Medical Testing Automation - Nord Robotics

Client Intro

Nord Robotics is one of the leading robotics companies in Lithuania and it is their aim to be the leading robotics company in the Baltic region. Nord Robotics is a representative company of a Japanese robotics company FANUC (Fuji Automatic Numerical Control) which is the largest maker of industrial robots in the world. Nord Robotics provides the most advanced solutions in the field of Artificial Intelligence and implements robotics process automation. It helps the machines to take the front seat which reduces human interaction and eliminates any chances of error.

Nord Robotics has successfully implemented the following robotic structures.

✔ **Robotic Production Gluing:**

This system was implemented in one of the companies in Lithuania where the work of gluing was done manually by humans before. This robotic structure uses UV rays to harden the glue and FANUC iR-Vision system for detecting any defects.

✔ **Robotic Unloading System:**

Nord Robotics designed and manufactured this system for unloading and stacking the products in the production line of a paint factory. It made the process of unloading and stacking faster.

✔ **Robotic Palletizing System:**

his system was also designed for production lines. It is specifically made to place pallets on the conveyor belt and stack boxes on top of them. The robot is also able to assess how many boxes can stack on top of a pallet by keeping in view the dimensions of the pallet and boxes.

✔ **Robotic Plasma Cutting and Welding:**

This automated cutting and welding system was made for an educational institute in Lithuania. It was meant to be programmed by the sudents in order to learn about AI and robotic process automation.

✔ **Medical Testing System:**

We at Evenlogics are proud to be a part of this project. This system was made by us in collaboration with Nord Robotics. This system is meant to do Covid testing with the help of a FANUC CRX 10iA/L Robot which is connected with a Kiosk machine through a Siemens Simatic S7-1500 PLC server. We will talk about it in further detail, later in this document.
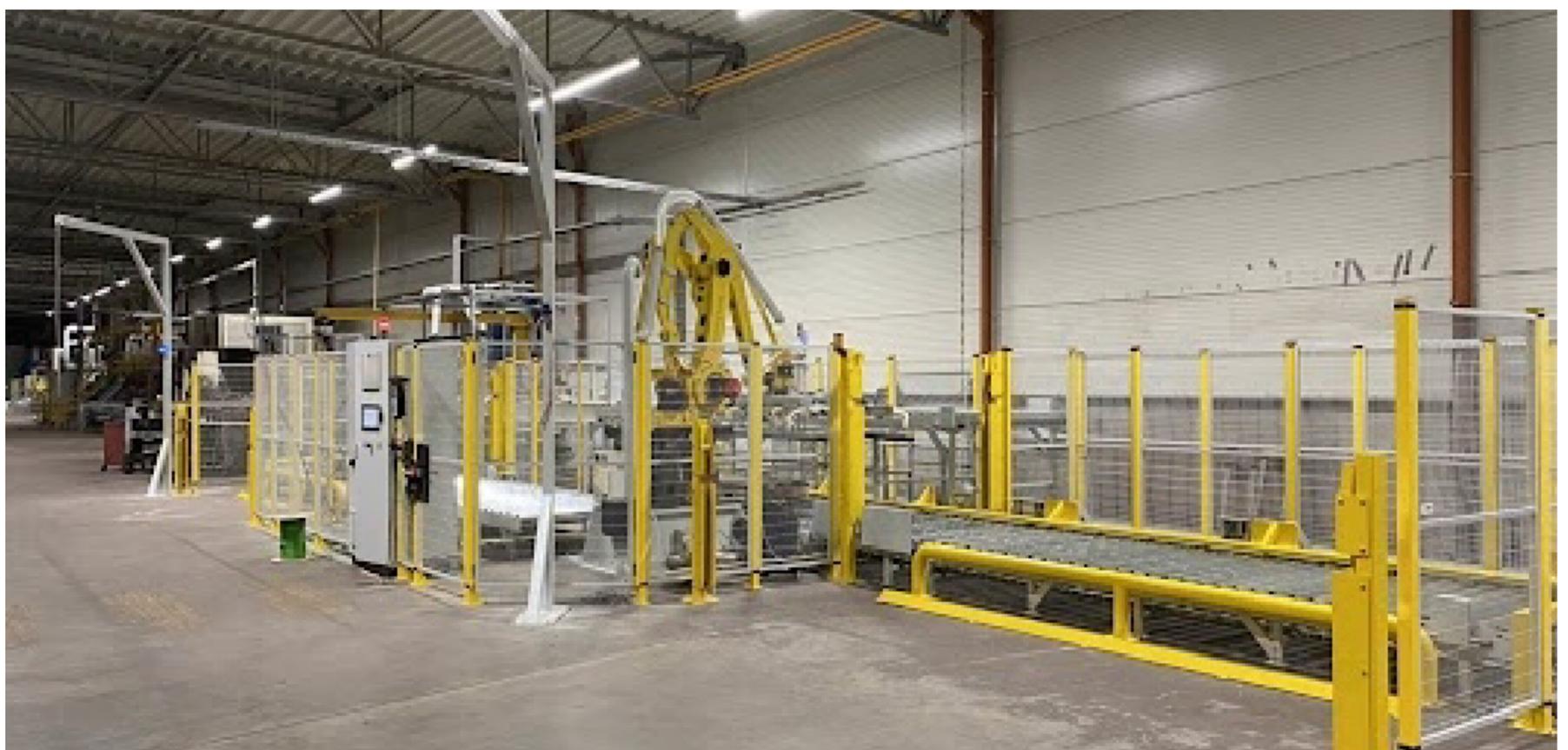
EXECUTIVE SUMMARY

This project was intended to automate the process of laboratory testing with the help of AI and the implementation of robotic process automation. It has eliminated the role of laboratory staff. For Example, famous fast food chains have automated their systems to handle the influx of customers. Similarly the Covid 19 pandemic has created an influx of people in medical testing facilities. To avoid human interaction as much as possible, innovations are being made in this field using the latest technologies.

Nord Robotics came up with their own solution by implementing a Kiosk device in their testing laboratory where patients can submit their tests to a robot and get results on their mobile and desktop devices without any human interaction. This system will be used by patients wanting to have medical tests such as Covid 19 tests. The testing part will be restricted to the medical laboratory premises for now. A patient will use a Kiosk device placed in the medical laboratory, select a test, submit the sample to the robot and do payment. The system that we have developed includes:

- Mobile responsive web application that will help patients to conduct tests and get results on their mobile or desktop devices. Patients will get a unique QR code after the payment of each test and can check the status of the test by scanning that QR code.
- An admin panel containing the information of patients and staff.
- Communication algorithm with AI integration which has made the communication between the Robot, PLC server and our System possible.
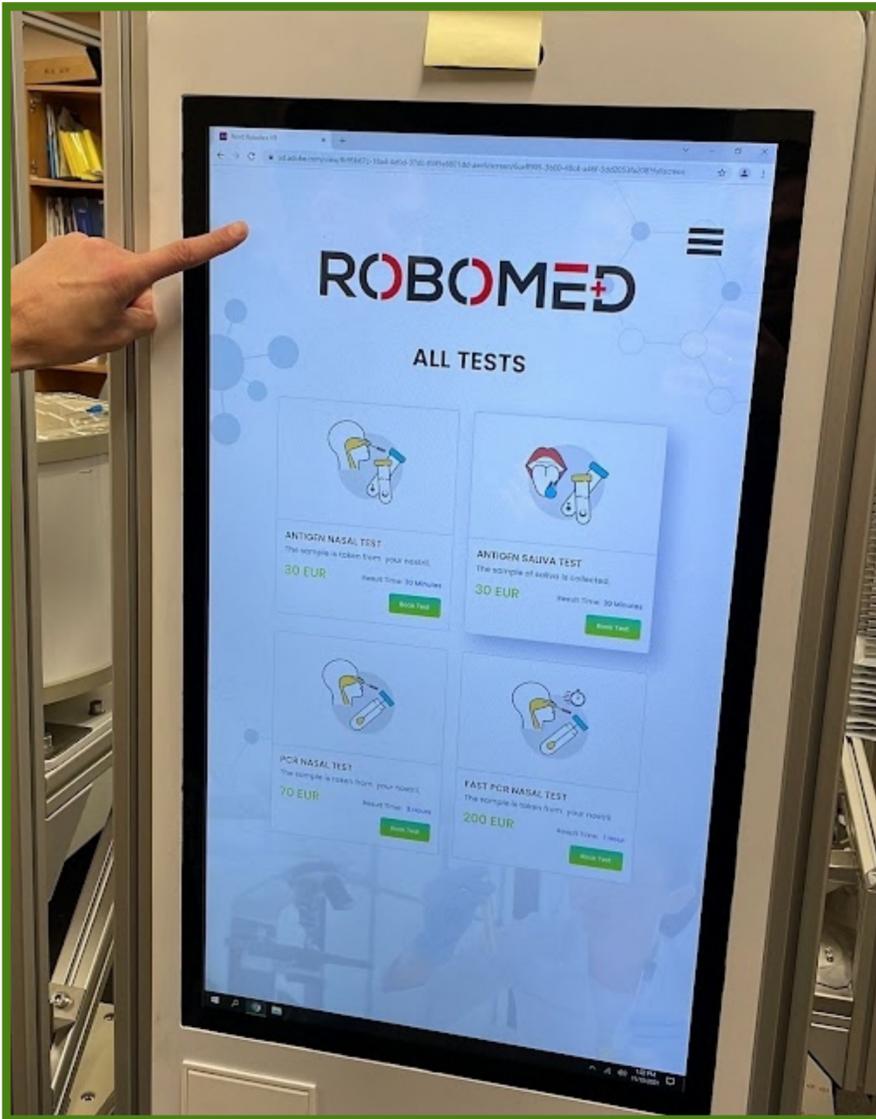
CHALLENGES

The biggest challenge for us was to establish communication of our system with the Robot through the PLC server while working remotely. The robot and the PLC server were present in Lithuania while we had to perform the communication of our system with the robot through PLC from Pakistan.

The PLC server used by the client had outdated client libraries which were responsible to perform communication between our system and the robot. These client libraries were written with an old and complex approach which was not compatible with modern systems. Though it was not an easy task, our top performance engineers worked around this problem and were successful in establishing the communication between our System and the Robot through PLC server in the initial phase using the existing client libraries.

Later on during the project our R&D department warned us that using an outdated approach will affect the scalability of the project in the future so we had to halt the development to find a better approach and build the whole communication solution from scratch. The previous approach would have worked for one system but our clienthad plans to implement this system in multiple testing laboratories throughout Lithuania and the Baltics. For that a parent system was needed which would act as a hub for all the child systems. If we had continued with the old approach, it would have made the system complex and prone to failure.

PROPOSED SOLUTIONS

We arranged a meeting of our Server Engineers with the PLC Engineers of Nord Robotics to find a way out of this predicament. After giving it a lot of thought, our R&D department suggested the implementation of a Web API based PLC server which would make the communication between our system and robot smooth and would be scalable in the future. Our R&D department specifically suggested the use of Siemens Simatic S7-1500 PLC server which is not much expensive as compared to other similar PLCs and is highly customizable as well.

Our technical team wrote a communication algorithm with the collaboration of the technical team of Nord Robotics. All the API requests and responses against requests were designed as well as how the orders will be mapped from scratch. The robot has a code reader inside it which reads the vial code on the test vials. We created several variables to keep track of the different states of the robot and mapped order IDs with vial codes in order to keep track of the correct order of tests.
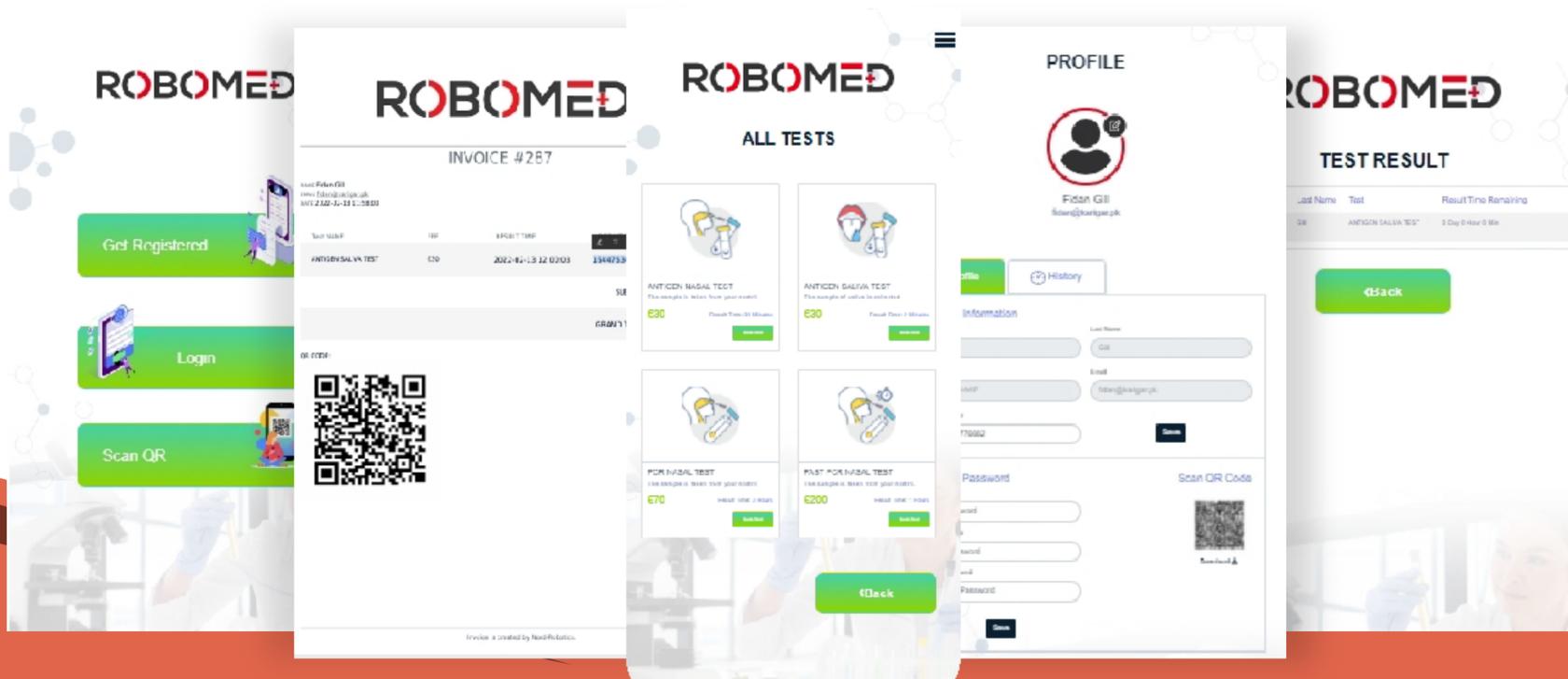
PLC COMMUNICATION

1. The PLC client is using Siemens Simatic S7-1500 which has JSON based Web APIs for communication. Required data is obtained by our system by sending an API request which is processed by the PLC's Web API. The PLC gets the required data from the robot and sends the response through an API response.

2. Patient starts the test by pushing the Start Test button. It generates an API request from our system, then our system waits for the response.

3. The PLC sends our system an API response that the request has been received.

4. The PLC prepares the robot for tests in the meantime.

5. The Robot prepares an empty test vial for sample collection.

6. While the Robot prepares for the test, the user(patient) is shown an informative video regarding the working of the Robot and steps the user has to take.

7. After the robot is done preparing the test vial for the patient, the PLC informs our system that, "The window will open in a few seconds" and it is displayed as a message on the Kiosk screen.

8. The window opens and the patient takes the test vial and puts the sample(Saliva) inside the vial. Patient puts the sample vial back in the Robot and presses the Initiate Process button.

9. When the Initiate Process button is pressed, our system sends an API request to the PLC to instruct the robot that the sample vial is in the robot, close the door. At the same time our system reads the API response from the PLC and displays on the frontend that the, "Door is closing".

10. When the robot is informed by the PLC that the test sample is in the robot, the robot checks the position and weight of the sample and the PLC will responds back accordingly.

    a. If the sample's weight and position is not correct then the PLC prompts our system to insert the sample again.

    b. If the sample's weight and position is correct then the robot will start the testing process according to the queue priority of tests.

CONCLUSION

Despite all the challenges and roadblocks, our team was able to check all the boxes for the completion of this project. We were able to build a user-friendly application which is so simple that even people with no tech knowledge can use it. We have developed a state of the art trainable Machine Learning Algorithm which runs perfectly on Neurofy's Cloud Platform. Neurofy's Milk Adulteration Detection System is another medal on our chest which we have earned after our sheer dedication and hard work.

APPLIED TECHNOLOGIES

When it comes to technologies, our team is armed to the teeth. We have all the expertise to hike the challenges, no matter how mountainous or difficult the terrain is. At Evenlogics we have the maestros who are proficient in all the latest technologies. Based on our requirements analysis and feasibility tests we have successfully completed this project using the following technologies.

Blade

Blade is a templating engine which works perfectly with Laravel. Its processing rate is pretty fast with Laravel. We wanted all the components of the application to work in perfect sync, that's why we chose Blade.

Laravel

We have a very strong team of Laravel developers. Laravel is the backbone of this project and is used in both the frontend and the backend of the app. We prefer Laravel because it is powerful and scalable. It is the best PHP framework in the market and 80% of the websites are powered by PHP. This framework enables rapid development with MVC architecture and its high end security features are required to make any modern day app secure. It allows an application to be more scalable. Keeping all the technicalities in view, choosing Laravel for this project was like a match made in heaven.

React JS

React js is one of the best frameworks (a library to be exact) to make catchy interfaces. React enables the reusability of components possible throughout the interface which makes the experience smooth and fluid. We have a very experienced team which is proficient in the big three frontend technologies i.e. React, Vue and Angular. We chose React for the admin panel to create an amazing user experience which is both fast and eye catching.

MySQL

MySQL is the most popular Relational Database Management System. It is known for its high performance, flexibility, security, round the clock uptime and complete work flow control. We have chosen MySQL because of all these features which sit really well with the scalable nature of the project.

Python

Python is the leading programming language in the field of AI and Machine Learning. It has the best packages for writing Machine Learning Algorithms and APIs. In this project we chose python to write the communication algorithm to automate the testing process which is done by the robot through the PLC server.

React JS

MySQL

python

laravel
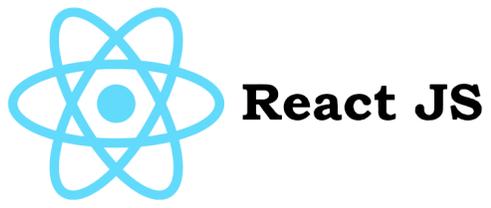
Thanks For Watching!

EVENLOGICS ®

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