GENESYS
ELECTRONICS DESIGN

Where Innovation Gets Smart

Case study: Company X

Creating safer construction sites

For commercial reasons, we can't reveal the name of this company. However, the case study is closely based on an actual product delivered.

Introduction

Company X provides physical safety products for the construction industry, where they dominate their niche. The range of safety products protect workers from inadvertent injury and restricts access to dangerous areas.

The company is primarily a distributor for the majority of the products it delivers but wanted to develop its own products, which the company felt it was in a good position to achieve, as it understands the market well and knows what its customers want. A particular need was the detection of unsafe activities.

Company X was working with a university researcher to develop an algorithm to differentiate normal construction activity from that potentially indicating safety issues, using a variety of sensor inputs. This algorithm was patented to protect the company's investment in the technology.

With the patent in place, the company approached Genesys to develop a range of "smart products" that would be integrated into its physical offerings and help differentiate its services from the competition.

Strategic analysis revealed that adding vision, motion and proximity sensors to its normally inert physical devices would enable them to provide a value-added service, delivering superior safety and security features and deliver value-added services. An examination of competition quickly established that no one product covered all the functions and features the company envisaged, forcing customers to purchase multiple products at greater expense.

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The initial business requirements for Company X's product was for a device operating off small, low-cost batteries for up to a year, with detection of tampering or incorrect installation, communication of alerts, ability to automatically turn some devices off during normal work hours, and regular health checks to ensure all devices are operational. All data needed to be communicated wirelessly to a virtual cloud server and then to a mobile app.

In the initial discussion with Genesys, Company X's business requirements included a vision system. However, examining the technical complexity and power requirements, it was quickly realised that the business case for this feature did not stack up.

Working backwards from the user needs, Company X identified that users just wanted to be sure each sensor was working correctly and that, when an alarm is triggered, the user could easily visualise which alarm has been triggered.

The first major product development activity in Company X's project was a full day user requirements workshop. Three of the most experienced staff of Company X attended along with their project manager. The workshop identified the requirements of the device without any reference to the possible technical solution. Requirements were coded as essential, desirable and future.

A key requirement was communicating the alarm data wirelessly and cost-effectively. It was identified that a Low Power Wide Area Network (LPWAN) technology would be appropriate. However, there were many competing and rapidly evolving technologies in this space. A decision was made to separate the LPWAN communication onto a plugin board, so that it could be easily updated as the technology changed, without having to redesign the entire board.

The Sigfox network was chosen as the initial direct connectivity option, as the technology was being rolled out nationally at the time, the first such LPWAN service in Australia. When a major telecommunication provider started rolling out the NB-IoT option for LPWAN, Genesys developed an NB-IoT plugin module as an additional option.

The company was also concerned about devices being subverted by contractors looking to avoid the safety rules set by site managers. A light sensor was included to detect masking of the device and an accelerometer was included to detect relocation or destructive abuse of the device.

Another key requirement was that Company X wanted to extend the capabilities of the safety device to act as a security sensor during non-working hours. However, they wanted to avoid the need to set working times.

It was realised the patented algorithm underpinning the system was also able to characterise between "normal" construction activities during working hours and the normal non-working hours activities of rodents, wind noise etc. The system was configured to automatically transition from a safety-oriented mode during working hours, to a security mode after hours, where all abnormal activities would generate an alarm.

Working with Company X's usability expert, Genesys develop a web browser and mobile app for interfacing with the system.

The app had two main functions. The first function was to commission a device and configure it for the system. This was facilitated by a Bluetooth connection directly to the device.

The second function was the management of alarms, including a visual representation of all the devices overlaid on a map of the construction site. A typical large-scale construction site may have dozens or hundreds of sensors. When an alarm is generated, the location of the device is illustrated on a map of the site. This feature allows the safety or security officers to quickly direct emergency personnel to the exact location. Alerts were sent by multiple pathways to ensure they were received and acted on.

Apart from the alert information, the only other data transmitted is a regular heart-beat signal so that the user or Company X knows if a device has gone offline. The status of the sensor is illustrated on the map using configurable colour codes.

Another key requirement was for the device to be battery operated, enabling easy installation. Genesys included a number of low power features in the product design, all aimed at minimising the energy requirements of the device. These features included a separate processor for handling motion, audio and proximity detection, so the main processor could be asleep most of the time.

The result was that the device is powered using four AA battery cells for up to a year of continuous operation. An additional benefit of using easily available batteries is that the product can be more easily shipped without batteries, and is easily set up by users.