Case Design Sheet

1. CASE DESCRIPTION

TITLE: Indoor Location of Seniors in Care (LISE)

	ACTORS	LOCATION
LEADER(S)	MSE	SAINT-ETIENNE, FR
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TIME PERIOD OF THE PROJECT: January 2022 – August 2024

SHORT DESCRIPTION OF THE CASE:

The aim of the LISE project is to adapt and test the Cartobat® localisation technology for residents of protected living units in EHPAD. Its aims are to give residents a degree of freedom of movement while ensuring their safety, to make it easier for healthcare professionals and carers to locate residents, and to prevent and analyse behaviour. The Living Lab approach involves all the stakeholders in a solution tailored to their needs. Cartobat® is a location system based on cartography, transmitters and receivers to track residents' movements in real time. The current study is focusing on the impact of residents' outings on their state of health and the organisation of the EHPAD.

2. 5.0 ORGANISATIONAL CHANGES OF HEALTHCARE PROCESSES

2.1. Short description of initial context and needs of organisational changes

The background to the organisational changes at Cité des Ainés is the implementation of the LISE project, which aims to improve the quality of life of residents in protected living units (UVP). The project involves testing a tracking device, Cartobat®, to enable residents to leave the UVP in complete safety, while ensuring that they are monitored. These changes meet a need for greater freedom for residents suffering from cognitive disorders such as Alzheimer's disease, while ensuring their safety and reducing the burden on care staff.

Indoor Positioning Systems (IPS) now play a major role in ensuring safety and autonomy in contexts where GPS is unsuitable, as is the case in medical-social establishments [1, 2]. While recurrent neural networks (RNNs) such as Long Short-Term Memory (LSTM) and Gated Recurrent Units (GRU) have recently demonstrated improved accuracy in indoor tracking—significantly reducing localization errors [3, 4]—studies conducted in hospital environments [5, 6] emphasize that technical performance alone is not sufficient. Human-centred elements, such as ergonomic usability, user comfort, and perceived safety, play a crucial role in how such systems are adopted. This is especially true for nursing staff and patients, who are directly influenced by the technology [7].

Cartobat® is a real-time tracking system that enables residents to move freely within secure areas. The trial, which was held between September and November 2023, was made to check how these outings change the health of residents and also how the care staff organise its work.

The aim is to reconcile residents' need for freedom and autonomy with efficient and secure management of human resources, by integrating appropriate technologies and implementing

personalised procedures for each resident. This approach is accompanied by regular meetings and medical monitoring to adjust the protocol in line with changes in residents' condition, guaranteeing appropriate and progressive care.

2.2. Challenges on Resilience of Healthcare processes

Resilience is a important element in this research to make sure residents of sheltered housing units (SHUs) can have the liberty to move while being safe. Resilience needs are coming from several kinds of problems:

- **Disturbances caused by cognitive impairment**: Residents who are diagnosed with dementia may show unpredictable behavior, like random walking or agitation, and this may lead to unsafe situations, such as being lost or exposed to danger.
- **Quick health changes**: When resident's cognitive state changes suddenly, it becomes harder for them to keep going out or participating in their usual program. Devices and protocols must be adjusted to these new conditions.
- **Some specific risks**: The goal of the project is giving more freedom to residents without making safety less. People must be able to move inside secure zones, but unsupervised exits are a big issue that require fast action from the system.

The integration of cutting-edge technologies, for example the Cartobat® system, helps making healthcare processes more flexible in the operational environment:

- Real-time tracking is a good tool which lets caregivers to know where residents are all the time, making easier to prioritize alerts depending on individual behavior.
- Personalised care can be provided due to movement data collected, allowing professionals to organize protocols that fit resident's needs and aging conditions.
- Technology is helping staff by freeing up more time so they can do other jobs that are more important and need more attention.

Human factors play a central role in increasing the flexibility and resilience of organisational processes:

- **Multidisciplinary collaborative work**: The Living Lab approach associated with the LISE project involves engineers, researchers, healthcare professionals and carers. This collaboration makes it possible to be more responsive to the challenges encountered and to adapt more nimbly to the changing needs of residents.
- **Ongoing staff training**: Staff members has been specially trained to operate the Cartobat® device and to follow protocols tailored to the discharges of residents. This training helps them to better respond to unexpected situations and allows for a more flexible kind of care.
- **Engagement of families and carers:** The families of residents are actively involved in the monitoring and evaluation of progress. This make the whole system more resilient by building a shared understanding of residents' needs and adapting interventions in line with the feedback that is received.

Several performance indicators can be monitored to assess the performance and resilience of the processes put in place:

- **Changes in behavioural problems**: The Neuropsychiatric Inventory (NPI) is used to monitor the severity of behavioural problems and their impact on residents and staff. A reduction in scores would indicate an improvement in residents' quality of life.
- **Impact on care staff**: The reduction in the impact of behavioural problems on carers is a key indicator for assessing the resilience of the care system and the reduction in the workload associated with behavioural problems.
- **Number of outings authorised and incidents avoided**: Monitoring the number of safe outings made by residents and the absence of incidents (such as attempted elopements or dangerous situations) is an indicator of the success of the protocols put in place.
- **Resident and carer satisfaction**: The level of satisfaction of residents and their families with the arrangements put in place could also be a good indicator of whether the objectives of freedom and safety are being achieved.
- **Reduction in medication**: As part of a less intrusive approach, a gradual reduction in medication, while maintaining behavioural stability, could indicate that the LISE protocol is more effective.

These indicators, combined with regular evaluation by care staff and carers, ensure that processes are efficient, resilient and adapted to the changing needs of residents.

2.3. Challenges on sustainability of Healthcare processes:

The LISE project includes a key environmental component to ensure that technological innovation is carried out in a sustainable way, especially in the field of healthcare. Cartobat® technology requires a continuous power supply and a stable Wi-Fi connection, which presents challenges in terms of energy consumption and the management of electronic devices. Rather than replacing hardware entirely, updating devices with new software versions is considered a more environmentally friendly solution that contributes to the circular economy.

The integration of technologies has leaded to promote a cleverer use of available resources. Connected devices such as the CartoModules make use of existing power sockets and Wi-Fi infrastructure, thereby maximising current resources and avoiding the need for energy-intensive new installations. This method helps not only to save energy but also to reduce unnecessary setup efforts. Making residents empowered while their safety is managed via technology leads to the fact that less human energy and staff is needed.

To verify the sustainability of the project, a number of indicators need to be monitored over the long term: the energy consumption of the devices, the lifespan of the equipment, the management of electronic waste, the optimisation of human resources, and the reduction in unnecessary travel. These indicators are meant to gauge the environmental footprint of the project and highlight areas where resource usage and sustainability could be better handled.

The LISE project takes on an integrated and multidisciplinary method, aiming not just to enhance the quality of life for residents in protected housing units, but also to push towards more eco-friendly healthcare practices. The main focus lies in reducing environmental harm and using resources more wisely. This objective is tackled by combining various fields of expertise to achieve more efficient outcomes.

2.4. Human-Centred Approach for the Healthcare processes

The LISE project puts a strong focus on the human side as a key part of making better the quality of life for residents in protected living units (UVPs) within care facilities. The innovation was made to answer the special needs of older individuals living with cognitive disorders like Alzheimer's disease, by giving more freedom and still keeping a high level of safety. This way, residents can feel better and move more, which is good for them and helps the staff too. Residents are able to move about independently thanks to the Cartobat® tracking system, which ensures continuous and secure monitoring. This autonomy contributes to their well-being by reducing stress and managing problematic behavior often associated with confinement. By this way, the system supports dignity and peace of mind for both residents and staff. It allows people to feel safer and live better, but still being watched discreetly.

Key stakeholders and the Living Lab approach

The main stakeholders in the innovation are:

- **EHPAD management**: responsible for implementing the project.
- **Care staff**: who accompany the residents and use the devices.
- **UVP residents**: direct beneficiaries of the innovation.
- **Family carers**: involved in evaluating the benefits for residents.
- **Researchers and engineers**: who developed the Cartobat® device and are helping to optimise it.

The LISE project adopts a Living Lab approach, engaging all relevant stakeholders from the beginning of the innovation process to ensure that the developed solution responds to users' actual needs. Meetings with caregiving staff happens frequently in order to evaluate how effective the protocols are and to do changes when needed. Moreover, family caregivers are asked about things to guarantee transparency and to make them part of the decision-making journey. Their involvement reinforces a collaborative dynamic, ensuring that the perspectives of both professionals and families are considered throughout the implementation process.

Human-centred needs and human-machine collaboration

Residents' main needs include freedom of movement, safety and a general improvement in quality of life. The Cartobat® device, which includes transmitters (CartoWear), receivers (CartoModules) and a mapping system (CartoCloud), enables residents to move around freely in secure areas, while being tracked in real time by staff.

This innovation introduces technological challenges associated with digitisation, particularly regarding the real-time tracking of residents' locations. The collaboration between humans and machines is essential to ensure the system operates effectively. The care staff must follow the alerts from Cartobat® and act if something happens, which needs to be done properly. Training staff to use the new technologies is very important, and the interfaces for users should be easy so that mistakes

don’t occur, especially because the care environment is often full of stress. Ensuring usability through intuitive design is key to successful adoption and reducing potential errors under pressure.

Users and beneficiaries of the innovation

The primary beneficiaries of this innovation are the residents of UVPs, who will enjoy greater freedom of movement whilst remaining safe through the use of tracking devices. Care staff also gets advantages from this innovation, since it helps reduce the necessity of constant supervision and lowers the burden linked to residents’ challenging behavior. Family caregivers is also gaining from this solution, as they can see their loved ones feeling better, with less stress and anxiety because of being confined. This collective benefit contributes to a more serene and supportive care environment for all involved.

The primary users of this innovation are care staff, who will operate the CartoWear and CartoCloud devices to monitor residents, and the residents themselves, who will be wearing the equipment. They are the ones who use the system directly, so it must be simple enough for them to do it well.

Impact of the Innovation on Users and the Community

This innovation is intended to enhance the living conditions of residents by allowing them increased freedom of movement and lessening the sense of confinement, thereby supporting their emotional and mental behavior. It helps them feel better in how they live every day, giving them more liberty and less stress. Residents are thus able to retain a certain degree of autonomy, which is essential to their quality of life, particularly in the early stages of cognitive decline. For the caregiving staff, the innovation enhances working conditions by alleviating the burden of constant supervision and reducing disruptive behaviors. This enables caregivers to devote more attention to personalized care, thereby improving the overall quality of service delivery.

At the community level, the nursing home (EHPAD) enjoys a calmer atmosphere, as residents show less stress and caregivers are less focused on managing behavioral issues. This makes better interactions happen between staff, residents and their families, thus helping the social links to grow stronger in the facility.

Promotion and Adoption of the Innovation

The innovation’s adoption is helped by a working together approach that includes all stakeholders at the very beginning of the process. Training staff to operate Cartobat® devices forms a key part of the deployment strategy, ensuring all users become familiar and confident with the technology. Including families in the process is important because it builds trust to the system and helps to make residents more involved.

Human-Centered Performance Indicators

To evaluate the human-centred performance of the innovation, several long-term indicators should be closely monitored:

- **Resident well-being**: Assessed using the Neuropsychiatric Inventory (NPI), which evaluates behavioral disorders and tracks how they evolve over time.

- **Impact on caregiving staff**: Measured by looking at fewer disturbances caused by residents, which affects staff workload. This gives informations about how much stress goes down.
- **Satisfaction of residents and family caregivers**: Regular survey tools should be used to find out how the innovation is seen in terms of improving the life quality. That way, opinions from users can be collected to know if it works well.
- **Incident frequency**: The number of unauthorised exit events acts as a strong indicator of whether the safety systems in place are performing effectively.
- **Staff engagement**: How much staff take part in follow-up meetings and how their involvement looks in the deployment shows how the innovation works.

In a nutshell, the human dimension is something very important in the LISE project, since it helps with improving life quality for the residents and gives a better situation for the staff at work. The innovation is based on advanced localization technologies, but it also highlights the collaboration between humans and machines, the involvement of stakeholders, and the use of methods that promote resident well-being while lowering the burden on staff.

3. METHOD AND SOLUTIONS *(Expected Length : 3 pages)*

3.1. Method

The LISE project embraced a user-centered approach comparable to Design Thinking in order to create and implement an innovation aimed at enhancing the quality of life for residents in protected living units (UVPs) within nursing homes (EHPADs). Although the method is not specifically labeled as “Design Thinking”, it is nonetheless based on the essential principles of that methodology, such as empathy, co-design, prototyping, and iteration.

Design Thinking-Inspired Approach

The LISE innovation was developed through several key stages that are typical in a Design Thinking process:

- **Empathy and Identification of Needs**: The project began with several early studies that tried to understand the needs of both residents and caregiving staff. These studies did show how it is important to open UVPs for more resident freedom and wellness, while still keeping them safe.
- **Co-design with Stakeholders**: A Living Lab method was used, with participation from multiple stakeholders—including residents, caregivers, families, engineers, and researchers—from the very beginning. This collective participation ensured a more better alignment between the expectations and the solution, giving everyone the chance to talk what they hope for.
- **Prototyping and Testing**: After understanding user needs, the Cartobat® solution was chosen. A testing phase was carried out to check if it would work inside the living units. The system got trialed with some residents at the Cité des Ainés from September to November 2023, during the LISE protocol, to see if the procedures and technology made sense.
- **Feedback and Iteration**: Regular evaluations were implemented, including biweekly meetings with caregiving staff and discussions with coordinating physicians and

psychologists. These feedback steps made it possible to change and make better the system again and again. This led to doing ongoing adjustments and continued optimization over time.

Design and Deployment of the Innovation

The design and deployment of the LISE innovation were guided by a structured process, split into several main phases.

- **Preliminary Study and Needs Assessment:** This first step tried to find out the specific needs of residents about mobility and safety. It looked at what was important so people could move but also stay safe.Working together sessions revealed that it was important to open protected living units, to help with feelings like confinement.
- **Selection and Testing of the Technological Device**: The Cartobat® system was chosen due to its ability to offer real-time location tracking while ensuring resident safety. After that, a testing period was made to check if the system works well at the Cité des Ainés.
- **Training and Stakeholder Engagement**: Caregiving staff were given training for using the Cartobat® system and understanding the protocols related to resident outings. The training included the objectives to follow, how to deal with the equipment, and what to do if there is an alert.
- **Monitoring and Adaptation**: Follow-up meetings happened every two weeks, bringing together caregivers, medical coordinators, and psychologists. This helped to constantly look at how good the system is and make again the protocols when needed to better fit the residents.

Innovation Project Structure

The project rested on several central components:

- **Multidisciplinary Team**: A varied group was brought together—engineers, researchers, caregivers, family members, residents, and facility managers. This mix gave a complete picture of the challenges and helped make sure the innovation was set up in the right way.
- **Living Lab Framework**: The Living Lab approach made it possible to involve all the stakeholders right from the start, which helped to make sure the solutions actually matched what people really needed in everyday situations. It focused on doing co-creation and lots of testing in environments where people live, using the feedback from them.
- **Testing Protocol and Schedule**: A specific calendar was set up to organise each resident's outings. Clear objectives was given to follow how much they are becoming more autonomous.
- **Continuous Feedback and Iteration**: Ongoing feedback mechanisms were used in the process, allowing for real-time changes to the system when needed. That way, the system could be changed quickly when people said things about how it worked.

Conclusion

The LISE project followed a methodology aligned with Design Thinking principles, prioritising co-design with all stakeholders and iterative development through frequent feedback. The design and deployment were carefully structured, encompassing early-stage studies, system testing, staff training, and routine follow-up meetings. Thanks to this way, it became possible to respond well to

residents' needs, to make the working environment easier for caregiving staff, and to deploy the innovation in a strong and long-lasting way.

3.2. Concrete organisational solution implemented

In the LISE project case study described in the document, various concrete organisational solutions were put into place to support the well-being of residents in protected living units (UVPs) within nursing homes (EHPADs), while also improving the organisation of work for caregiving staff. The main organisational measures taken are detailed below.

Implementation of a Personalised Outing Schedule

Each resident who was in the project got a personalised outing schedule, made to fit their own needs and abilities. Outings was scheduled every week, with some objectives like fetching the newspaper, going to the hairdresser, or doing a social activity. This method helps to keep a regular routine and give residents time markers that are stable, while also helping reduce the amount of work for the caregiving staff.

Progressive Phases Towards Resident Autonomy

Residents in the trial was sorted into three outing steps, each letting them go more free little by little:

- Phase 1: Close Supervision – The resident is accompanied during the outing by a caregiver.
- Phase 2: Remote Monitoring – The resident is watched from a distance using the localisation device, with staff keeping visual checks.
- Phase 3: Full Autonomy – The resident walks freely in the safe zones of the facility.

This staged setup lets each resident get the support they need while moving slowly to being more independent. It also helps organise the caregivers work in a way more good for their time and energy.

Designation of a Responsible Staff Member

A healthcare assistant is assigned to oversee access, fit the CartoWear device (pendant), and supervise the outings—either directly (Phase 1) or remotely (Phases 2 and 3). Allocating a specific member of staff to this role ensures smoother coordination of outings while maintaining high standards of safety.

Use of the Cartobat® System for Safety

The Cartobat® system plays a key role in organising outings for residents by allowing their movements to be tracked in real time. It consists of CartoWear—a pendant worn by the residents—and CartoModules, which plug into standard electrical sockets to send location info to the CartoCloud platform. This setup helps monitor where residents are and makes their outings more secure, but it does require proper management to function as intended. Thanks to this system, care staff can check on residents' locations and receive alerts if someone enters a restricted area, helping ensure their safety without needing to watch them all the time.

Fortnightly Follow-up Meetings

Every two weeks, meetings was held with caregiving staff, coordinating doctors and sometimes the psychologist. These sessions are designed to monitor residents' progress, review how outings are planned, and resolve logistical matters. They are also useful to make the protocols changed if needed, from what is seen in the field. This approach supports continuous improvement and reinforces the responsiveness of the care system.

Staff Training

Caregiving staff involved in the project received dedicated training for the implementation of the LISE protocol. This training covered the project's objectives, the use of the Cartobat® system, the criteria for resident inclusion, and the outing schedule. It ensured that staff were fully prepared to manage the new responsibilities associated with residents' increased autonomy.

Resident Monitoring Protocol

A scenario sheet was developed for each participating resident to monitor the specific goals of their outings and to assess their progression through the various phases (accompaniment, remote monitoring, autonomy). This follow-up personalised allows outings to be done safely and matching the capacities of each resident, while making sure the progress is written down properly.

Adjustment of Human Resources

Organising the outings involved adapting the available human resources. For each resident in Phase 1, an additional healthcare assistant was allocated to provide direct support. In Phase 2, a member of staff was appointed to oversee the resident's safety remotely. In Phase 3, residents do not need extra supervision because they are fully independent, which means less staff are needed. This phased setup helps to use resources better depending on what each resident needs, so the team works in a more efficient way. It enables more effective distribution of human resources while optimizing time and personnel according to residents' levels of autonomy.

Family Involvement

Residents' families were engaged from the very beginning of the project through regular discussions to keep them informed about their loved ones' progress. Their consent was necessary for participation in the trials, and some caregivers also showed interest in assessing the well-being outcomes linked to the system. This connection makes families more OK with the changes and keeps them feeling included. Having them join in helps everyone feel like the project is more human and less just technical.

Conclusion

The organisational solutions devised within the LISE project aimed to provide residents in protected living units (UVPs) with increased freedom of movement, while maintaining their safety and optimizing the use of human resources. These included the use of advanced localization technologies, a step-by-step structure for outings, the assignment of dedicated staff, and active training and involvement of all stakeholders. By this complete strategy, the project was able to put together the

autonomy wishes of residents with the facility's needs for safety and efficient processes. This balance represents a significant step forward in harmonising care quality with organisational effectiveness.

3.3. Key Skills And Competences Necessary

To ensure the successful adoption of the solutions proposed by the LISE project, several key competencies are required within the organization, both for caregiving staff and other stakeholders.

Technical and Digital Skills

Staff are required to operate the Cartobat® system, which includes the CartoWear, CartoModules, and CartoCloud components, to ensure real-time tracking of residents. This involves handling connected devices, monitoring alerts, and conducting software updates when needed. They must to know how the system works and keep it running well.

Organisational Skills

Implementing the project demands a restructuring of available resources and redistribution of tasks. Staff must be able to organise personalised outing schedules and allocate human resources efficiently. It's very important that time is used correctly so that supervision and other caregiving tasks are managed nicely.

Communication and Collaboration Skills

The success of the initiative depends heavily on ongoing cooperation among all involved parties, including caregivers, family members, researchers, and residents. To make the project go smooth, workers must speak well with people like families, residents and different professionals. Effective communication fosters commitment and supports coordination at each stage of implementation.

Adaptability and Flexibility

The LISE project adopts an iterative approach, where practices are modified based on feedback. Staff must show the capacity to adapt to evolving procedures and manage the unpredictability associated with cognitive disorders. This means changing quickly what they do when the protocols change or when new things comes up.

Crisis Management and Decision-Making

Care staff need to act quickly when an alert goes off—for example, if a resident leaves a permitted area. Good crisis management skills are essential to make sure the right steps are taken and that risks stay low. They have to be able to decide fast and respond properly, even when things get complicated. This helps avoid serious issues and keeps everyone safer.

Empathy and Human-Centred Approach

Keeping a human-centred mindset is still a key part of improving how residents live day to day. It takes empathy and genuine care to make sure each person feels seen, respected, and looked after in the right way. Staff must display empathy, remain attentive to residents' individual needs, and provide

tailored support, all while building a relationship based on trust. Being nice and understanding to residents is very needed to help them feel good.

Conclusion

The adoption of the solutions from the LISE project needs a mix of technical, human, interpersonal, and organizational skills. These competencies are very important for making the implementation of localization technologies successful, organising the resources in a good way, and for working together between different stakeholders. Also, it helps to change the practices when residents' needs change, and all that while trying to make their life quality more better.

3.4. Result and Feedback

The LISE project generated meaningful outcomes through the transformation introduced by the Cartobat® system and the newly adopted organisational solutions. Those results shows that there were better things happening both in how work is done and how residents feel.

Results and Improvements in Operational Processes

- **Increased Resident Autonomy**: Thanks to the Cartobat® system, residents in secured living areas were able to move around more freely within a safe setting. The project introduced personalised outing schedules tailored to each resident, which encouraged autonomy and supported emotional well-being. This shift made it easier for residents to go outside more frequently—a thing they genuinely appreciated.
- **Decrease in Behavioural Disorders**: Assessments revealed a clear drop in behavioural symptoms among residents, mostly thanks to more regular time spent outdoors. For example, some individuals showed improved scores on the Neuropsychiatric Inventory (NPI), pointing to positive developments in their condition.
- **Reduced Burden on Staff**: The initiative also led to a noticeable decrease in how disruptive behaviours affected caregiving teams. This helped improve working conditions and lower stress levels. Staff reported feeling less overwhelmed, as residents were generally calmer and less agitated.
- **Optimisation of Human Resources**: By redistributing responsibilities across the three outing phases—direct support, remote supervision, and independent outings—the system allowed for a more effective use of staff. This made it possible to save time and use staff better, since not all residents needed watching all the time.

User Feedback

Biweekly meetings was happening with staff to collect feedback and make changes if something didn’t work properly. These discussions allowed for timely adjustments to the implemented protocols, enhancing the flexibility of the system. Also, families of residents said their opinions and helped making the solution more better. This ongoing feedback coming from both the staff and the family caregivers highlighted the positive reception of the innovation. It shown how the well-being of residents was better, which is a good thing for everybody. Families felt more peace in their mind and more relaxed because they saw some noticeable improvements in daily living.

Performance Indicators

Several performance indicators were established to evaluate the effects of the innovation:

- **Neuropsychiatric Inventory (NPI) Scores**: These were used to measure how much residents' behavioural issues had gone down, giving a sense of whether their overall well-being had improved or not.
- **Impact on Staff**: The team looked at how much extra work was caused by residents' behavioural problems. The idea was to understand how much this affected caregiver stress and whether staff felt more pressure because of it.
- **Number of Safe Outings**: They tracked how many outings happened without any incidents, to check if the safety protocols were doing their job. This gave a good indication of whether things were running smoothly when residents went outside.
- **Family Satisfaction**: Feedback from families was used to evaluate their perception of improvements in residents' well-being.

These indicators confirmed the beneficial effects of the project on both the quality of life of residents and the efficiency of organizational processes within the nursing home.

4. CONCLUSION AND RECOMMENDATIONS

The LISE project, through the integration of the Cartobat® system, has demonstrated that it is possible to combine technological innovation with human well-being to improve the quality of life of residents in protected living units (UVP), while optimizing organizational processes within nursing homes (EHPAD). Thanks to real-time location technology and a collaborative setup inspired by the Living Lab approach, residents were able to move about more freely. This gave them an overall better feeling, helped reduce behavioural issues, and slightly lightened the workload for staff.

The LISE case study offers valuable insights for managing the shift towards Industry 5.0—a model that mixes cutting-edge technologies with people-centred values to build sustainable, long-term benefits. Based on the observations from this experience, the following recommendations were made:

- **Involve All Stakeholders from the Beginning**: The LISE project's success depended a lot on bringing in all key stakeholders—residents, families, caregivers, engineers, and researchers—from the start. To go to Industry 5.0 correctly, it's needed to use a people-first way, so that everyone says what they need and helps with the solution.
- **Embrace a Collaborative and Iterative Approach (Living Lab)**: The Living Lab method, which supports co-creation with users in realistic settings, played a major role in the overall success of the project. Innovations should be tried out, with user feedback taken often, and improvements done again and again so they match what people want.
- **Build Both Technical and Human Capabilities**: Transitioning to Industry 5.0 not only requires training employees in the use of modern technologies, but also enhancing crucial interpersonal abilities such as empathy, flexibility, and teamwork. People working with tech must also stay focused on being human-oriented.
- **Use Technology to Free Up Time for High-Value Activities**: Automation and the use of connected devices—such as the Cartobat® system—have enabled caregiving staff to devote more time to personalized care and human interaction with residents. In the context of Industry

5.0, technology should be viewed as a means to allow workers to focus on the creative and relational dimensions of their work.

- **Establish Human-Centered Performance Indicators**: Indicators such as resident well-being, caregiver stress reduction, and family satisfaction have been instrumental in assessing the positive impact of the LISE project. Similarly, the success of Industry 5.0 relies on implementing metrics that not only measure process efficiency but also assess their impact on employees and end-users.

In summary, the LISE project shows that moving towards Industry 5.0 relies on a successful blend of technology and human-centred values, demanding active stakeholder involvement, suitable training, and continuous evaluation of performance to achieve broad improvements in both quality of life and working conditions. It's by doing all these things together that real progress can be made for everyone.

5. REFERENCES

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