



Case Study



Remote urine analysis for cancer patients at home using machine learning

A healthcare company revolutionizes testing to bring convenience, speed and efficiency to a traditional laboratory test

Executive Summary

A revolution is taking place in healthcare. Machine learning is revolutionizing the way we diagnose, test for, and treat ailments. This case study showcases how ML based remote urine analysis is not only reducing hassles for cancer patients, but is also making the entire process faster.

Overview

Lately, one of the biggest changes being observed in the healthcare industry is that patients are becoming consumers. And these new-age healthcare consumers give more importance to one crucial thing above all; convenience.

Cancer patients who have undergone chemotherapy have to perform urine tests at regular intervals. Experts analyze the test strips in labs to compute diagnostic parameters. The patients or their relatives have to visit these labs for the tests. This causes delays in getting the results.

Our customer wanted to minimize this delay and make the test more convenient for the cancer patients. They envisioned a scenario in which the patients would be able to complete the entire test from comforts of their home. These sample also contain rich information which could be used for future studies without compromising patient confidentiality.

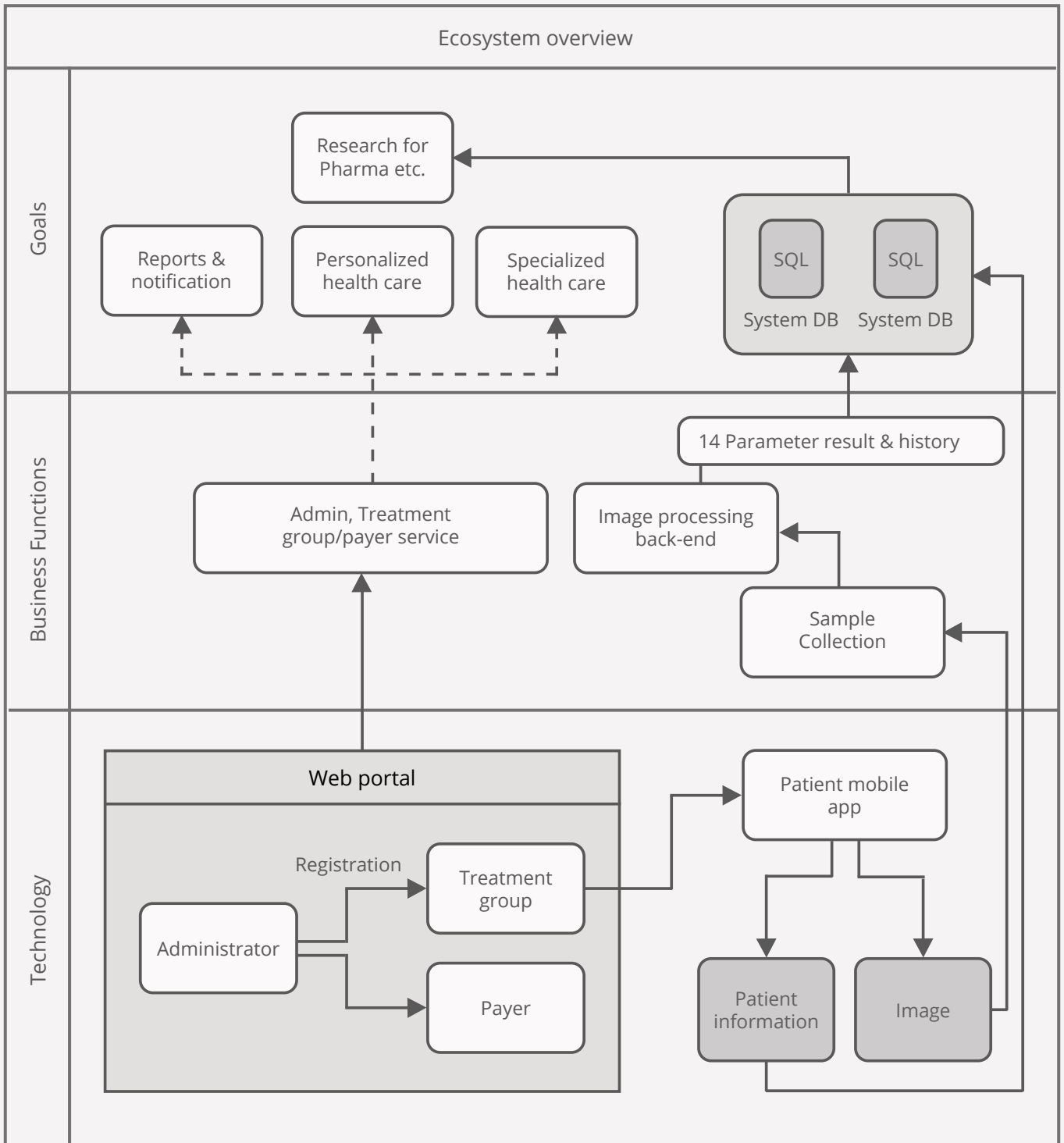
Challenge

Our customer wanted to create a solution which would simply require the patient to click a photograph of the test strip and upload it. Using machine learning, the urine analyzer would compute all the important diagnostic parameters and provide a report instantaneously. The doctor would also get a report for their records and treatment plans. A payment system would be plugged in to take care of co-payments. For this vision to become a reality, our customer had to overcome several challenges:

- The end user; the patient, is usually under stress after chemotherapy. The average age of patients is between 45 and 55 years. While practitioners are used to technology, the user experience had to be intuitive and seamless for people who might not be tech-savvy.
- The process had to work using mobile devices and laptops.
- Data access controls, confidentiality, secure transmission and storage critical concerns which needed to be addressed.
- Manual analysis was backed by human expertise and experience. A high fidelity ML model was needed to match this credibility.
- Deep image processing knowledge was required to extract the right features from the data.

Solution

Great Software Laboratory developed the entire product from scratch.



Solution architecture

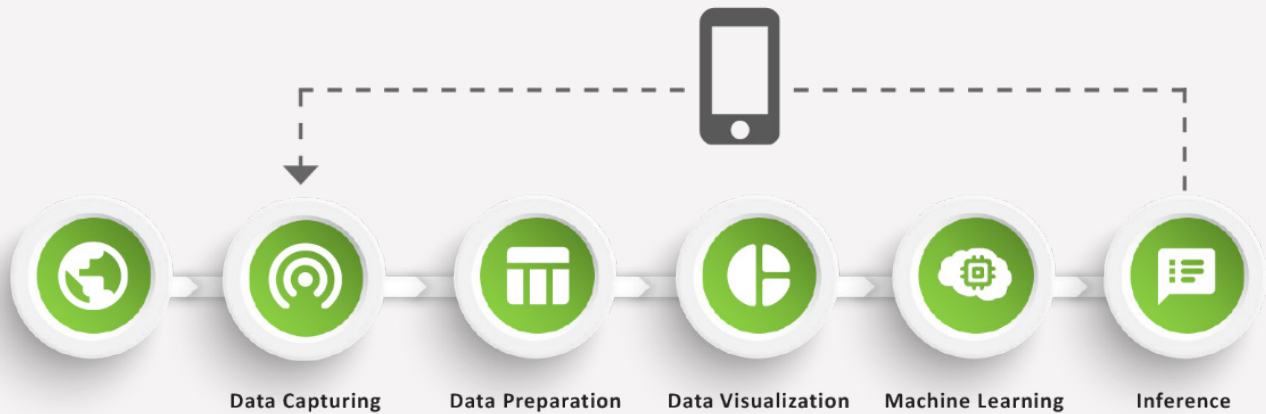
User experience

GS Lab worked on the user stories for the patients, doctors, administrators and payers. We then defined product workflows for each of those stories. For increased accessibility, the product was designed to work with simple mobile devices. Extra functionality was added for payers and administrators.

Data science process

- Working with the customer, GS Lab got sample images and their results (the input and output for training the ML model).
- We developed mobile and web applications to collect the images of the strips.
- Leveraging our experience in advanced image processing, we developed algorithms to extract the right features from the images.
- Feature extraction had to deal with noise and variability in image capturing. Our solution was designed to deal with such images.
- Looking at the pattern in the features, GS Lab decided the most suitable ML algorithms.
- We initially experimented with various ML models. The promising model was developed and tuned with a larger dataset.
- Our mobile application displayed diagnostic parameters using simple dashboards.
- The consulting oncologist was notified and they could access the results with the click of button along with patient history and past results.
- The data in anonymized form was made available for further research.
- GS Lab managed data engineering for the entire process.
- We had domain experts who could help with the interpretation of ML model results. This accelerated the development process.

Azure micro services were used for the entire data science process.



Data protection and compliance

Healthcare regulations and expected usage across the globe required strict compliance on many fronts.

1. Complying with the local regulations, the sample data was cleansed and stored in the local geography.
2. The feature extraction algorithms were run in the same geography. Only features and corresponding output were used for ML model training.
3. The regulatory compliance documentation and approval process included documenting high-level risk assessment, master validation plan, IQ/PQ/OQ plan and scripts, deployment security, database security etc.

Ecosystem integrations

1. The payer workflow was integrated with the application to create a seamless experience for the patient.
2. SMS and email notification mechanisms were developed to keep the patients and healthcare providers informed.

Impact



**Faster
Results**



**Reduced
load on labs**



**Improved app
Scalability**

This product will hit the market soon.

- The high fidelity ML model and its accuracy was appreciated by our customer and their investors.
- The product will revolutionize urine analysis for the cancer patients.
- It will save a lot of hassle for patients, reduce delays and reduce load on the test facilities.
- The scalability of the product will enable more frequent testing of the patients.
- A powerful and enriched urine-database will be generated for future data analytics and predictive use.

Great Software Laboratory (GS Lab) has been the technology partner of choice to 100+ organizations across North America, Europe and Asia-Pacific for over 16 years. Leveraging our expertise in 130+ tools & technologies, we have created 300+ 'first-of-its-kind' solutions to real-world problems. Our 'Beyond code' philosophy ensures that we not only push boundaries of existing technologies but also try out newer problem solving approaches to keep our customers one step ahead of their competitors. Our global team of 1200+ employees is adept at creating 'real value' at each stage of the customer growth journey, right from proof-of-concepts to completely scaled up products. For more information about our solutions & offerings, please visit www.gslab.com

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