

CASE STUDY

SMART BED

EMBEDDED SYSTEM

Smart ICU Bed Embedded System Development

Customer

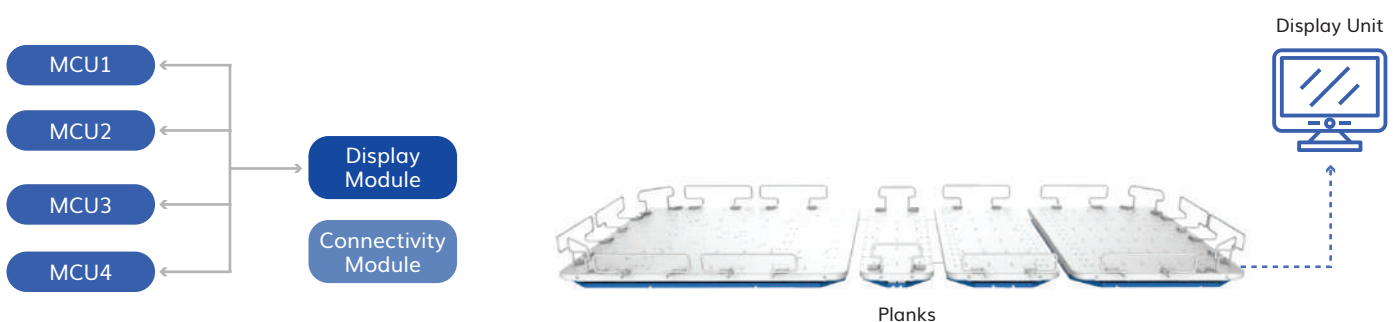
A leading global healthcare product company.

Business Need

The customer wanted SFO to design ICU smart beds to monitor vital patient information, like weight and lying position. The data need to be transferred to the Cloud and processed in order to identify risk for potential adverse conditions like pressure ulcers. For doing this, a sensor-based monitoring system needs to be embedded in the Smart bed. The Smart bed system also monitors the current geo location of the bed using GPS/AGPS. A bedside display module/gateway is required to control the sensor system, collect data from it, display the data and transfer the data to the Cloud for further analysis.

Solution in Brief

- Smart ICU bed is a system that embeds sensors, a micro controller system and a Gateway to transfer the collected sensor data to the cloud
- Real time monitoring of patient weight and position by sensors
- Summary of Patient data is displayed in the Display module for quick action
- Display module triggers alarms and notifications whenever necessary
- Display module acts as a Gateway to transfer the collected sensor data to cloud
- Gateway uses NBIOT based GSM module that can talk directly to the cloud
- Location of the bed can be monitored using GPS/AGPS



Weight Monitoring using Micro Controllers

- The smart bed embeds a number of micro controllers that attaches various sensors
- Each of the microcontrollers is connected to a bed side Display module
- The Microcontroller collects the sensor data periodically and passes it to the Display module on request

Display Module/Gateway Module

- The display module is an Embedded Linux based system
- Collects sensor data from the embedded micro controllers and applies necessary data processing
- Displays the weight data in the LCD Display
- The display module communicates with cloud through the Connectivity Module attached to it
- Runs Azure IOT client on top Of the Azure IOT Client platform from Microsoft
- The collected sensor data is formatted as per the Azure required format and then sent to the Azure IOT Cloud framework for storage and further processing

Connectivity Module

- Connectivity Module is a Micro controller-based Module with an NBIOT module for cloud connectivity
- The Connectivity Module has two working modes: standalone and Integrated
- In Standalone Mode, the connectivity module is powered from a battery and it sends location data to the cloud in periodic intervals
- In integrated mode, the Display module connects to the cloud through the connectivity module

Technologies

- Embedded C, C++
- QT/QML
- Embedded Linux
- I.MX6 Processor device driver integration
- Microcontroller programming – STM32F0
- Serial protocols I2C,SPI
- GPS/AGPS
- GSM/GPRS Module with NBIOT Capability
- IOT Cloud Framework – Azure IOT

SFO's Role

SFO was involved in the whole product development life cycle that includes:

- Product realization
- System architecture design
- Design and development of hardware, firmware and application software
- System testing
- Support testing in field
- Expertise in all fields like hardware, firmware and application software helped in the integration of different components and saved much time in overall system development