



SUCCESS STORY HEALTHCARE

WILLOW BRINGS GROUNDBREAKING NEW PRODUCT TO MARKET FASTER

Apexon leverages "blitzscaling"
approach to cut cycle time by 80%

willow

Willow, a Silicon Valley-based healthcare startup, is completely re-imagining the way busy moms pump breast milk with an innovative, patented technology called the Willow Wearable Breast Pump.

To realize its product vision and get it to market as quickly as possible, Willow required a combination of manufacturing innovation and digital technology expertise.



**FDA-APPROVED, PATENTED
TECHNOLOGY**



**USED BY MORE THAN 70,000
WOMEN IN THE US**



**RANKED ONE OF TIME
MAGAZINE'S 25 BEST
INVENTIONS**



In 2019, Willow partnered with Apexon to deliver on the digital technology aspect. This included the development of a companion mobile application with firmware testing and verification. Apexon employed a "blitzscaling" approach to deliver the project within six months, developing a complete device firmware protocol test framework. In addition, Apexon provided end-to-end mobile application design and development, as well as application automation framework design and development.

THE RESULTS

KEY OUTCOMES



COMPLETE DEVICE FIRMWARE PROTOCOL TEST FRAMEWORK

Developed from scratch, ready-to-use for firmware verification on manufactured devices and FDA compliance verification.



END-TO-END MOBILE APPLICATION DESIGN & DEVELOPMENT

New architecture of the companion app for scalability and performance improvement.



APPLICATION AUTOMATION FRAMEWORK DESIGN & DEVELOPMENT

Leveraged an off-the-shelf automation framework to accelerate cycle time by 80%.

OUR METHODOLOGY

THE DIGITAL LIFECYCLE

Apexon works with companies across the digital lifecycle.



GO DIGITAL

LAUNCH & EXPERIMENT



BE DIGITAL

AUTOMATE & ACCELERATE



EVOLVE DIGITAL

BE INTELLIGENT & AUTONOMOUS

Enable digital adoption in a quick and agile manner



Build digital infrastructure and foundation for enterprises to scale



Leverage data engineering to make strategic decisions and get digital right every time

Apexon assigned an Agile POD to develop a companion mobile application and device firmware.

The POD worked with Willow in the development and discovery phases to determine the solution functional requirements and architecture design. The POD then developed an application automation strategy, firmware protocol test automation strategy, and a Proof-of-Concept (PoC) with Apexon QAF (Quality Automation Framework) to validate all QA automation requirements.

The Apexon POD helped Willow develop its test framework and comprehensive release verification and testing program.

Apexon developed an iOS and Android companion application, worked on their cloud integrations and performed end-to-end verification activities.

Apexon performed device testing (BLE interface testing and BLE protocol framework) and application testing.

The Apexon team developed a companion application with device usage and user behavior analytics. This included a device firmware protocol test framework that supports data structures and expected data verification. Apexon also deployed the application on the Firebase Google Cloud platform.

AGILE POD

A multi-skilled team consisting of digital strategists, Digital Engineering and Quality Engineering professionals

THE CHALLENGE

TO DEVELOP NEW FUNCTIONALITY



The Willow Wearable Breast Pump is a Class C medical device subject to strict FDA compliance requirements. In addition to the physical breast pump designed and manufactured by Willow, each of the software and messaging components also had to be developed with functionality and performance fully verified before and after the breast pumps were manufactured. In some cases, Willow was testing functionality that had never been developed before. There were a variety of difficult technical challenges which needed to be addressed in a timely manner, all within tight FDA compliance requirements.

THE SOLUTION

WORKING AS A TEAM

Apexon started by conducting a thorough analysis of Willow's functional and application architecture requirements and developed a proof of concept to confirm all QA automation requirements.

From there, the scope of Apexon's engagement included a combination of digital engineering and quality engineering. A ten member multifunctional Apexon POD worked with Willow in four phases - Discovery, Development & Integration, Verification & Validation, and Implementation & Production Set-up.

The outputs from this effort included:



COMPANION MOBILE APPLICATION DEVELOPMENT

- Android and iOS Applications
- QA Automation Framework for Mobile Applications

This included both the application layer and wireless interfaces. Apexon handled the development of all functionality for both Android and iOS applications, as well as the automation of testing for all application functionality on both operating systems.



DEVICE FIRMWARE

- Firmware protocol test framework including behavior-driven test scenarios for functional modules on iOS and Android
- Firmware verification for device manufacturing
- Firmware functional verification



DEVELOPMENT & QA OF THE BLE COMMUNICATION INTERFACE

The Apexon team was responsible for developing the BLE protocol test framework, data format, data structure verification format, and all QA and testing for the BLE wireless interface.



QA FOR INPUT/OUTPUTS IN DEVICE MOTORS & SENSORS

This included data logging and algorithm verification for functionality like controlling the rate of milk suction, amount pumped, auto-shutoff when full, etc. in the wearable breast pump.



QA FOR PROCESSING & CONTROLLING OF WIRELESS INTERFACES

Apexon validated all device functionality and performance and verified compliance in a variety of different possible usage conditions.



ANALYTICS

Apexon collected analytics on usage, device performance, user experience, adoption, and fed it back into Willow's existing custom and off-the-shelf analytics packages.



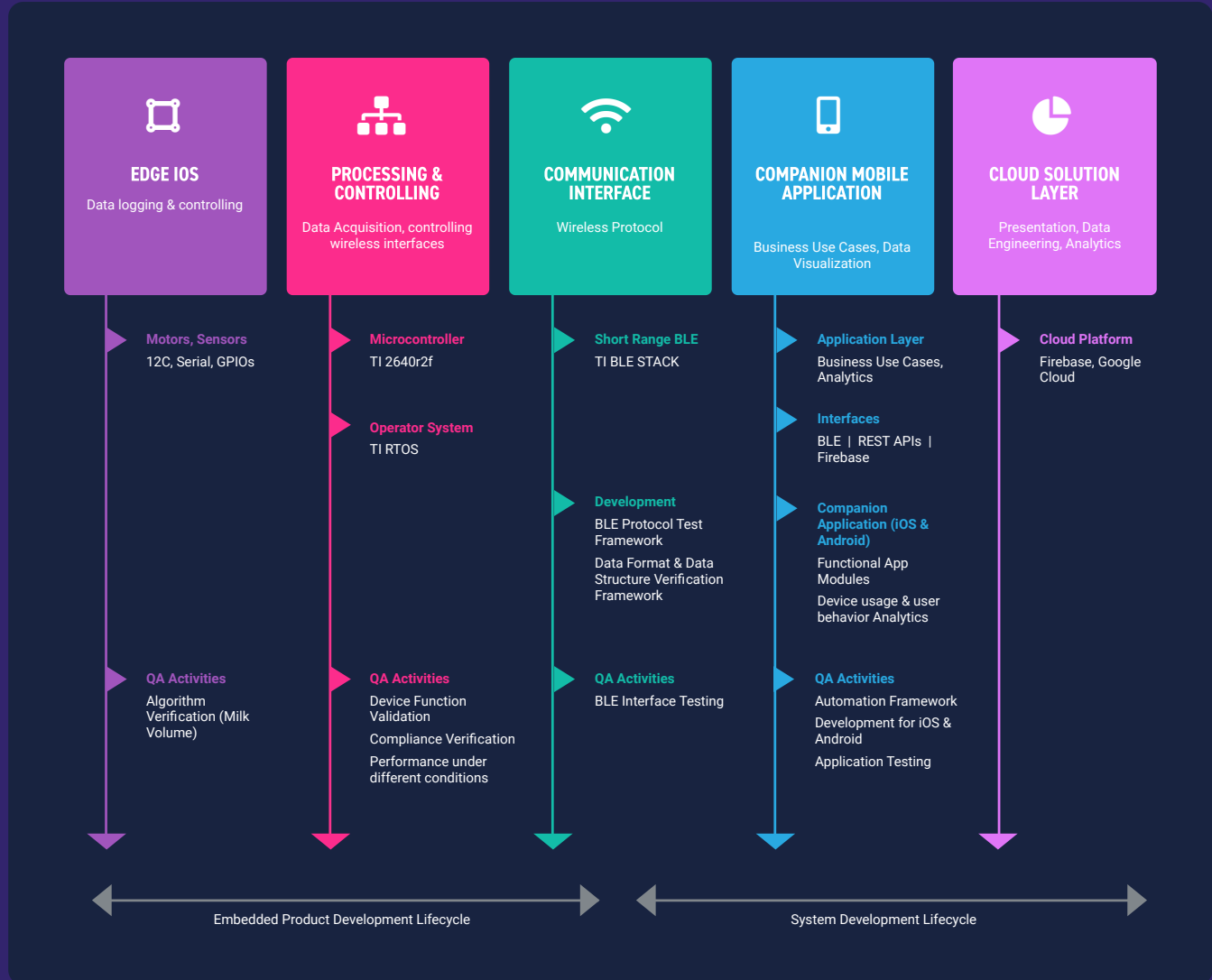
CLOUD SOLUTION LAYER

Apexon also worked with Willow to customize its cloud presentation layer for data engineering and analytics.

SUMMARY

APEXON ENGAGEMENT

By solving the difficult software development, performance and testing challenges, Apexon helped Willow get its patented innovation to market in a timely manner, fully compliant with FDA requirements, and with full user functionality. It was a win for all involved - and especially busy, multi-tasking moms.



Apexon is a pure-play digital engineering services firm focused on helping companies accelerate their digital initiatives from strategy and planning through execution. We leverage deep technical expertise, Agile methodologies and data-driven intelligence to modernize systems of engagement and simplify human/tech interaction.

We deliver custom solutions that meet customers' technology needs wherever they are in their digital lifecycle. Backed by Goldman Sachs and Everstone Capital, Apexon works with both large enterprises and emerging innovators — putting digital to work to enable new products and business models, engage with customers in new ways, and create sustainable competitive differentiation.

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FEELING SOCIAL?

