myTUL – Your Digital Campus

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ABSTRACT This project addresses the lack of digital visibility into study and rest spaces at our university. Currently, students have no reliable way to view available rooms, compare options, or assess occupancy. We developed a prototype application that consolidates essential student tools and introduces a new feature: 'Study Places'. This function lists available rooms with detailed attributes, such as building, campus location, and amenities. To enhance this, we built a working model that uses video input to detect and count individuals entering each space. While real-time campus monitoring integration remains a future goal, the model demonstrates accurate performance with test footage. This paves the way for future implementation of predictive occupancy graphs, enabling students to make informed choices about where to study or collaborate.

KEYWORDS camera-based detection, campus navigation, data analysis, occupancy monitoring, prototype application, student spaces, study rooms, university facilities, video processing, visual room data.

I. INTRODUCTION

A. BACKGROUND INFORMATION

As digital technologies increasingly permeate education, universities are expected to provide streamlined, efficient, and intuitive digital platforms for their students. Yet, despite numerous digital tools in place, students at Lodz University of Technology (TUL) face practical obstacles in managing their academic routines. One persistent issue is the lack of reliable information about study and rest spaces across campus. There are no official maps, occupancy data, or integrated digital tools to assist students in finding suitable places to work, relax, or collaborate. This results in inefficient time use, over-reliance on word-of-mouth recommendations, and the overcrowding of a limited number of known spaces. The problem affects a wide demographic of students and has a direct impact on productivity and wellbeing, reflecting a broader shortcoming in the digital integration of university services.

B. PROBLEM FINDING

The project began with the general theme of the digital society. We interpreted this through various lenses - Digital School, Smart Cities, Digital Services - and ultimately focused on the digital experience of students at TUL. Our initial desk research involved evaluating the tools currently used by students and staff, such as Wikamp (the university's virtual campus), MS Teams, Outlook, and the TUL website. We identified multiple usability issues: lack of a unified calendar, inconsistent communication tools, outdated interfaces, and inconvenient access to schedules.

However, through surveys and informal interviews with students (primarily from the IFE programme), we noticed that one issue stood out: the complete absence of digital information about study and rest spaces on campus. This issue resonated strongly with our peers, confirming it as a concrete and meaningful problem to address. Rather than attempt a full overhaul of TUL's digital infrastructure - an unrealistic task given our scope - we chose to address this smaller but more tangible problem in a creative and data-informed way.

II. IDEA FINDING

A. STATE OF THE ART

To explore existing approaches to the problem, we reviewed academic research and commercial tools related to space usage and campus navigation. Recent studies show that Wi-Fi logs and sensor data can be used to analyse student behaviour and visualise room occupancy patterns [1]. Commercial solutions such as Waitz [2] already offer real-time crowding information in university buildings using signal detection technology. Broader research into smart campus environments confirms that access to spatial data can improve time management, student wellbeing, and efficient space usage [3].

B. INNOVATIVE IDEAS

Once we had identified the lack of digital information about study and rest spaces as our focus area, we explored a range of ideas to address this issue. These included creating an interactive campus map, developing a review-based system for student-rated spaces, implementing a live chat assistant to suggest nearby rooms, and designing a booking feature for shared study areas. We also discussed the potential for using crowd-sourced data or integrating with existing university platforms.

C. MAIN IDEA SELECTION AND JUSTIFICATION

Among the various ideas generated during our brainstorming process, the most suitable and clearly defined was the concept of a digital feature that would provide students with structured information about available study and rest spaces across campus - referred to in our project as *Study Places*. This feature would allow users to explore different locations based on factors such as building, type of space (e.g. individual, group, or relaxation), and available amenities, including seating, power outlets, or quiet zones.

We selected this idea because it directly addressed the issue identified through our interviews and research: students are largely unaware of the study space options available to them. The solution was realistic in terms of technical implementation within our timeframe and skill set, while also offering the possibility for future development, such as integrating live occupancy data. Overall, it matched our goal of improving student life with a clear and practical digital solution.

III. SOLUTION IMPLEMENTATION

Our solution is a prototype application named *myTUL*, designed to address the lack of digital information about study and rest spaces at Lodz University of Technology.

The app serves as a unified digital platform, with modular access to core academic tools such as Wikamp, Outlook, WebDziekanat, news feeds, calendars, and faculty websites (Fig. 1). Users may select their faculty (Fig. 2), to personalise content accordingly. While these functions were only partially implemented in the prototype, they provide the framework for future integration.

The principal feature is *Study Places* - a tool that allows students to browse available locations for study, rest, or group work (Fig. 3). Each entry includes location data (sortable by proximity), amenities (e.g. power outlets, seating types), building and campus identifiers, and photo galleries. A key innovation is the planned integration of Google Maps-style crowding graphs, based on data from a YOLO-based computer vision model (Fig. 4) trained to detect and count people from video input. Although access to the university's live security camera feeds was not granted, the model functions accurately on test footage. Our system includes a database structure capable of storing occupancy data, which could be used in future development to generate predictive crowding statistics and help students make informed decisions about where to study.

FIGURE 1. Screenshot of the main dashboard view of *myTUL*. Users can change the selected faculty (top right), and navigate to different features using clearly labelled buttons.

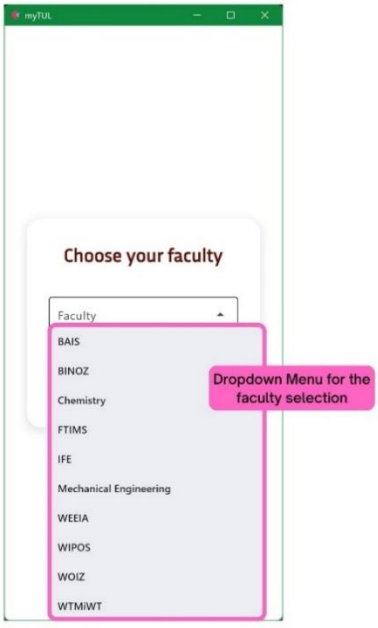

FIGURE 2. Screenshot of the faculty selection screen in *myTUL*, featuring a dropdown menu.

FIGURE 3. Screenshot of the *Study Places* interface in *myTUL*, showing filtering options, location-based sorting, and a sample study place card. Each entry displays the location name, building, available amenities, occupancy status, and a button linking to detailed information.

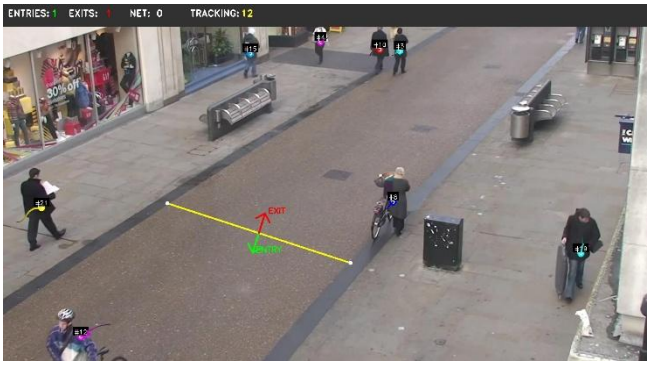

FIGURE 4. Visual output of the YOLO-based people detection and tracking system. The model identifies individuals with unique IDs, tracks their movement across a defined line, and counts entries and exits in real time using directional logic.

A. TECHNICAL DETAILS

The *myTUL* prototype was developed in **Python 3.11** using the **Flet framework**, enabling reactive, cross-platform UI design. Users select their faculty at launch, after which a tailored dashboard is displayed. Navigation is handled via Flet's internal routing, while data such as faculty choice, study space details (stored in .csv), and images are stored locally. Additional metadata is managed through in-code Python dictionaries.

A **YOLO model**, trained using a custom dataset via Roboflow, enables real-time person detection from video feeds. Users can define tracking zones, and the system applies **ByteTrack** to count entries and exits within those areas, allowing for accurate occupancy monitoring.

Real-time data is transferred via a **Firebase Realtime Database**, supported by a dedicated server that interfaces with cameras using multithreaded control. This server processes camera input, updates occupancy data live, and writes daily statistics to a local SQL database, which is then pushed to Firebase for app access.

Version control was maintained through **Git** and **GitHub**.

IV. WAYS OF VERIFICATION

To evaluate the effectiveness of our solution, we conducted initial user testing with a selected group of students from our field of study. The testing method followed a rapid-presentation format introduced during our PBL classes, where each team presents their project in a brief two-minute interaction. In these sessions, we outlined the core problem, explained our chosen solution, and demonstrated the prototype.

Feedback was largely positive. Participants expressed support for further development and noted with surprise the variety of study spaces available - underscoring the existing lack of awareness and validating our project's core premise.

V. CONCLUSIONS AND PERSPECTIVES

This project addressed the lack of digital visibility into study and rest spaces at Lodz University of Technology by developing *myTUL* - a prototype app combining spatial awareness, personalisation, and student services. It guides users to underused spaces, helps them make informed decisions, and presents a vision for a unified digital platform that TUL could adopt to modernise its infrastructure.

Key strengths include promoting better use of campus resources, enhancing student experience, and introducing predictive occupancy data through a custom-trained computer vision model. The concept also demonstrates how digital tools can support a more connected academic environment.

The prototype's limitations lie in its early stage of development. It is currently restricted to one device type, lacks integration with university systems, and was tested using publicly available video rather than live campus footage.

Future work could include expanding device support, accessing real-time camera data, and piloting the solution with university backing. With further development, *myTUL* has strong potential to evolve into a fully deployable campus tool.

APPENDIX

The source code and development materials for the *myTUL* prototype are available at the following GitHub repository: https://github.com/klaudiaban/myTUL

This repository contains the application code and documentation necessary to understand the project's technical structure.

ACKNOWLEDGMENT

We would like to express our sincere thanks to **Dr Daria Drwal** for her thoughtful guidance throughout the project. Her precise feedback on areas for improvement, combined with consistent encouragement, played a key role in shaping the direction and quality of our work.

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AUTHOR BIOS AND CONTRIBUTIONS

Klaudia Banasiewicz Team leader. Oversaw the overall coordination of the project, from early planning through to the final prototype. Took primary responsibility for the technical implementation of the *myTUL* application using Python and the Flet framework. Designed the application's structure, implemented navigation logic, and ensured functionality across its various modules. Actively facilitated communication within the team, assigned responsibilities, and ensured deadlines were met. Also served as the main point of contact with the project supervisor, Dr Daria Drwal, and helped translate supervisor feedback into actionable improvements.

Marta Goltz Participated in shaping the project concept and refining its direction during ideation stages. Contributed to team discussions by helping define and visualise potential solutions, including how the app could present and structure information. Took part in supporting technical tasks, especially in data cleaning and naming standardisation for study space entries. Additionally led the development of the team's presentation materials and external communication style, including the creation of the project identity and team image. Represented the team during project presentations and supported the final documentation phase.

Yuriy Mosorov Led the development of the computer vision component. Trained and optimised the YOLO-based object detection model for identifying and counting people in camera footage. Created the system for defining polygonal tracking zones and implemented logic for direction-based entry and exit counting. Also contributed to selecting the appropriate tracking algorithm (ByteTrack) and tuning the model for real-time performance. Participated in technical brainstorming and helped connect the analytical component with broader project goals.

Laura Vazquez Focused on the visual and spatial documentation of campus study areas. Personally collected photographs, building names, and contextual information for each listed space. Helped categorise and label study locations according to their features (e.g. group vs. individual use, available amenities). Played an important role in shaping the content structure of the *Study Places* section and ensured that each entry was clear and informative for users.

Mieszko Strzelczyk Responsible for the design and implementation of the data infrastructure supporting the application. Created the logic for integrating the computer vision model with Firebase (for live data) and SQL (for statistical aggregation). Developed the back-end components that transmit and synchronise room occupancy data between the detection system and the app. Ensured scalability of the database structure and assisted in aligning technical systems with the app's front-end design.

Anna Talar Worked alongside Laura Vazquez on gathering and preparing descriptive data for study spaces. Contributed to the documentation of physical locations across the TUL campus, ensuring that each entry was complete with photographs, location markers, and feature notes. Participated actively in the assembly of the *Study Places* dataset and in cross-checking the accuracy of location-based content within the prototype.

All team members contributed to initial desk research, analysis of TUL's existing digital systems, student interviews, ideation sessions, and final documentation. The project was shaped collaboratively through ongoing discussion, feedback exchange, and iterative refinement.