

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Aaditi Singh
Student number	5035082

Studio		
Name / Theme	User Perspective	
Main mentor	Tong Wang	MBE- DCM
Second mentor	Herman Vande Putte	MBE- REM
Argumentation of choice of the studio	My topic of interest in a broader perspective for the thesis was the impact of built environment on occupants' health, influenced by the experience of COVID-19 pandemic. I wanted to explore smart technologies that facilitate managers in creating healthy indoor environments. Hence, I chose the theme of user perspective as it focuses on the well-being of the users as dealt with by the managers and, the alignment of the users with the operation and adaptation of real estate.	

Graduation project	
Title of the graduation project	IoT Integration in Facility Management: Implementing strategies for data driven IAQ management in the post pandemic era
Goal	
Location:	The Netherlands
The posed problem,	<p>The post-pandemic era has brought about a paradigm shift in the way indoor environments are managed, particularly with regards to indoor air quality (IAQ) (Ding et al., 2023). As the world battles the aftermath of the COVID-19 pandemic, the significance of maintaining healthy indoor spaces has become a focal point for occupant health and well-being. Facility managers (FM), entrusted with the responsibility of ensuring optimal building conditions, face prominent challenges in adapting their practices to the evolving demands of post-pandemic situation (Hounsell, 2023).</p> <p>In response to these challenges, emerging technologies such as IoT offer a promising avenue for FMs to monitor, analyse and optimise IAQ in real-time (Daniotti et al., 2020). However, the overarching problem revolves around the existing gaps in knowledge regarding how IoT technology can effectively aid FMs in their mission to create healthier indoor air quality post-pandemic. While the literature acknowledges the potential</p>

	<p>benefits of IoT in IAQ monitoring, it has been found that there is a need for data driven IAQ management models (Dai et al., 2023). There is a necessity to provide the FMs with a strategy on how to utilise the collected data (Ding, 2023). Moreover, the study of Zhang et al. (2022) states that applications of technology in FM heavily rely on algorithms created prior to the COVID-19 pandemic, hence, new research is necessary as the historical data might not be relevant in the post-pandemic situation.</p> <p>Therefore, this research aims to fill this knowledge gap by formulating strategies based on IoT data that can be utilised by FMs in their pursuit of IAQ enhancement in the post pandemic era.</p>
research questions and	<p>Main research question: How can facility managers implement IoT based strategies for post-pandemic IAQ management?</p> <p>In order to answer the main research question, 5 sub-questions are formulated:</p> <p>Sub 1: How has COVID-19 pandemic affected IAQ management?</p> <p>Sub 2: What is the current status and application of IoT in IAQ management?</p> <p>Sub 3: How have FMs adapted to the post pandemic changes, and what roles does IoT play in influencing these adaptations?</p> <p>Sub 4: How has IoT been leveraged to manage IAQ in post pandemic workplaces?</p> <p>Sub 5: What strategic approaches can FMs employ utilising the IoT data?</p>
design assignment in which these result.	<p>Sub 1: Identification of the changes occurred after the pandemic regarding IAQ</p> <p>Sub 2: Knowledge on the state of IoT application in IAQ management</p> <p>Sub 3: Insights on the implementation of IoT in facility management</p> <p>Sub 4: Evaluation of IoT to manage IAQ in the specific case study</p> <p>Sub 5: Formulation of strategies for FMs to utilise the IoT data</p> <p>The final result of the research is the formulation of strategies which can be used by facility managers in IAQ management. These strategies will be based on data collected by IoT technology; hence, it aids FMs in data-drive decision making.</p>

Process

Method description

The research method for the thesis consists of two parts, theoretical research, and empirical research.

Phase 1: Theoretical Research

The theoretical research includes the literature review which focuses on the different concepts included in the research question and helps to answer the sub questions as well. The topics on which the literature review is conducted are IAQ management, Facility Management and IoT technology. This literature study combined with the Activity theory, formulates the theoretical framework for this research. Knowledge on these topics provide a concrete background for the research. In addition to the background, this information is used to design the interview protocol. Furthermore, the knowledge from the literature will also be used as a basis to select the case to conduct the case study. At the end of this phase, sub questions 1, 2 and 3 (partly) will be answered.

Phase 2: Empirical Research

The empirical research for this thesis includes a case study and in-depth interview with the facility manager involved in the chosen case. The interview can further add some practical knowledge in addition to the theoretical knowledge from literature to Sub-question 3 (about FMs adapting to the changes after the pandemic and the role of IoT in influencing this change). With this case study, more in depth insights will be gained regarding how IoT has been leveraged in IAQ management and the main research question will be answered by developing a strategy along with the facility manager to utilise the IoT data to enhance IAQ management. At the end of the case study and interview, sub questions 3, 4 and 5 (partly) will be answered.

Phase 3: Synthesis and conclusions

In the final phase of the research, all the collected data is analysed and synthesised. Sub question 5 will be answered and conclusions are drawn to answer the main research question.

Literature and general practical references

The literature purpose of the literature review was, firstly, to identify the knowledge gap in the topic that I was interested in. The study of Zhang et al. (2022), Dai et al. (2023), and Hou (2023) helped significantly in this aspect. Second purpose was to understand the concepts of the main research question better. Various review papers and journal articles contributed in this. Lastly, the purpose was also to formulate a theoretical framework for the research design. The activity theory adapted by Hasim and Jones (2014) was used as a basis for this part.

Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

The topic of this graduation project relates to the theme of User perspective as the outcome (creation of healthy indoor air quality) directly impacts the needs and preferences of the users. Moreover, it addresses the user perspective as dealt with by project managers and real estate portfolio managers, which includes the facility managers as well. Hence, my topic about the impact of facility management intervention in creating healthy indoor air quality relates well to the studio topic.

My master track, MBE as the name suggests, is about management in the built environment, which includes real estate management and facility management within it. My research provides guidance and facilitates the manager in achieving one of the main goals which is to ensure a healthy indoor environment for the occupants.

The research is also related to the master program of MSc AUBS as it contributes to creating a healthier built environment which is more efficiently managed.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

Scientific Relevance

The research on using technology to aid facility managers regarding IAQ holds scientific relevance as it addresses an intersection between technological advancements and the optimisation of IAQ. The aim of this research is to bridge the gap regarding the knowledge of IoT technologies and IAQ management by FMs. As mentioned earlier, COVID-19 pandemic has created challenges and pressure on FMs to pay due attention to user's health in indoor environments. Hence, this research contributes to the scientific understanding of how technology can be implied comprehensively by facility managers to address issues of IAQ.

The scientific relevance of this research extends beyond immediate applications to broader implications for building science, sustainability and public health. As the scientific community gains deeper insights into the integration of technology in facility management, this research contributes to a practical knowledge of its implementation to enhance IAQ. It aims to provide data-driven solutions for facility managers contributing to the existing knowledge of smart FM but extending its relevance to post pandemic situations as well. The research eventually contributes to the development of health-focused building strategies. Additionally, the findings have the potential to influence industry standards and guide the development of future technologies aimed at creating healthier indoor environments which takes into account the perspective of building facility managers.

Societal Relevance

This research question explores the role of technology in public health within built environments. As a substantial segment of the global population spends a significant portion of their lives indoors, the impact of indoor environmental quality (IEQ) on well-being and health is a pressing societal concern (WHO, 2021). This research holds societal significance by examining the potential of technological interventions in facility management to positively influence occupants' health and overall quality of life. The findings from this research can play a crucial role in informing policies and guidelines towards enhancing indoor health standards. Facility managers can use these insights into effective strategies that contribute to the creation of healthier indoor environments in various settings. Such advancements align with broader societal aspirations for sustainable and health-focused development.

The research has the capacity to create indoor environments that are not only healthier but also more conducive to productivity, learning, and overall societal flourishing. As the research unfolds, its societal relevance becomes increasingly evident, emphasising the importance of technological interventions in shaping the future of indoor environments for the betterment of society as a whole.

References:

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