## INTRO INTO Wi-Fi TRACKING

The Wi-Fi technologies are used in everyday life on numerous applications that detect the crowd information for commercial, security and other reasons. Wi-Fi is a communication that uses radio waves over the air. It includes the end-user devices, such as smartphones, laptops etc., the radio frequency spectrum, and the infrastructure of the Wi-Fi network.

## GOALS OF THE PROJECT

To what extend and how reliable it is possible to determine the activities of individuals through the users’ characteristics that can be derived from a Wi-Fi network? TRACK-id explores the use of the buildings of the TU Delft Campus during irregular hours, in order to possibly allow efficient real estate management and provide security solutions. The irregular hours are specified as the hours outside of the opening hours of the buildings, not including exceptions like extended opening hours or events.

## METHODOLOGY

An estimation of the users’ occupation (student, academic staff, support staff, other) is calculated from the use of a Markov model with the information that derive from the Wi-Fi dataset. Their identity is used in order to estimate the activity that a user is probably doing (study, research, work, other).

## OUTCOMES

The results of the use of the TU Delft campus are visualised on different spatial levels and on different representations. The spatial levels that are used, are related to the campus, building and floor levels. Tables and graphs, a dynamic visualisation and a GIS and Web application are created during this project.

## ACCURACY

The overall accuracy of the determination of the number of users per building is 94%. Regarding the determination of the users’ occupation using the Markov model, the accuracy of the process is 50%. The pre-process and the analysis conducted to detect distinct users are regarded of good quality and can be used further. Additionally, the identification of specific events and exceptions on the opening hours of buildings can be identified by detecting irregularities of user connections.

## DATA PROTECTION

TRACK-id is the data processor of this project and it’s purpose is clear enough and according to the needs of TU Delft (data controller). The security of the data is taken into consideration. TRACK-id is ensuring the security of the dataset using a password secured database during the process and the deletion of it, after the completionness of the project. Furthermore, the outcomes do not include any information about individuals, but only aggregated data. TRACK-id is assigning profiles to the users, such as student, academic staff, support staff or other, based on general assumptions.

## CONCLUSION

The identification of specific events and exceptions on the opening hours of buildings can be identified by detecting irregularities of user connections. Finally, it is clear that through Wi-Fi tracking it is possible to extract information that will allow efficient real estate management and provide security solutions.

---

### DETERMINE ACTIVITY BASED ON THE CLASSIFIED IDENTITY OF USERS BY USING WI-FI MONITORING

#### CAMPUS LEVEL OUTCOMES

The largest groups of users of the TU Delft Campus are in descending order: students, academic staff, support staff, and others. In terms of gross hours spent, the activities are ranked in descending order: study, work, other, and the least hours were spent on research. Regarding the irregular hours, when hours are spent, they usually tend to be during the weekends, rather than in the weekdays. The differences however in the number of users, between weekends and the weekdays, are little. During the irregular hours, the hours spent in the campus are varying a lot throughout the two-month period.

Depending on the various Dutch holidays and activities that took place in TU Delft Campus during the research period, it is possible to distinguish variations in the graphs, e.g., the low number of users at the TU Delft Campus on the 16th of May, which is a national Dutch holiday and most of the buildings of the campus are actually closed.

#### EXAMPLE OF BUILDING LEVEL OUTCOME

In the Aula Conference Centre a lot more hours are spent during the irregular hours in weekends rather than in weekdays. On Fridays there are always less people using the Aula facilities than in other normal weekdays. In both graphs during the weekends only events in irregular hours are represented. This accounts for Aula Conference Centre being closed in weekends, except for events. Also, there are many users during the first two weekends, which were the exams period on TU Delft and students were studying during extended (exceptional) hours.

#### FLOOR LEVEL ON DASHBOARD

The hourly user count on the ground floor of Faculty of Architecture and Built Environment is shown in the graphs below. It’s clearly visible that something happened at midnight on Friday on the 22nd of April and lasted until 5 am the next day (Faculty party). The maximum number of visitors connected to the Wi-Fi network is around 800. Also, about 500 people left between 4 AM and 5 AM. On Saturday morning, there were about 15 people on the ground floor; these people are presumably staff or students, with the responsibility of cleaning the event.