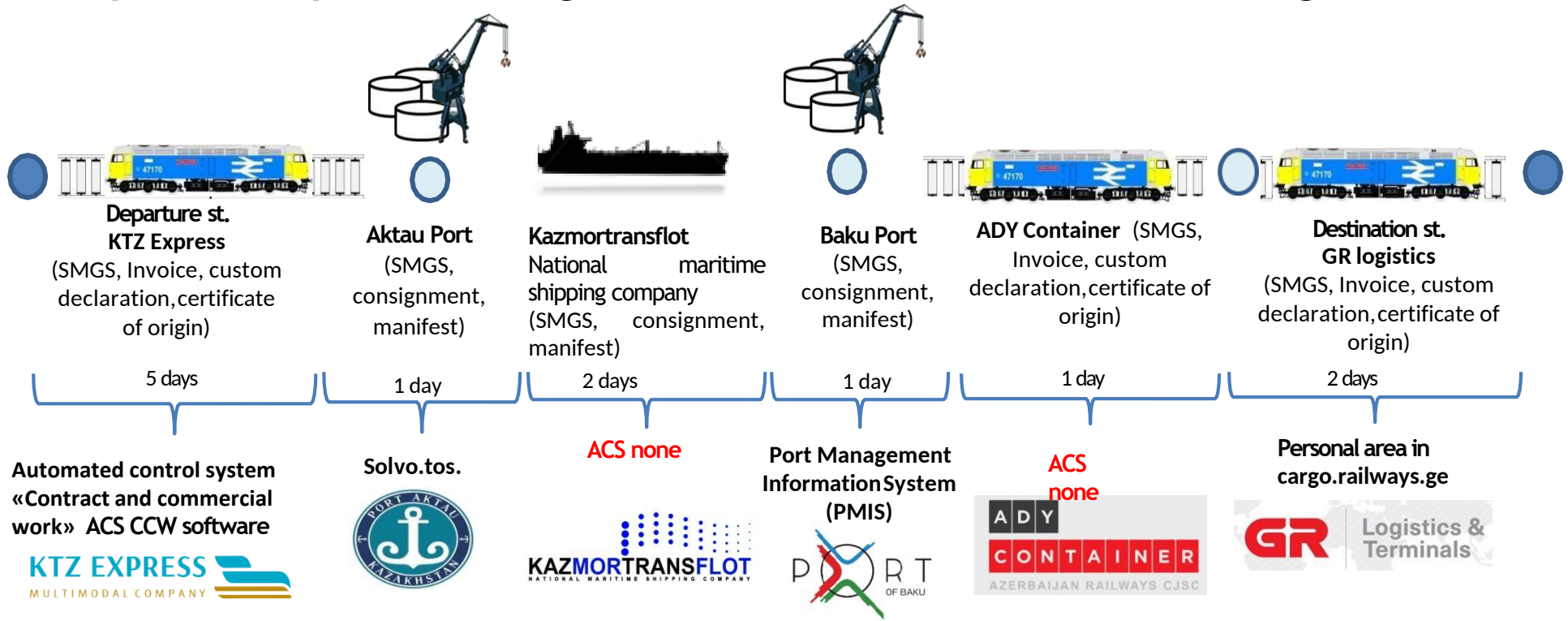"Using Artificial Intelligence to recognize and digitalize freight documentation"

InterRes (Int'l Resources)
**New Jersey, USA**
June 2021

Transportation process diagram on the TITR Corridor from Karaganda to Poti

Departure st. KTZ Express (SMGS, Invoice, custom declaration, certificate of origin)

Aktau Port (SMGS, consignment, manifest)

Kazmortransflot National maritime shipping company (SMGS, consignment, manifest)

Baku Port (SMGS, consignment, manifest)

ADY Container (SMGS, Invoice, custom declaration, certificate of origin)

Destination st. GR logistics (SMGS, Invoice, custom declaration, certificate of origin)

| 5 days | 1 day | 2 days | 1 day | 1 day | 2 days |

Automated control system «Contract and commercial work» ACS CCW software

Solvo.tos.

ACS none

Port Management Information System (PMIS)

ACS none

Personal area in cargo.railways.ge

Consignor: «YDD Corporation» Ltd
Forwarding agent: KTZE (KZ)
Transport territory: KZ – Azerbaijan – Georgia
**Usual transit time:** minimum of 12 days – **4 days of which are for Customs processing**
Integration points: 11 total – 3 of which are for Customs processing

Information systems interaction structure
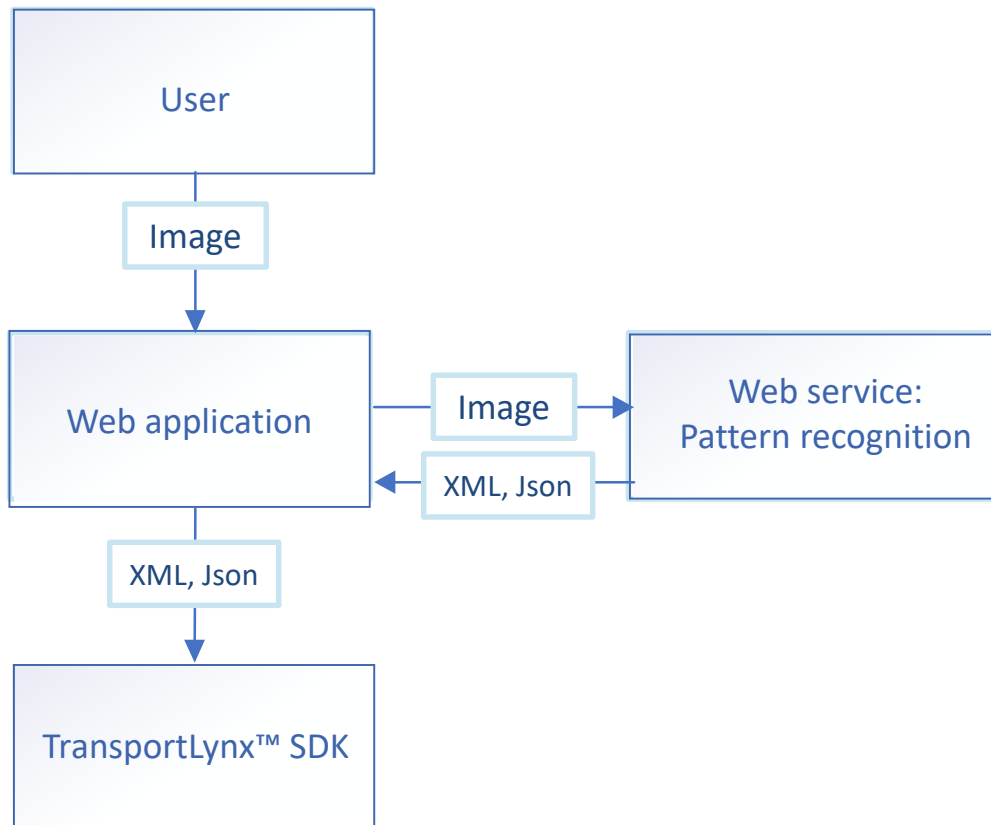
1. **Web-service** – main tool for user interaction.

2. **Image Recognition Web-Service -** images recognition and digitization (PDF, images), using a set of neural networks, their conversion to XML or JSON format and subsequent processing in the system.

3. **TransportLynx™ SDK** – application layer that stores the entire implementation of the interaction with the blockchain network and the protected repository.
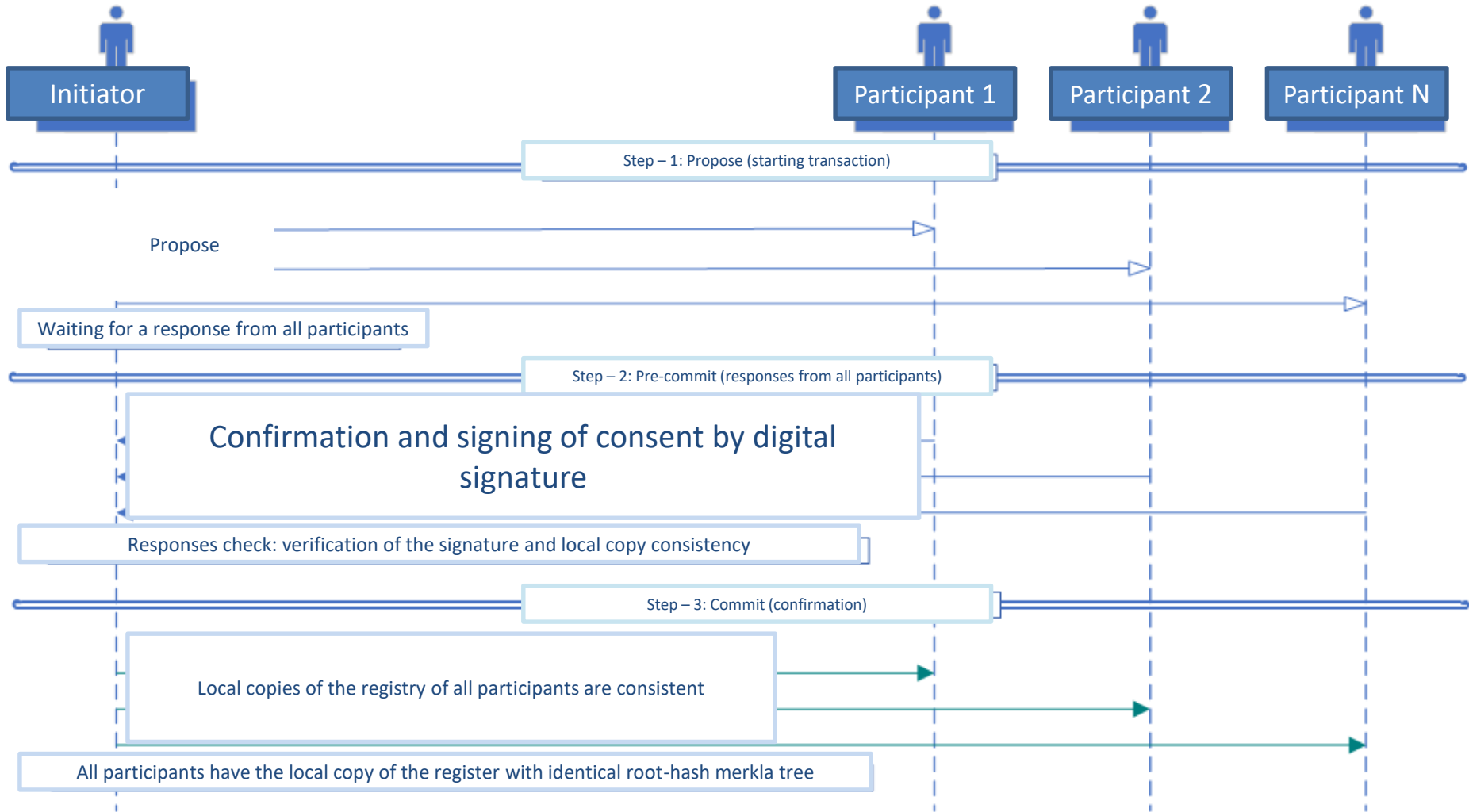
Integration of TITR Corridor Participants
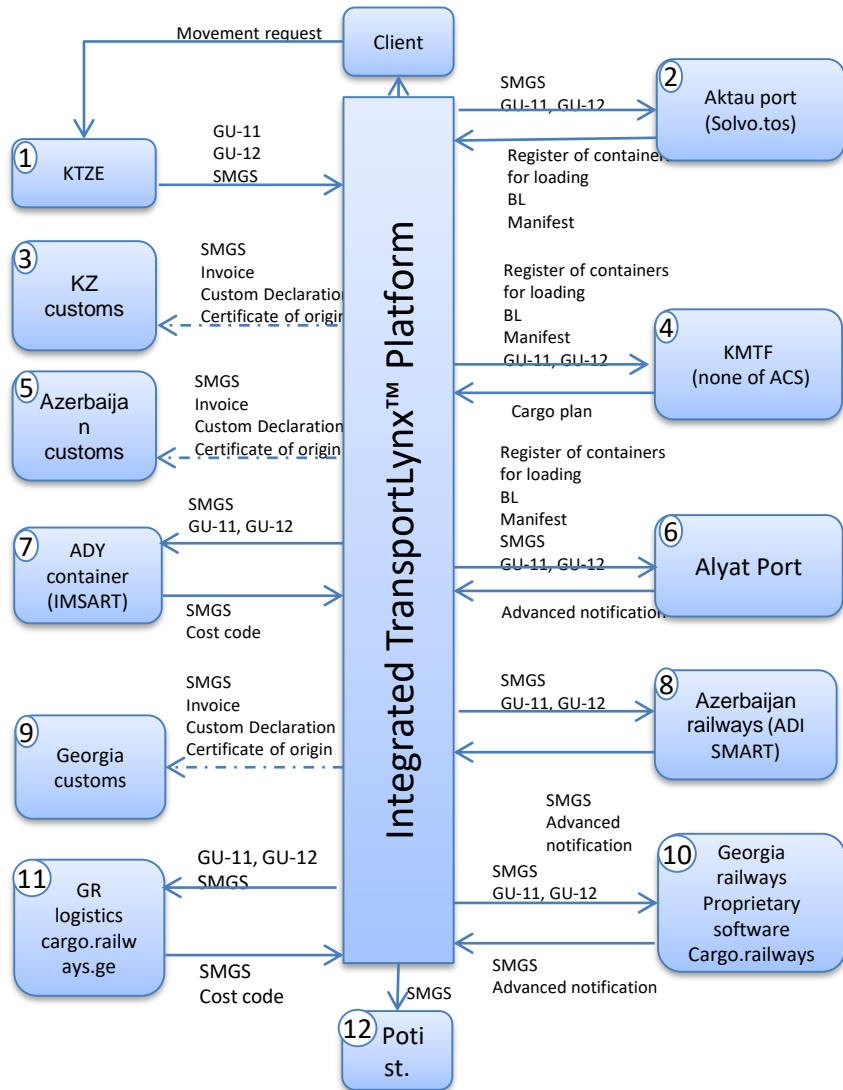
1. The customer, in the person of the consignor, concludes a freight contract with KTZ Express. KTZ Express creates GU-11 and GU-12 cargo plans, after which the data from ACS CCW software through ACS Mesplan are transferred to other railway administrations and Sirius. Sirius notifies ports and forwarders on shipping plans.
2. Then KTZ Express creates a consignment note in the ACS CCW software and transmits payment codes from ADI Container and GR Logistics.
3. Stores the documents in a secure Wallet repository and registers the documents in a distributed registry.
4. Sirius runs a clock generator, according to which documents are sent to other transportation participants. The order in which the documents are sent is indicated on the general outline of the interaction.
5. Upon receipt of the consignment note from other participants Sirius verifies the validity and integrity of the documents according to the previously entered documents. If the audit is not completed, the participant's ACS will be notified and the document transmission chain will be interrupted until the correct documents are obtained.
6. The cargo lifecycle ends at Poti station, the point of last transfer of documents.
7. The customer can check the status and location of the cargo at any lifecycle stage.

Consensus installation mechanism among blockchain participants

Initiator | Participant 1 | Participant 2 | Participant N

Step – 1: Propose (starting transaction)

Propose

Waiting for a response from all participants

Step – 2: Pre-commit (responses from all participants)

Confirmation and signing of consent by digital signature

Responses check: verification of the signature and local copy consistency

Step – 3: Commit (confirmation)

Local copies of the registry of all participants are consistent

All participants have the local copy of the register with identical root-hash merkla tree

Route participants generate cryptographic keys themselves. IndiLynx™ offers a DKMS (distributed key management system) based on the Sovrin Blockchain Network, eliminating the need to have a single RCA (root center authority) and freely builds its own Root-of-Trust with each member
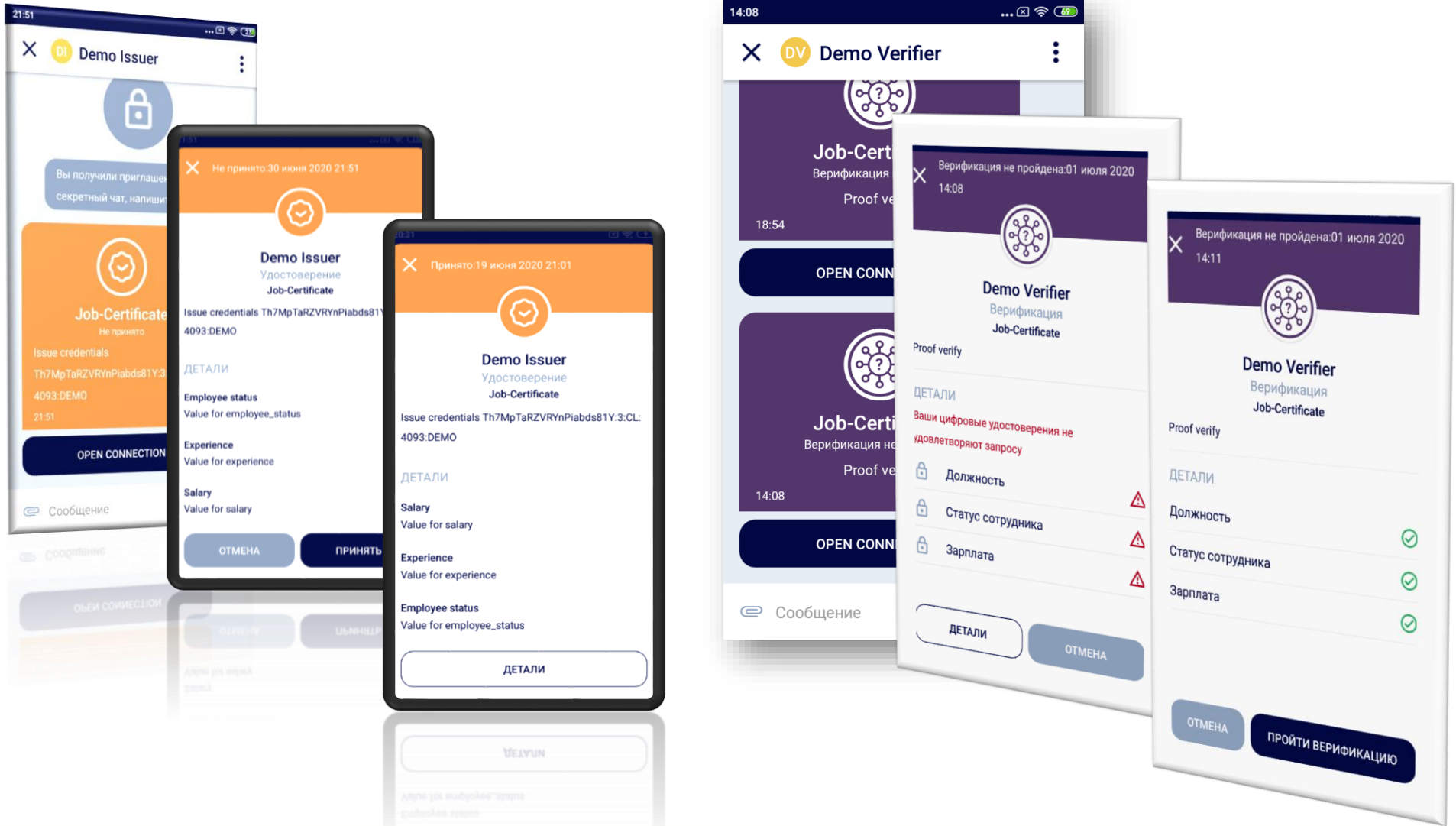
Logic consensus installation mechanism among blockchain participants
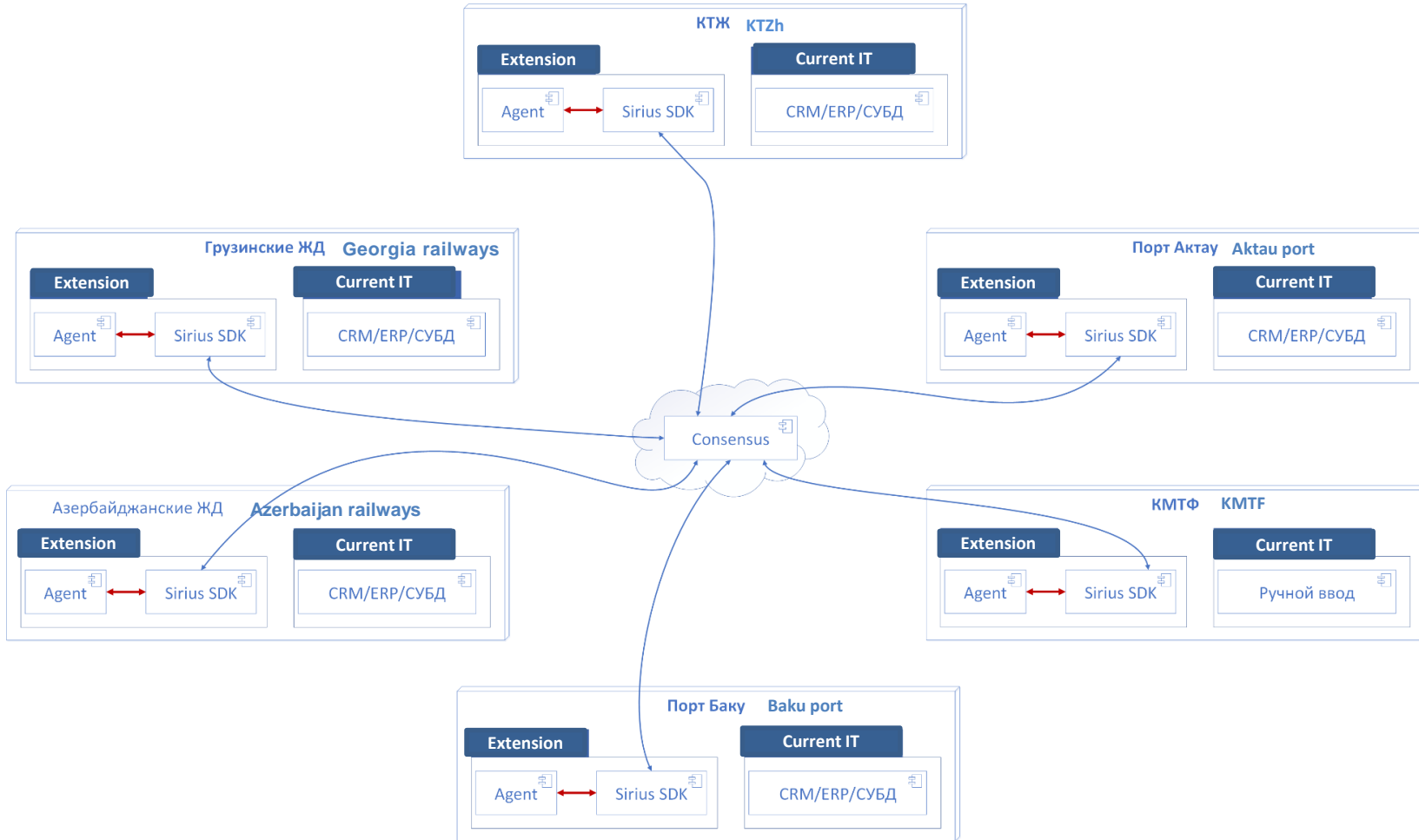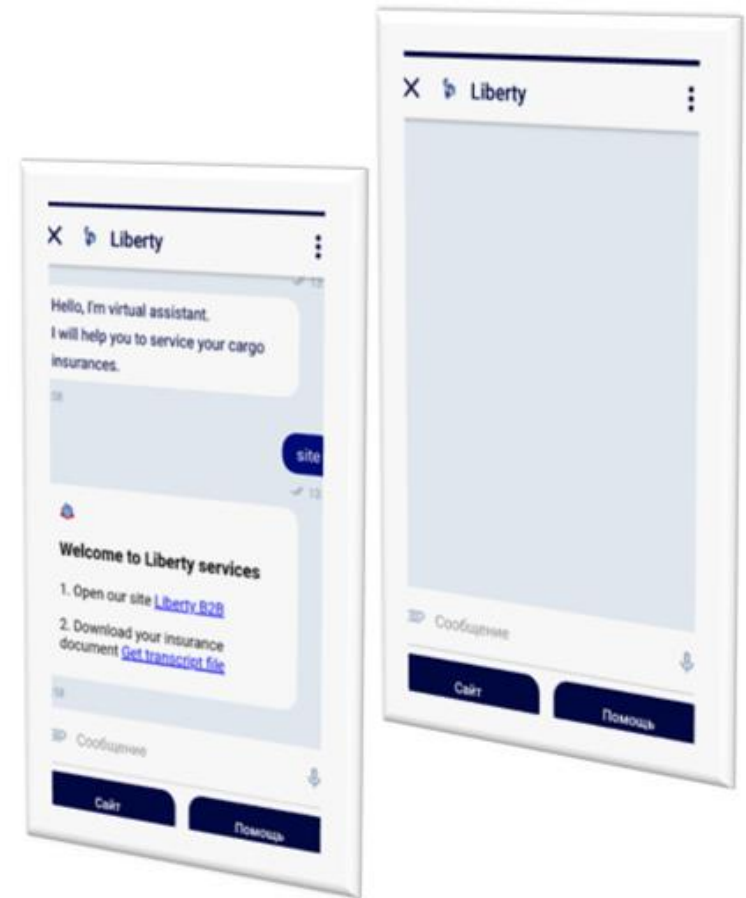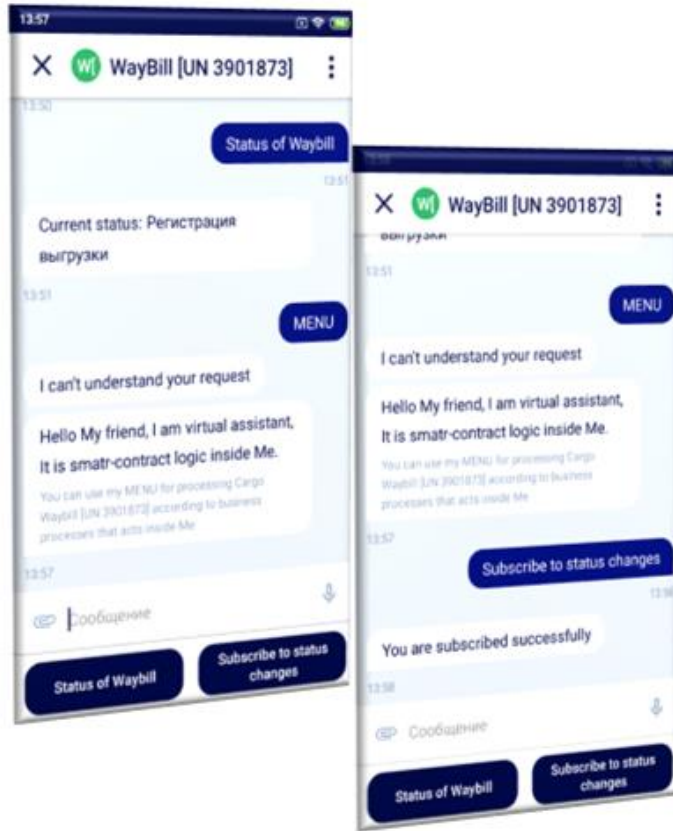

Agent – is a program module
TransportLynx™ SDK – is an Open Source repository, available at GitHub.

TransportLynx™ Agent for smartphone – "Blockchain in your hand"

TransportLynx™ Virtual Assist is your virtual assistant

Mobile application interface is implemented in the following languages:

The TransportLynx™ Platform: Expected Results

⇒ Integration of individual participants of the logistics route, which previously operated in silos, through a single **_TransportLynx™_** integration hub.

⇒ The next stage will be local automation by each participant independently – transformation of the logistics route into an infrastructure and a foundation for development and optimization of the supply chain.

⇒ Integration of independent participants via a single hub allows them to be included in the IT superstructure that will permit:

- **planning the route according to a <u>set</u> of quality criteria** – current systems often optimize a route based on a single parameter (only cost, only time, etc) **_TransportLynx™_** supports both building and marketing tailored services for customers within the supply chain management

- **using Artificial Intelligence to support resource planning** – this can occur even in situations of incomplete information and inaccurate knowledge of system elements

- **integrating multimodal transportation** – the least technical players (eg, truck drivers) can be informed participants and share in data for optimal Supply Chain Management

TransportLynx™ Platform: Expected Cost Savings (Operating Profit Increase)

⇒ Assumptions for shipment: Mixed container train (50 wagons); total 50 items shipped; roundtrip time (standard processing): 14 days = 26 roundtrips per year possible.

⇒ Assumptions for document processing: 20 mins (standard); 1 min (**TransportLynx™**); per shipment: three borders crossed requiring document processing.

- **Time required for Standard document processing:**
  (50 items) x (20 mins/item) x (3 borders/shipment) = 2 days 2 hrs /shipment
  Note: For 14 days roundtrip time (standard processing), **4 days are processing docs!**

- **Time required for document processing using TransportLynx™:**
  (50 items) x (1 mins/item) x (3 borders/shipment) = ~3 hours/shipment
  > Roundtrip time savings compared to standard document processing: **4 days!**
  > New roundtrip time (TransportLynx™ document processing): **10 days!**
  > New annual capacity (TransportLynx™ document processing): **36 roundtrips!**

- **Increase in Operating Profits:**
  10 roundtrips per year x _____ per round trip = ???

ARTIFICIAL INTELLIGENCE

Many options for filling the graph
(printed text/manuscript, language, etc.)

Different quality of document
(stamps, seals, intersections, overlays, noises, etc.)

The ability to make corrections to train the solution
(the more examples, the more accurate the result)

Extracting from a document only what is needed in the context of the task
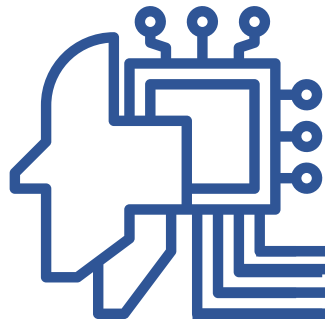("smart" extraction)

Automation solutions for manual processing of documents

Current process of transport operators processing primary documentation

AS IS   ~1 hour

1	**2**	**3**	**4**
Paper consignment note	Manual translation	Manually Typing Text into a Form	Consignment setting in ACS CCW

AI (Artificial Intelligence) is applied for documents classification and content recognition, with the possibility of continuous learning

Key opportunities
- Documents scanning and displaying.
- Content recognition
- Correction
- «Smart» view
- Monitoring and control

Advantages
- Rapid roll out
- Continuous learning
- Flexibility
- Projected accuracy

Optimization of operators' labor inputs to reduce number of errors in processing primary documentation

TO BE   ~ 1 min

1	**2**	**3**	**4**	**5**
Paper consignment	Scanning	Scan copy into TextLynx™	Auto recognition and translation	Auto consignment note setting in ACS CCW

Filling the graph

The web service recognition:
http://168.119.40.132:5002/api/predict

```
{
    "fields": {
        "CargoStatement": "no BY производится через АО <UNK>ОТЛК ЕРА<UNK> код",
        "ContainerNumber": "DFSU7037366 (P) 4561 30480",
    ...
        "DepartStationCode": "194210",
        "DestStationCode": "040600",
        "InvoiceNumber": "11289873",
        "Recipient": "8 HAT HES Baron предоставлен /9 BCE",
        "Sender": "Tower B, SMOC Building No.1033 Xiehe",
        "SenderStatement": "6 ВВГ -Пограничные станции переходов"
    },
    ...
}
```

Quality of documents

The solution will allow you to get the content of graphs even if it is of low quality
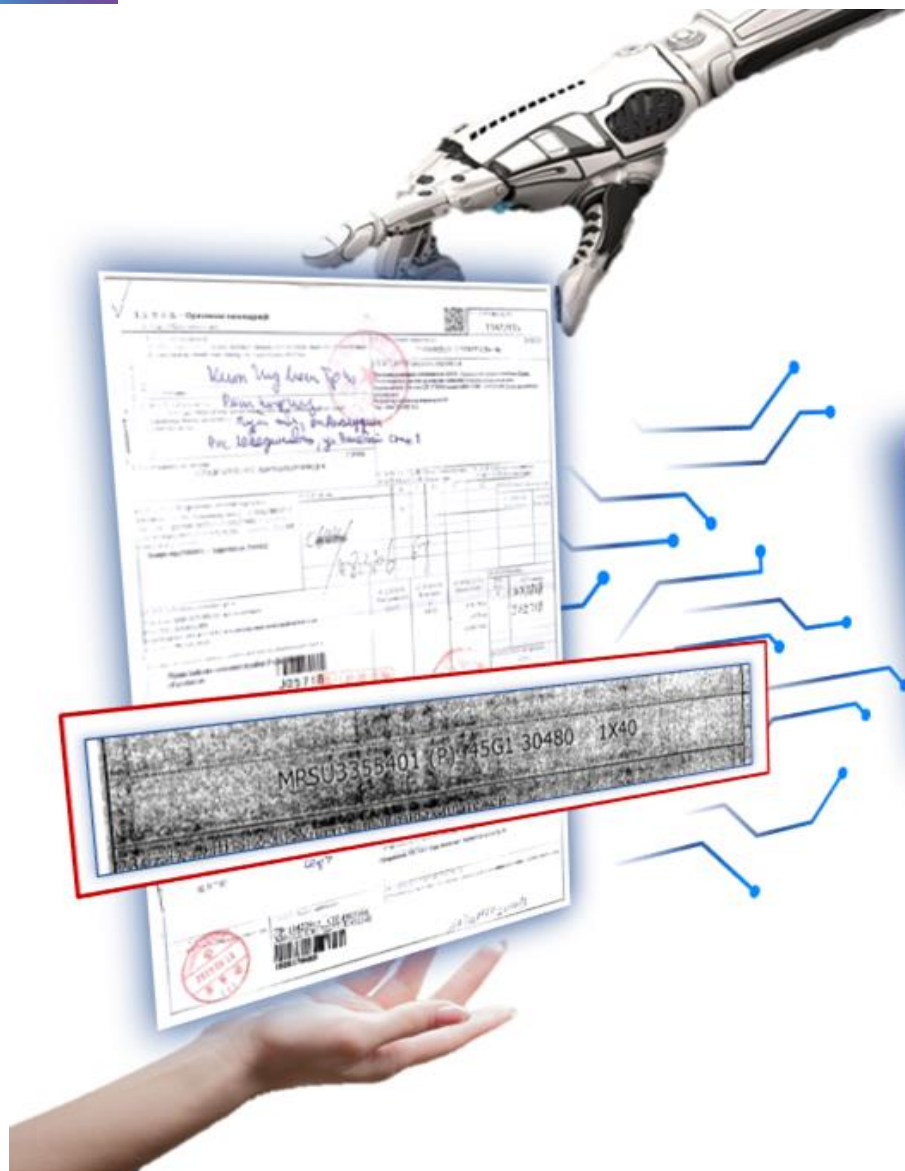
```
{ ...

"ContainerNumber": "MRSU335501 (P) 45G1 30480 1X40"

...
}
```
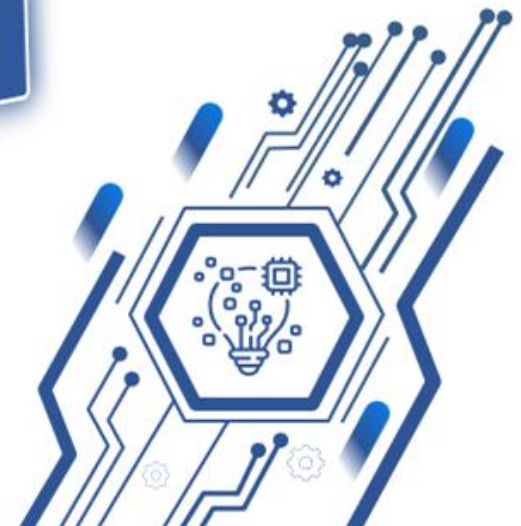
MRSU335501 (P) 45G1 30480 1X40
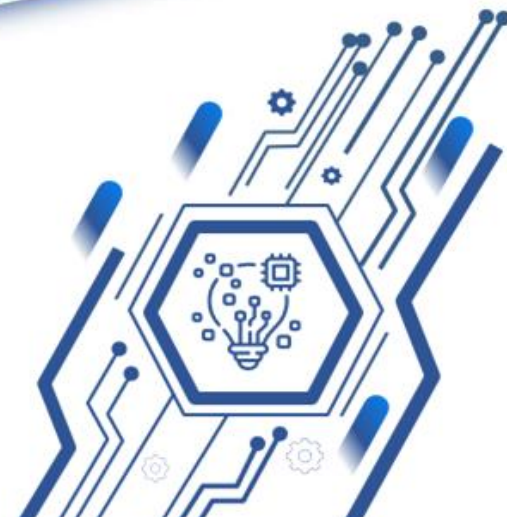
Smart Extraction

The solution allows you to give an answer even if the graph's value is partially readable

```
{
    "InvoiceNumber": "11291843",
    ...
}
```
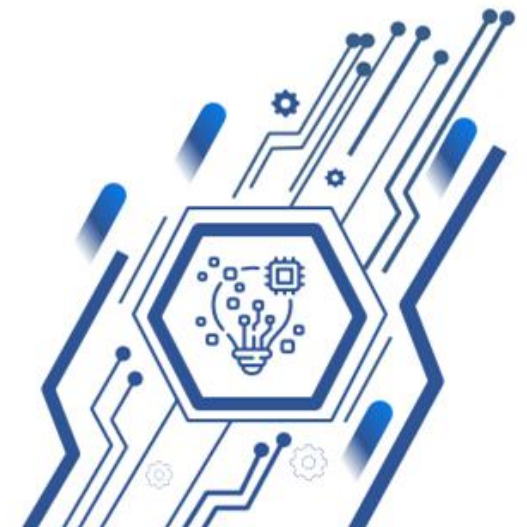
Learning

Learning once a day

The solution allows you to pass corrected graph values if they were incorrectly recognized.

When more fixes are added to the solution, the quality will become better.
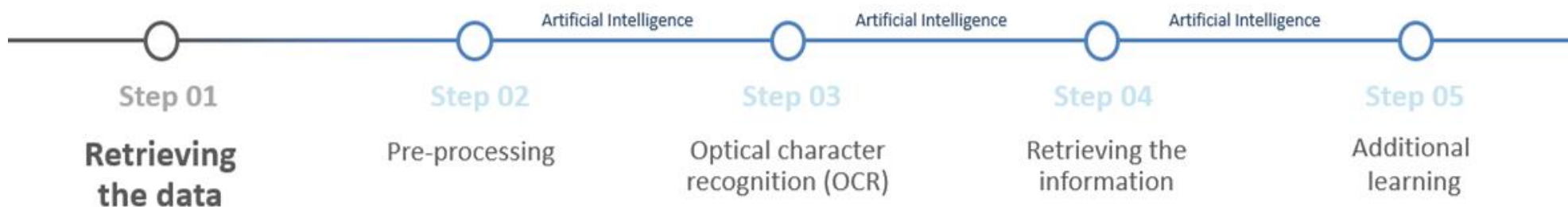
The required number of documents in the DataSet is at least 20 thousand copies. In this case, the predicted value of the recognition coefficient is not less than 90%.

Learning method:
http://168.119.40.132:5002/api/learn/

```
root@Ubuntu – 2004 focal – 64 – minimal / dataset_v3/train # ls –l
Total 3620
-rw-r–r– 1root root 1574292 Oct 9 13:52 10522811_11274290.preprocessed.json
-rw-r–r– 1root root  229082 Oct 9 13:52 10522811_11274290.preprocessed.png
-rw-r–r– 1root root 1666197 Oct 8 10:47 10524164_11297144.preprocessed.json
-rw-r–r– 1root root  231216 Oct 8 10:47 10524164_11297144.preprocessed.png
root@Ubuntu – 2004 focal – 64 – minimal / dataset_v3/train #
```

Process of retrieving the data from graph => Scanning/Saving the Images

		Artificial Intelligence		Artificial Intelligence		Artificial Intelligence	

Step 01 — **Retrieving the data**

Step 02 — Pre-processing

Step 03 — Optical character recognition (OCR)

Step 04 — Retrieving the information

Step 05 — Additional learning

Scanning the image
*pdf

Process of retrieving data from the graph => Pre-Processing the Images

Step 01	Step 02	Step 03	Step 04	Step 05
Retrieving the data	**Pre-processing**	Optical character recognition (OCR)	Retrieving the information	Additional learning

Artificial Intelligence — Artificial Intelligence — Artificial Intelligence

Original scanned image

Eliminating image rotation

Raising the sharpness, contrast, DPI (resolution)

General image improvements

Removing noisy or uninformative elements

Process of retrieving the data from graph => OCR Applications

Step 01	Step 02	Step 03	Step 04	Step 05
Retrieving the data	Pre-processing	Optical character recognition (OCR)	Retrieving the information	Additional learning

Artificial Intelligence

Computer vision

HOCR data:
```
{
    {
        text : "11460484",
        position :
            {
                x : 2564,
                y : 119
            }
    },

    ...

    {
        text : "TEMU7691430 (P)
45G1 30480 1X40",
        position :
            {
                x : 198,
                y : 1875
            }
    }
}
```

Save the result

Docu ment ment

The structure of the recognition Results
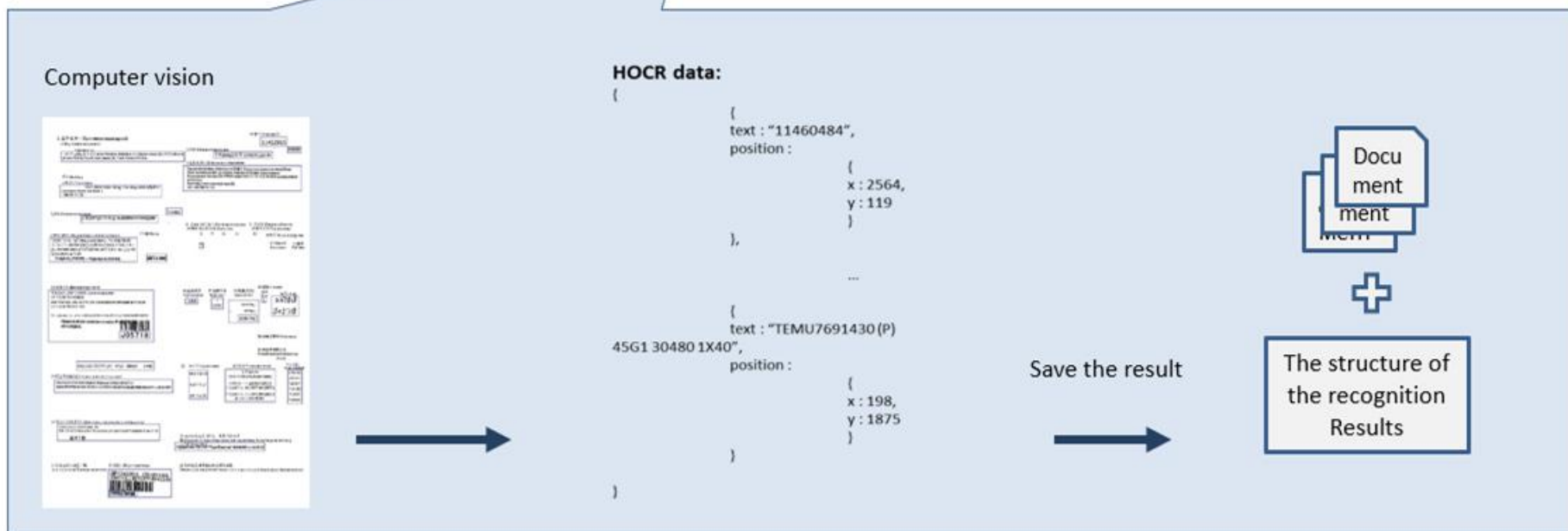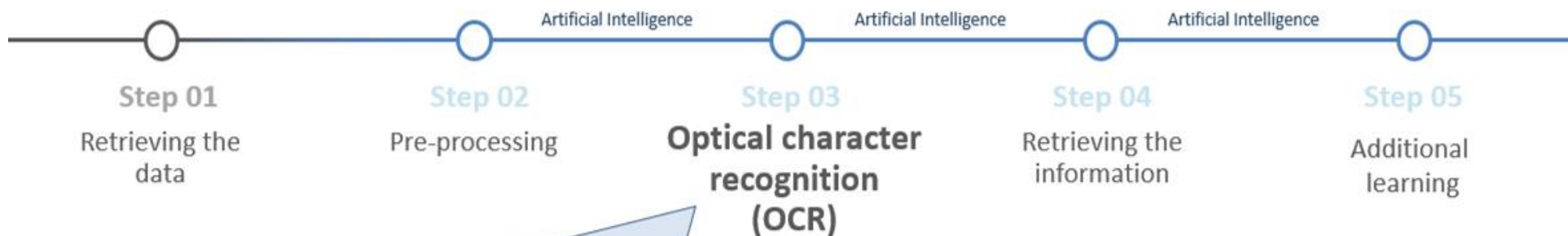
Process of retrieving the data from graph => OCR Voting Tool
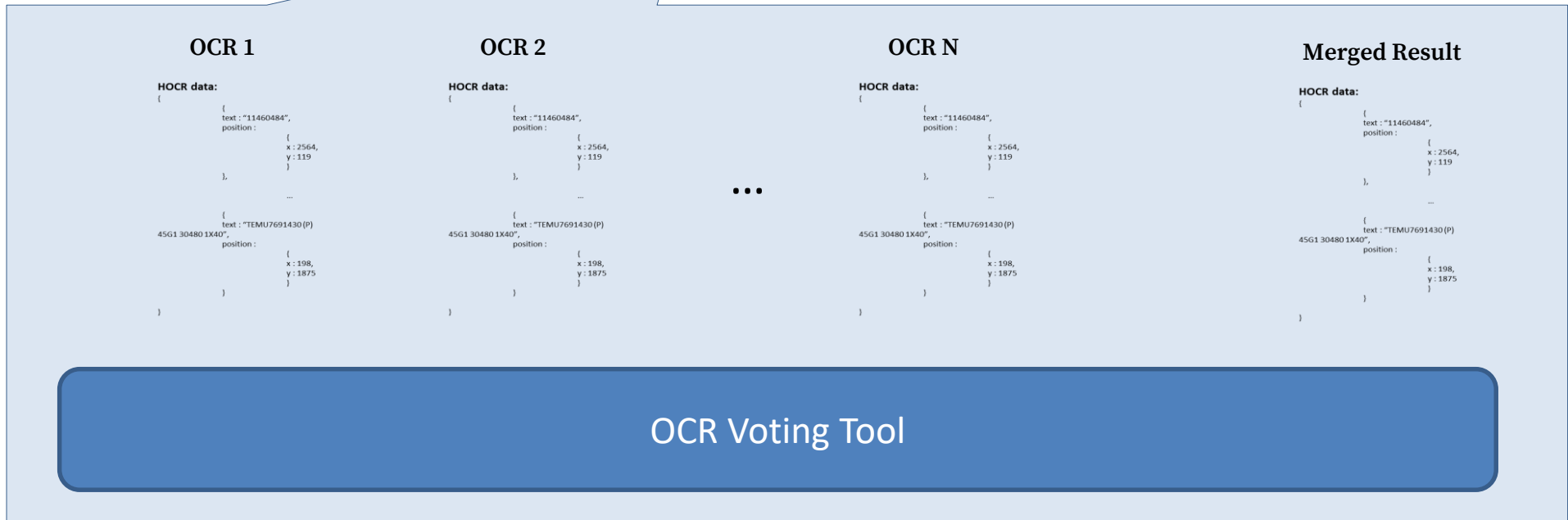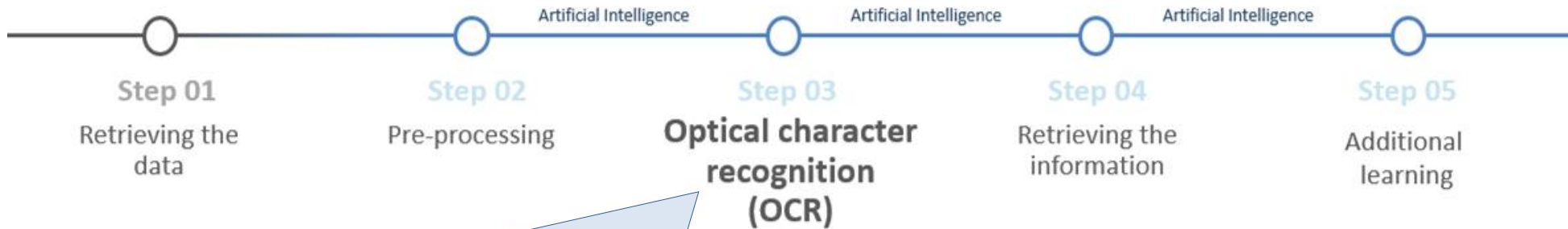
Process of retrieving the data from graph => Using Transformers

Step 01	Step 02	Step 03	Step 04	Step 05
Retrieving the data	Pre-processing	Optical character recognition (OCR)	Retrieving the information	Additional learning

Artificial Intelligence (between steps)
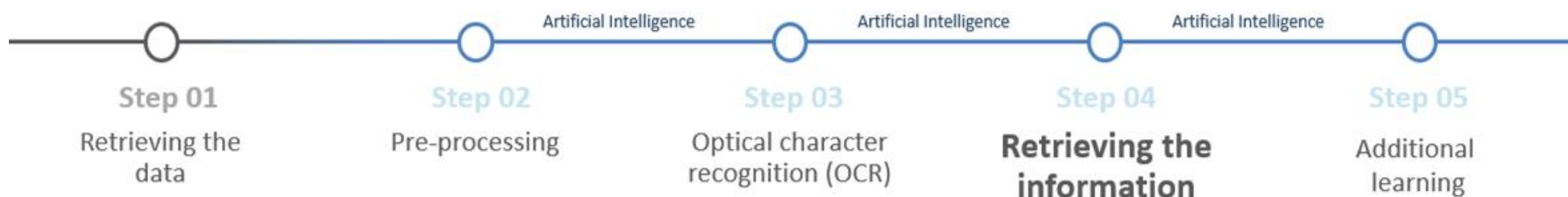
OCR

CKSO11TION CO. TD. 32, AiFgu-ro 12de0n-gil, Gi4eung-gu, Tonginsi,Guionggi-do, Republic Korea

Информация, не предназначенная для перевозчика, № договора на поставку Таможенное декларирование по республике Казахстан осуществляет тос таможенно брокерский центр жибек жолы договор 196 15 tab о 30 04 2015 пункт таможенного оформления пто 09107 брест восточный 92 нмз аль оль se сее ко а др ая аа
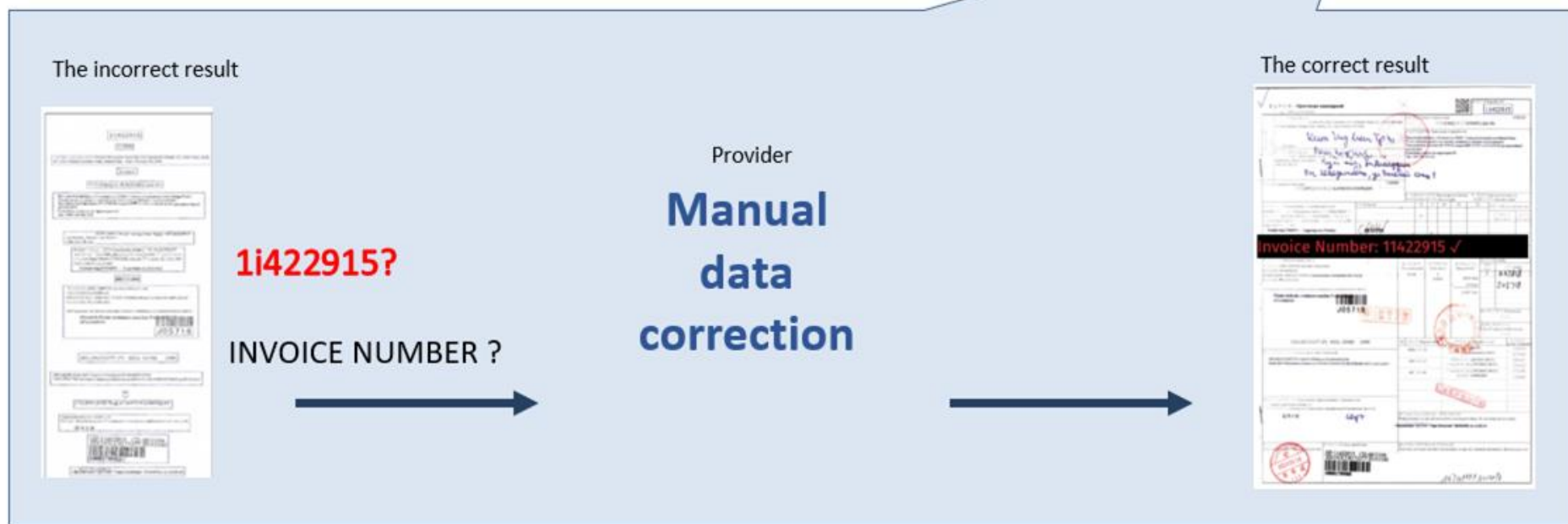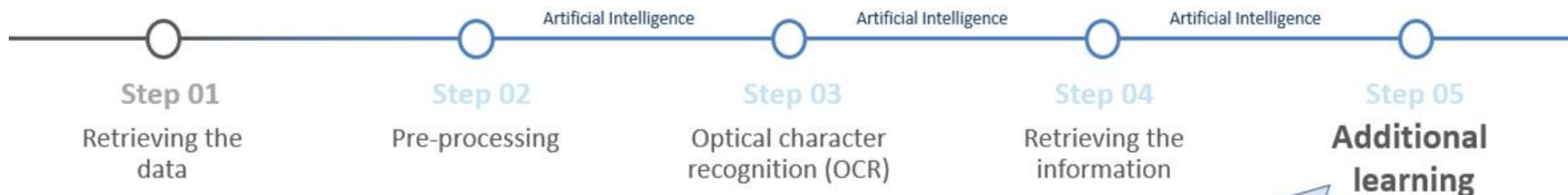
Transformers

CK SOLUTION CO., LTD. 32, Singu-ro 12beon-gil, Giheung-gu, Yongin-si,Gyeonggi-do, Republic of Korea

Таможенное декларирование по республике Казахстан осуществляет ТОО таможеннброкреский центр "Жибек-жолы" Договор № 196-15-ТАВ от 30.04.2015г Пункт таможенного оформления ПТО 09107 БрестВосточный

Process of retrieving the data from graph => Making Manual Corrections

Step 01 — Retrieving the data

Step 02 — Pre-processing — Artificial Intelligence

Step 03 — Optical character recognition (OCR) — Artificial Intelligence

Step 04 — Retrieving the information — Artificial Intelligence

Step 05 — Additional learning

The incorrect result

1i422915?

INVOICE NUMBER ?

Provider

Manual data correction

The correct result

Invoice Number: 11422915 ✓

TransportLynx™ Platform & App

Thank you for your interest!

For further information, to schedule a demonstration, or to discuss an implementation, please contact:

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M-KAZ: +7-777-954-0400
Jeff.IndiLynx@interres.biz