

# Business Intelligence System for an Elderly Nursing Home

Degree programme: Master of Science in Engineering | Specialisation: Information and Communication Technologies

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The main goal of this master thesis is to develop a Business Intelligence System for nursing homes for the elderly such as EMS (Établissement Médico-Social) to help management in taking appropriate decisions to improve resident safety and satisfaction. This project serves as a POC for implementing a report cockpit for evaluating KPIs (Key Performance Indicators), which were determined through various interviews with the stakeholders (EMS Gravelone, LPS Defense SA, BFH).

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## Initial Situation

EMS (Établissement Médico-Social) Gravelone is a nursing home for the elderly, which offers geriatric healthcare accommodation and psycho-geriatric compatible open environment. The entire premises of Gravelone is equipped with «Sonitor Sense RTLS (Real Time Location System) System»[1] which combines the High Definition Ultrasound Technology with Wi-Fi and Low Frequency. Sonitor Sense Tags (Alarm Wrist Watches) are embedded with the logic to know their location and to communicate over the Wi-Fi network when their position changes (movement of the residents). This solution enables efficient communication between the residents and the nurses and enables a safe and secure environment for the disabled residents and dementia patients. The existing communications between nurses and residents and other types of communications are driven by the IMATIS Platform ([www.imatis.com](http://www.imatis.com)). IMATIS solution helps in receiving the alarms and forwarding them to the concerned departments. All this real-time data is collected and stored on the MS SQL Database. «How can this data be used and what reports can be generated»; is the management's question.

## Source Data Challenges

As with most of the Business Intelligence projects, source data quality was a major concern. As this project only serves as a POC, data cleaning and data profiling was not a part of this work. The feasibility of generating the needed reports and KPIs was another concern. One such problem was resident history data. What happens if a resident dies or moves from one room to another, where is this data stored? This data was nowhere to be found in the source database. Another such problem was lack of an identifier, which links all the related events of a nurse call. So, calculating the duration between the various events was

very difficult. What approaches and measures did the author follow to overcome these data challenges is an interesting part of this project.

## System Architecture

The main components of the system are: ETL (Extract, Transform and Load), creation of cube, report generation. For the generation of needed reports and KPIs, Microsoft data tools were used. ETL was done using SSIS (SQL Server Integration Services), the cube was created using SSAS (SQL Server Analysis Services) and the reports and KPIs were generated using SSRS (SQL Server Reporting Services), Report Builder, Web Portal, and PowerPivot. Ad hoc reports and KPIs can also be generated using PowerPivot and Report Builder. For ETL, Kimball's reference architecture approach is used.

## Reports and KPIs

Nurse Call plays a very important role in effective communication between resident and nurse. Each nurse call consists of 3 main events, which are «Nurse Call Timestamp» i.e., time at which the resident triggered an alarm, «Nurse Call Room Presence Timestamp» i.e., time at which the nurse started attending to the resident and «Nurse Call Task Completion Timestamp» i.e., time at which the nurse finished attending to the resident. The calculation of duration between these timestamps for each nurse call serves as an evaluating component to measure resident safety and satisfaction. Another such measure is the number of escalations for each nurse call at a given point of time. Reports and KPIs related to duration and escalations are generated and displayed on Report Server Web Portal.



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[1] <http://www.sonitor.com/products-sonitor-sense.html>