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Crowdsensing-enabled service design for floating students during the COVID-19 pandemic

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This pictorial presents the concept and preliminary design of "Tecnico Go!", an application conceived to support college students during the COVID-19 pandemic. The project applied HCI and user-centred design methods to understand students' needs, pains, and desires during the pandemic period. The authors collected, unpacked, and reflected on user-centred data, synthesised personas and scenarios via the research through design approach. Synthesis of results points to the concept of "floating students" as a model embracing flexibility in visiting the campus safely and using the facilities when needed. Problem-oriented student journeys were identified and then used to ideate solution-oriented scenarios and a service blueprint to illuminate the continued development of the "Tecnico Go!" mobile application. This pictorial illustrates this process from data collection through customer journeys, user-centred blueprint and wireframes.

Keywords: pandemic design; crowdsensing; service design; campus attendance; floating students

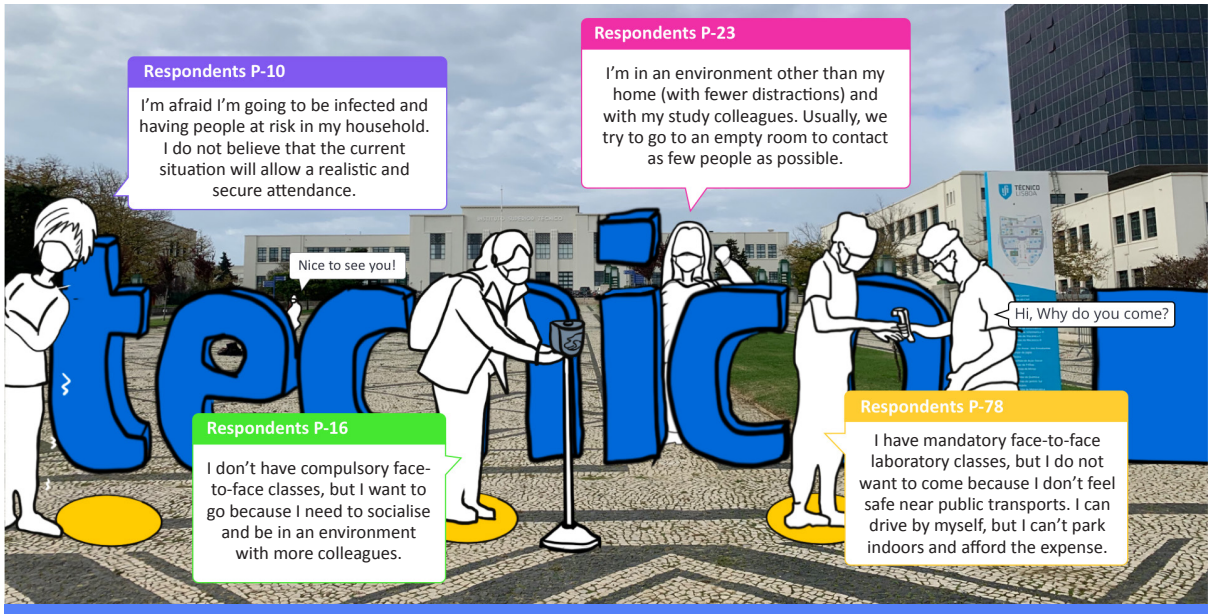


Figure 1. Floating students entering the campus: representative comments from the data collected during October and November 2020 through online surveys.

1 Introduction and related works

Universities have faced unprecedented challenges since the COVID-19 pandemic outbreak. In-person interactions are inevitable and depend on varying degrees of social, cultural, and academic purposes. During the COVID-19 lockdown, campus access became an issue for communities that still relied on it for various services and activities. For example, many courses (such as biology and medical sciences) rely on laboratories and physical infrastructures, which students and staff need to use. In response, the school employed a series of strategies and offered the necessary personal protection equipment to support safe onsite work. However, much research has shown that in-campus safety is only one of several factors contributing to students' well-being during the COVID-19 pandemic. Other equally important issues include mental health (Grubic, Badovinac & Johri 2020; Son et al. 2020), study effectiveness (Tang et al. 2020), and social needs (Bu, Steptoe & Fancourt 2020).

Consequently, students' fears, needs, and desires should be investigated before designing solutions to improve their overall experience. Social needs, feeling of belonging, academic life and studying performance are equally important along with the sense of safety. This pictorial exposes the service design process employed while aiming to design for students and support them as a community dealing with the COVID-19 pandemic.

In response to the COVID-19 pandemic, a plethora of mobile apps have been developed, catering for contact tracing, communication with the public, identifying hotspots, and getting real-time updates (Budd et al. 2020). Some works initiated by universities mainly focused on contact tracing, self-report, and campus pass (such as Campus Clear, Campus Screen and Covid Pass). Despite all these efforts to support the student's safe return to campus, to the best of our knowledge, none of the proposed solutions embraced human-centred approaches, involving students' opinions to better understand their needs, pains, and desires during this unusual time of COVID-19 pandemic. An inspiring approach that focuses on tourists is "Madeira Safe to Discover" being designed to facilitate a pleasant and safe visit to the Islands of Madeira and Porto Santo. In the attempt to cater for tourists' safety, it provides an integrated approach involving pandemic surveys, offering a visual map of tourists Point of Interests (POIs) occupancy, and proposing a gamification strategy where tourists can earn points by satisfying pandemic requirements and exchange them for free experiences (Ribeiro et al. 2021). Therefore, as different communities deal with the COVID-19 pandemic constraints, a human-centred design approach can help designers cater to diverse typologies of users and achieve higher adoption, satisfaction, and safety. This approach can contribute to the flourishing genres of "design in and for pandemics" (Taylor, Rosner & Wiberg 2020).

From the onset, we avoided contact tracing as a strategy for improving safety and mitigating the pandemic spread. Unlike many contact tracing applications that saw various degrees of adoption and very little success, we saw an opportunity to use digital technologies to assist people in their daily activities. We looked up to Madeira Safe to Discover App and expanded on its passive Wi-Fi networked system, augmenting it with user-centred features derived from surveying students' needs, such as crowdsensing, self-reporting and gamification rewards. In summary, we designed "Tecnico Go!" App which focuses specifically on university students and provides a collaborative tool to support them during and after COVID -19 lockdown. This pictorial illustrates the design process of "Tecnico Go!" in which passive Wi-Fi monitoring complemented with a crowdsensing-enabled service system engages "floating students" as a user typology and empowers the community from the students' perspective than authorities.

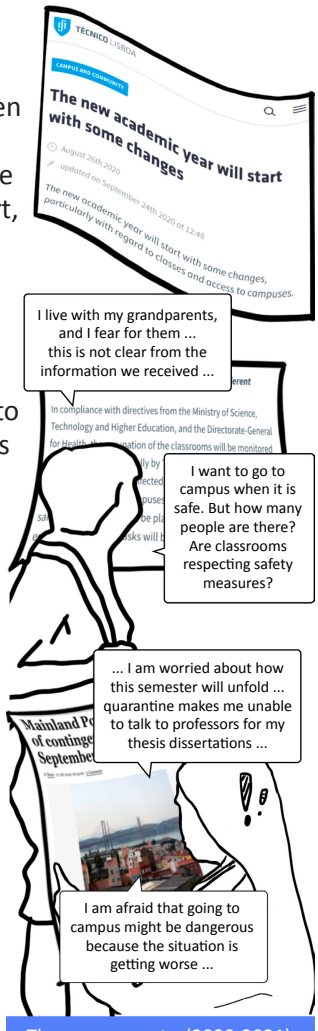
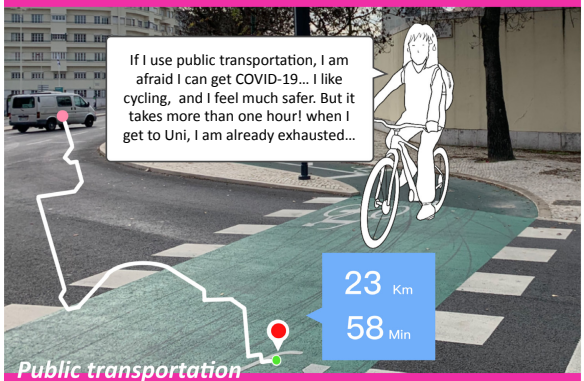


Figure 2. Floating students facing choices and doubts connected to campus presential attendance.

2 “Floating students” problematic experiences during COVID-19 lockdown

Quotes and situations interpreted from the survey data



Public transportation

The presential teaching has been mostly moved online. However, in-person teaching and learning are still inevitable for many students and academic staff. Scientific disciplines still require presidential labs attendance. Transportation is one of the main issues students are concerned about. Risk-taking(public transit), time-consuming(walking or cycling) and costly (car) led students to feelings of anxiety and intense burnout.

Observations from the on-site fieldwork

Onsite setting

Although the UniversityUniversity quickly introduced relevant epidemic policies, the pressure on public service is unprecedented, causing much confusion and complaints from students.

Quotes and situations interpreted from the survey data

Study

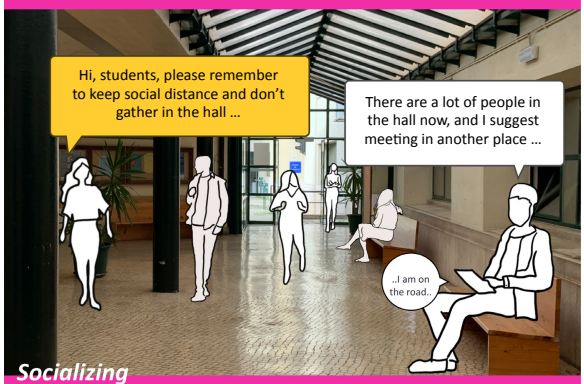
Traditional learning practices are restricted, and students have been losing contact with their peers and their mentors. Their studies, commitment, performance and initiative has suffered. Studying at home is not always possible or effective. But attending UniversityUniversity can be frustrating because regulations are continuously changing, and public facilities are semi-open (limited times or restricted number of occupants) or closed.

Observations from the on-site fieldwork

Campus service

The UniversityUniversity struggles to provide high-quality public services in these conditions, resulting in a downgrade campus experience.

Quotes and situations interpreted from the survey data



Socializing

Social needs contradict the safety measures for epidemic regulations and pandemic prevention. Scientific offline curriculum settings can alleviate the contradiction. Still, the uncertainty of the campus safety and environment occupancy due to the difficulties of monitoring the flow of people has caused further anxiety among students.

Observations from the on-site fieldwork

Contact tracing

Because of privacy and personal devices’ access, the University cannot track every student’s location. Students are also struggling to receive real-time news from the campus service. The uncertainty of information may subject students to more psychological pressure.

Figure 3. Vignette scenarios of students experiences derived from the field studies and survey data.

Most universities have promoted safe access to the campus during the pandemic by launching a series of policies, including total lockdown of the campus, half-lockdown, remote work, and mixed modes of attendance (i.e. even versus uneven student numbers can attend at any given week). Our campus set a mixed-mode access policy in which students attended presential classes in alternate weeks. Meanwhile, the campus deployed prevention regulations with temperature checkers and hand sanitisers, timely cleaning and disinfecting classrooms.

However, through onsite observation and informal interactions with students, the authors quickly discovered that on-campus safety concerns are only a part of the students' problem. This new mode of engagement brought unprecedented challenges for most communities, the academic population included. While the health authorities worried about health, the academic community was concerned with teaching and learning issues. On the other hand, the students were missing social contact, intimacy, information, advice, and study groups. The campus service being degraded due to COVID-19 affected the community and students to various degrees. We decided to conduct an online study to give students the opportunity to voice their issues and eventually confirm our hunches.

3 Research Methods

We started by applying HCI and user-centred design methods to understand our target users' needs, pains, and desires. Through a Research Through Design (RTD) process (Zimmerman, Forlizzi & Evenson 2007), we unpacked and reflected on our data, synthesised personas, and problem-oriented journeys to share results and brainstorm solutions based on the system beneficiaries' real needs. The effort was interdisciplinary and combined expertise from a broad group of researchers, from service design to interaction design and computer science.

We complemented our research using online questionnaires. Our survey reached out to 225 students from different departments asking them to express their patterns, needs, fears and wishes to visit the campus. From the collected data, we grouped students into four primary personas and summarised their problem-oriented journeys. Then, we developed solution-oriented scenarios and designed a service application articulated in three phases: before, during, and after campus attendance. We also created an accurate blueprint that was used for the application deployment.

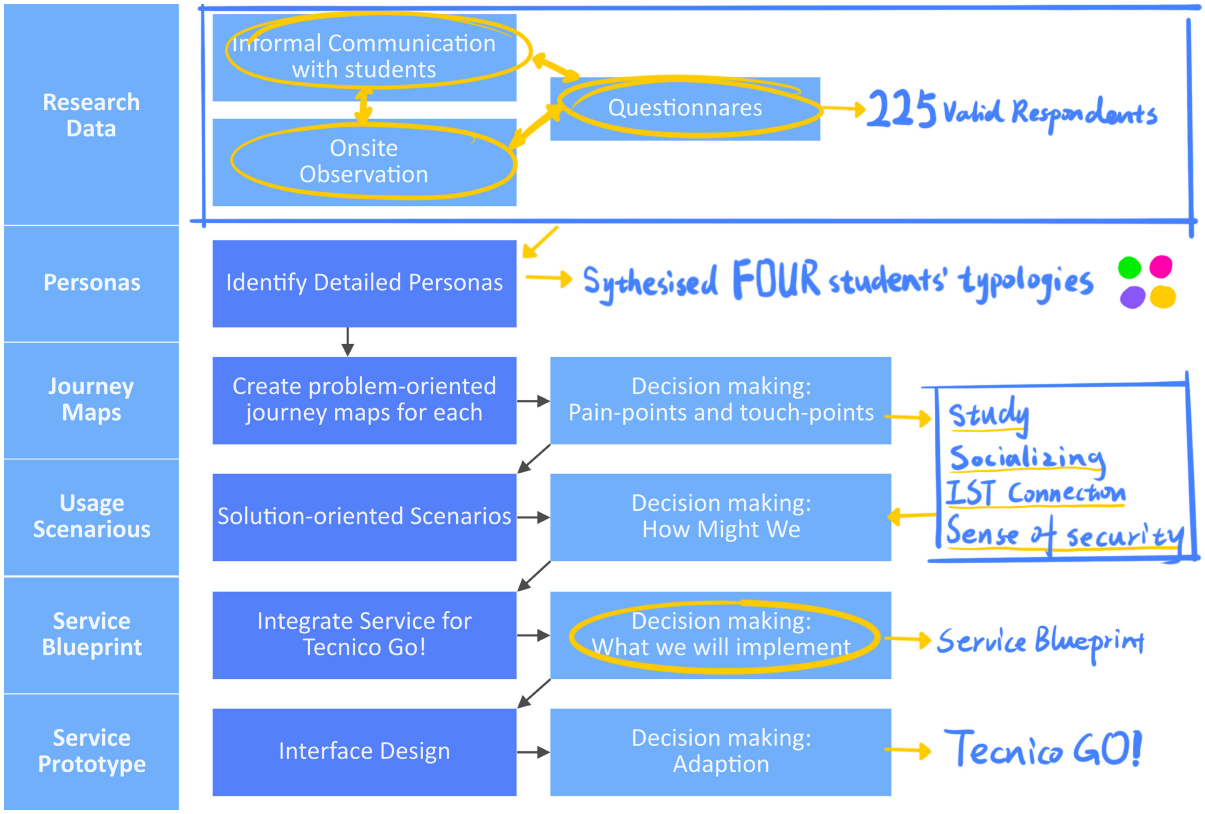


Figure 4. Research process and main outcomes.

4 Personas of “floating students” and problem-oriented journey maps

The quantitative data collected through the survey was aggregated in the four-quadrant form, highlighting four different student typologies: those who visited campus because they had to (16%), those who visited because they wanted to (50%) which were the majority of students. Moreover, the second biggest group of students were those who wanted to but were not able to visit the campus (19%). Only a minority of students did not visit the campus because they did not want to (14%). In summary, the vast majority of our respondents came or wanted to come back to campus during the pandemic, while only a minority did not want to visit or did not visit at all. Based on these four typologies, we identify a majority of what we called “floating students” typology (who came to campus willingly or unwillingly). Based on the overall data, we synthesised four primary personas, one per quadrant: Lisa (who willingly visits campus), Afonso (who wants to go to campus but is worried about safety), Tomás (who has been doing great from home and does not want or need to visit campus), António (who has to go but would rather not). The qualitative answers to the survey’s open-ended questions help us detail the scenarios and journey of each persona.

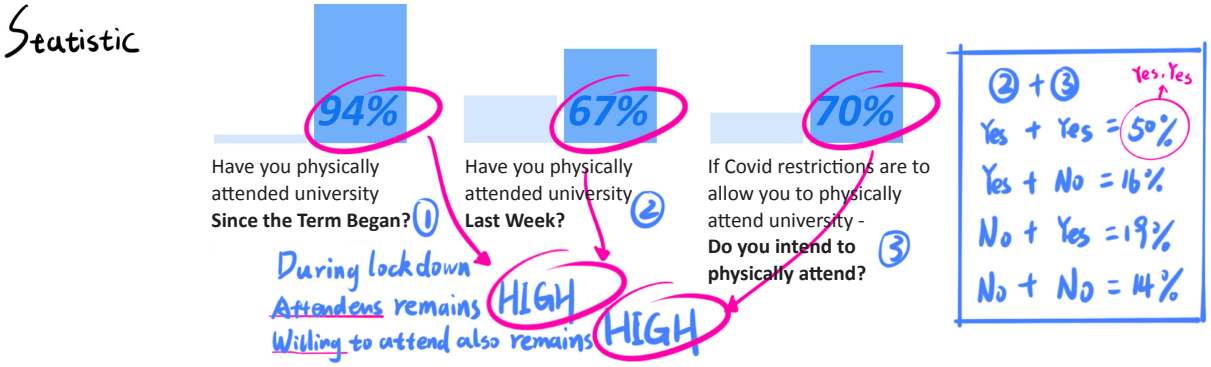


Figure 5. The statistic about students’ feedback about backing to the campus.

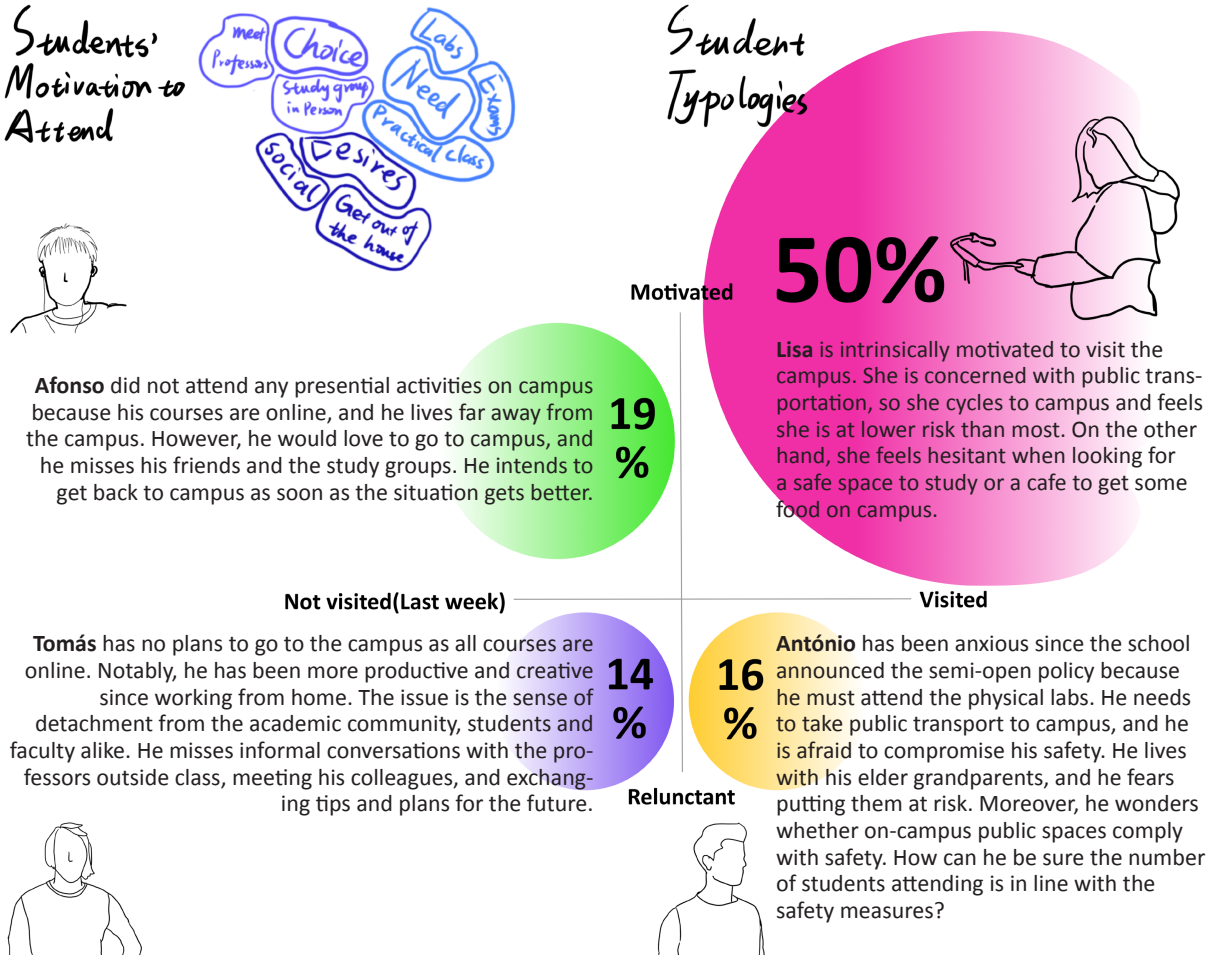


Figure 6. Students’ needs, choices and desires and synthesized typologies of students.

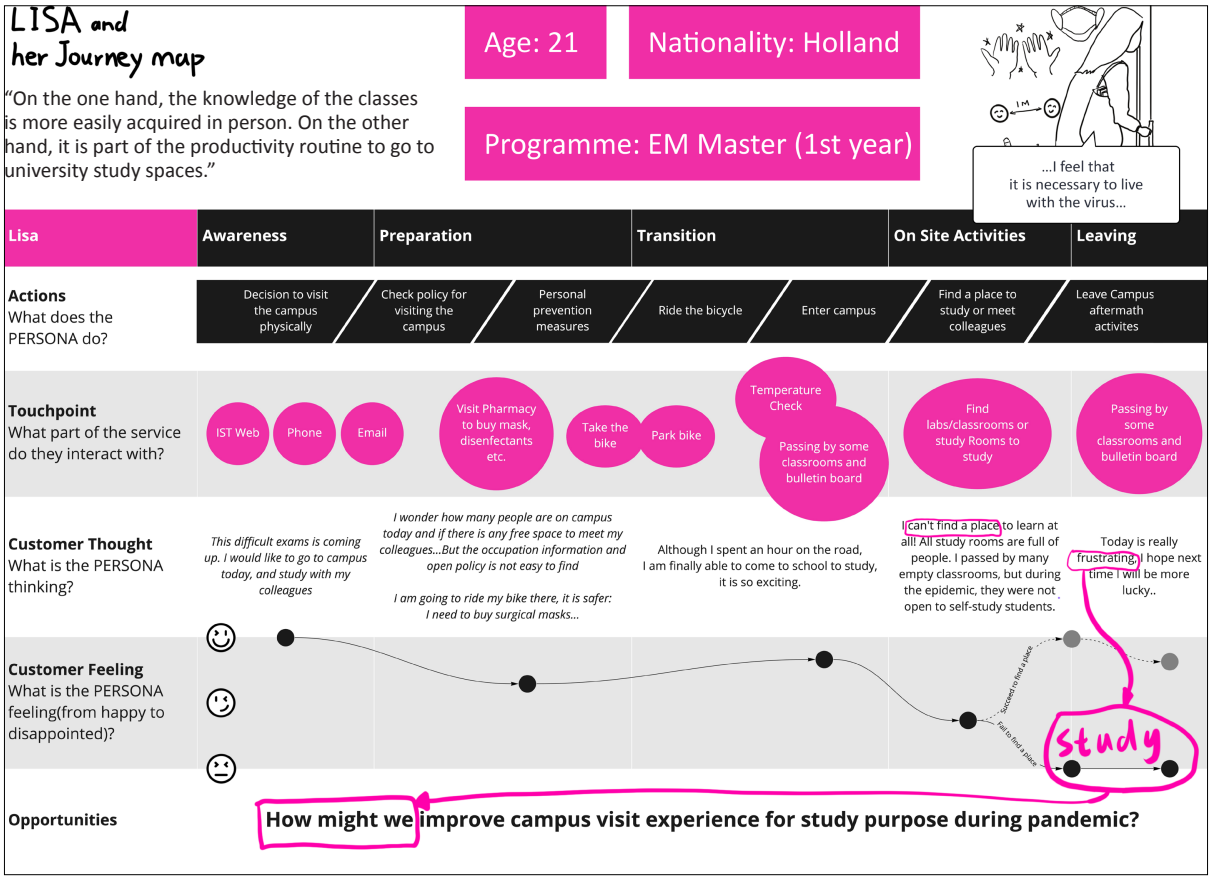


Figure 7. Persona - Lisa and her journey map.

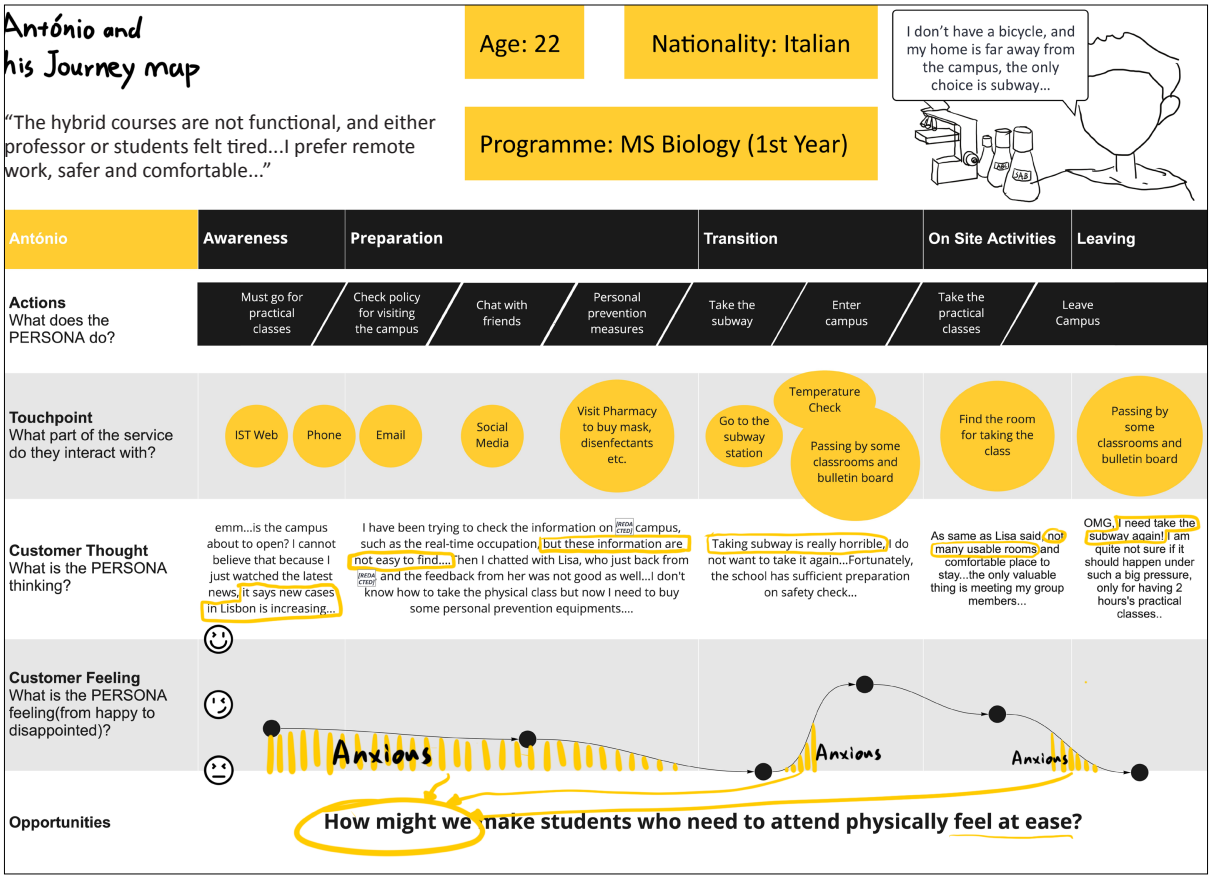


Figure 8. Persona - Antonio and his journey map.

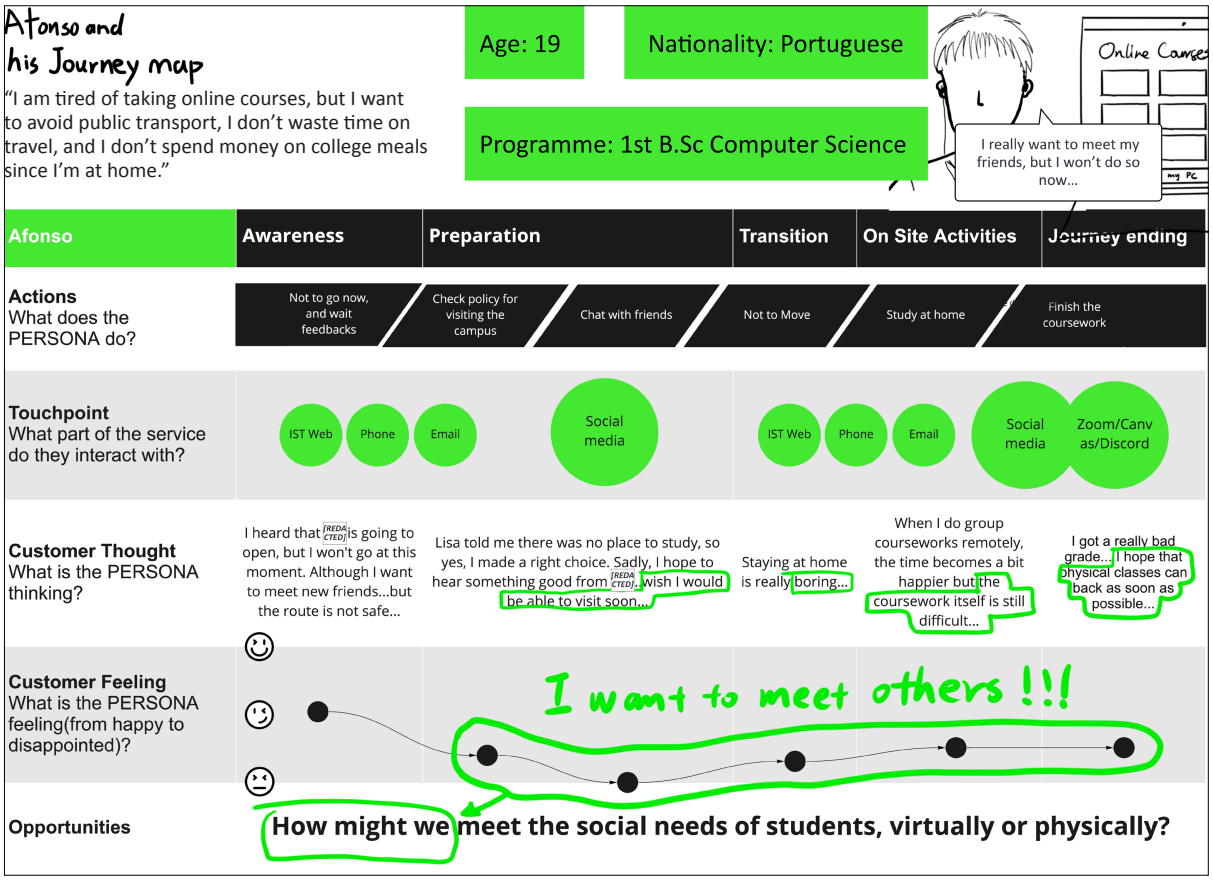


Figure 9. Persona - Afonso and his journey map.

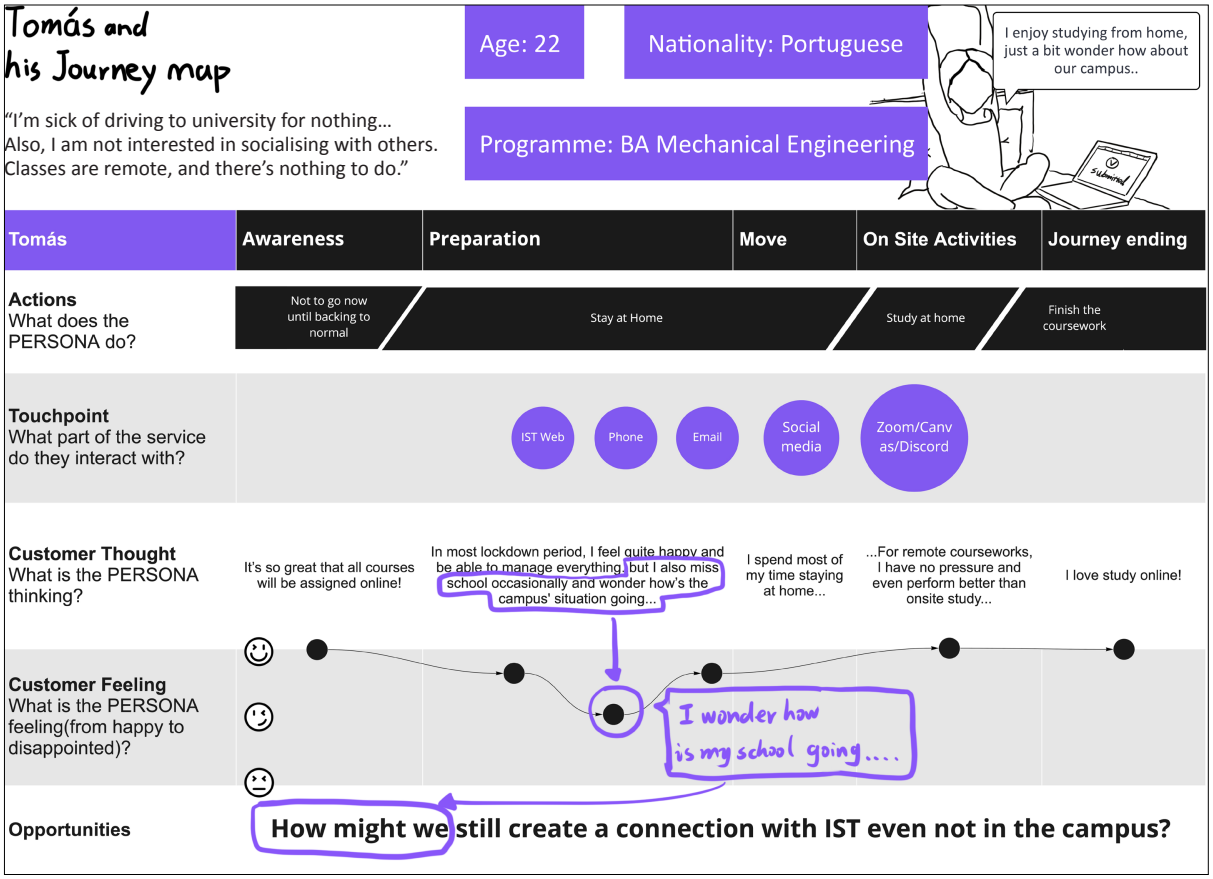


Figure 10. Persona - Tomas and his journey map.

5 Tecnico Go! usage scenarios

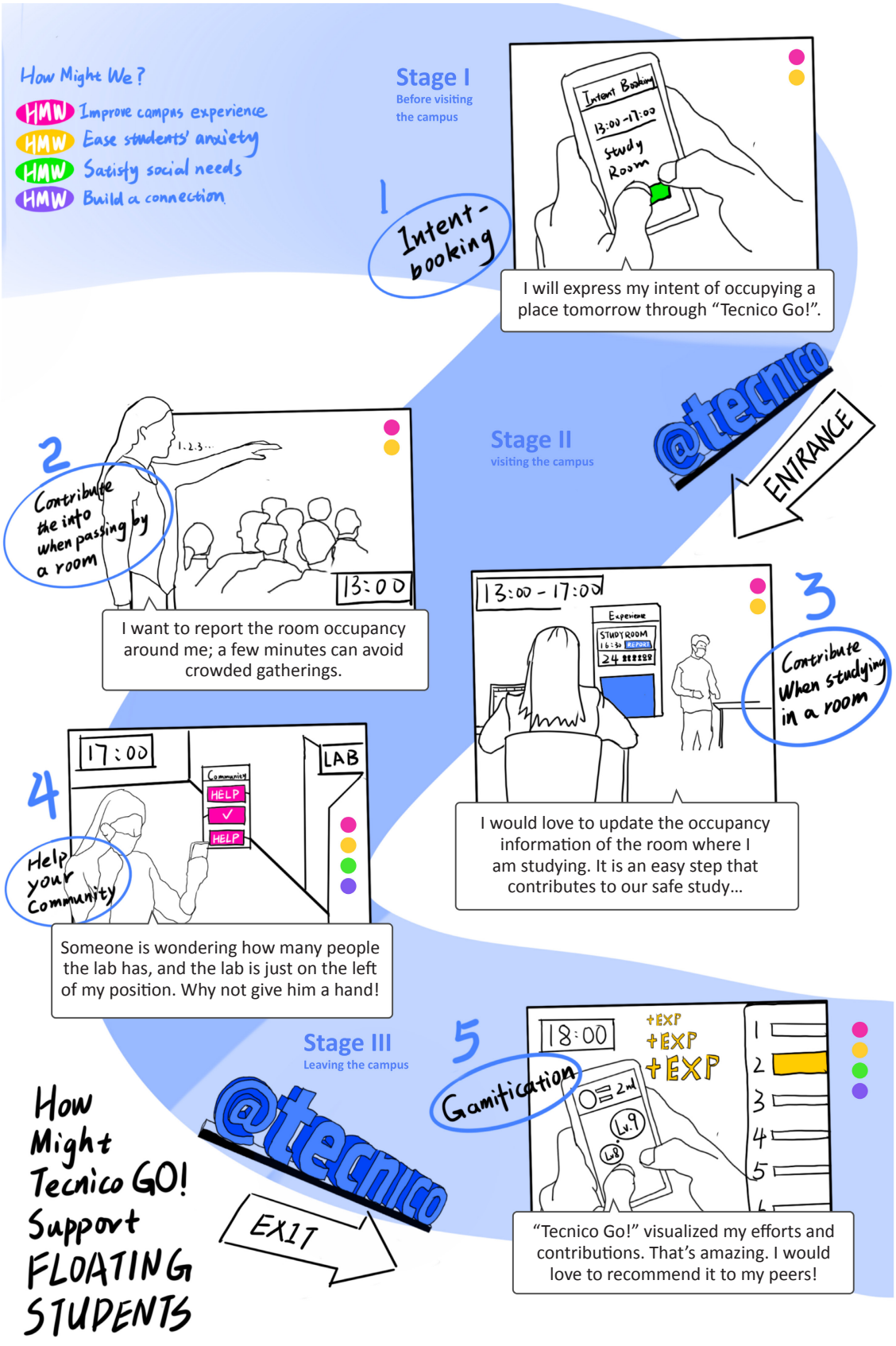


Figure 11. "Tecnico GO!" usage scenarios, including stage I (Before visiting the campus), stage II (Visiting the campus) and stage III (Leaving the campus).

6 Crowdsensing as a way to support floating students

In order to cater for the different students' typologies, their needs and concerns, we designed "Tecnico Go!", a mobile APP based on passive Wi-Fi sensing augmented by crowdsensing in the form of students self-reporting public spaces occupancy, helping the system to match the passive device count with the presence of real people. In fact, prevention of COVID-19 spread requires high precision of occupancy information. A critical number of Wi-Fi routers installed in the university public spaces (indoors and outdoors) can improve device count precision but does not cater for a precise count of the number of people as each person can easily own more than one device. Moreover, counting devices do not account for students' mobility transitioning between spaces (Zakaria et al. 2021). Crowdsensing technology can be regarded as one solution to supplement the passive Wi-Fi information and support students' choices to attend the campus in general or visit specific rooms. Our crowdsensing-enabled service is conceived to expand the granularity of the passive Wi-Fi information and anticipate occupancy information at the classroom level through an intent-booking system. Engaging and empowering students in pandemic prevention, "Tecnico Go!" challenges traditional contact tracing and offers alternatives to protect users' privacy and improve reliability.

Figure 12. Passive Wi-Fi can count the number of devices for a zone but no people for a specific space(e.g. One zone may include three rooms). How do we optimise the estimated number of devices to match the actual number of people in a room and comply with safety measures? Self-reporting and crowdsensing can be exploited to this end.

7 Service Bluprint

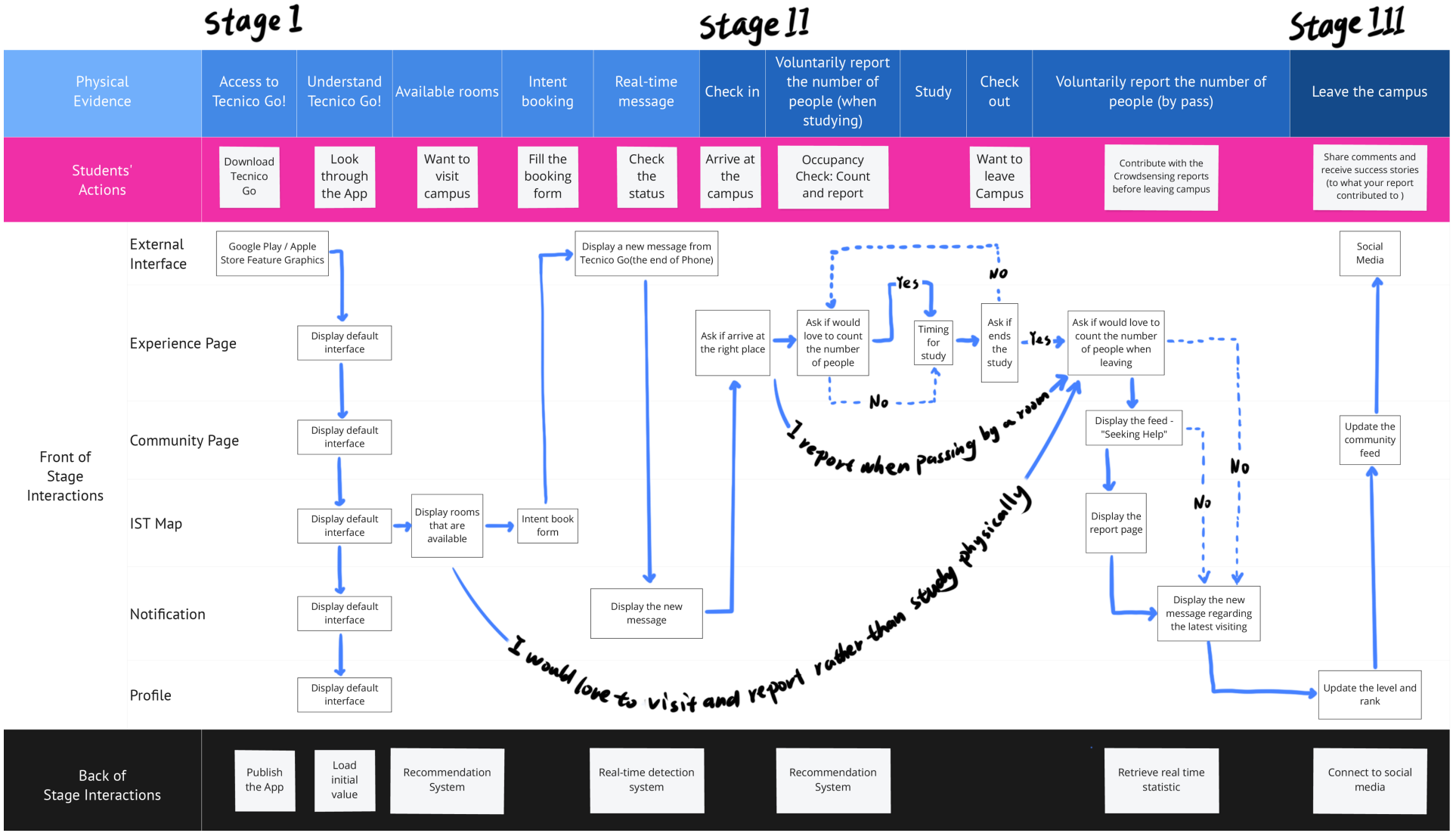
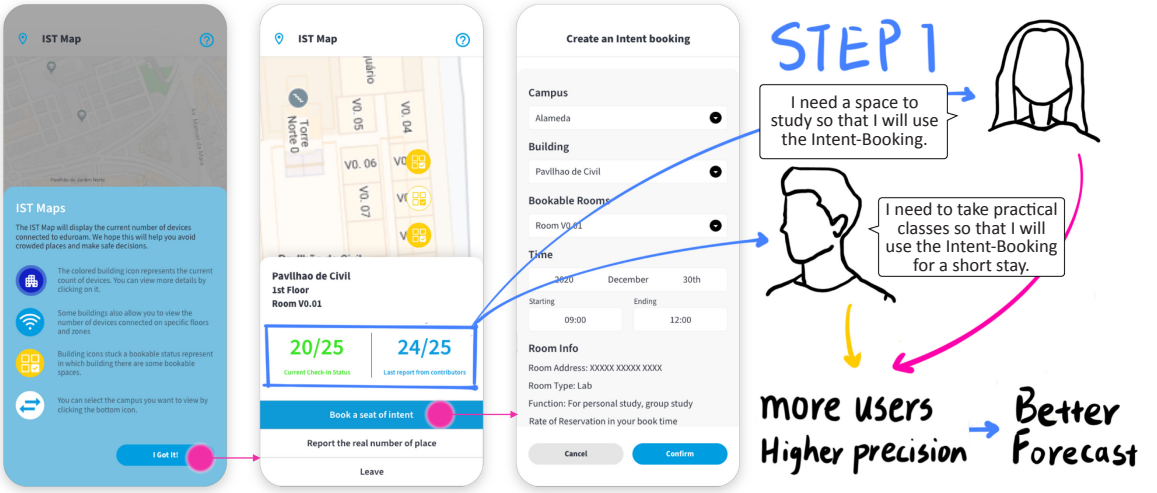


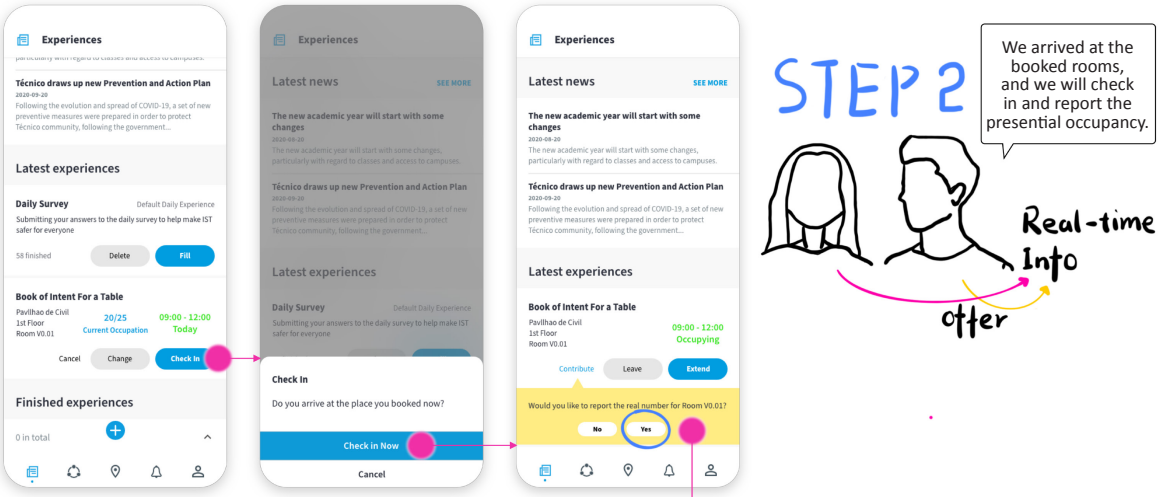
Figure 13. "Tecnico Go!" service blueprint.

8 Hi-Fi wireframes sequence of “Tecnico Go!“

I. Intent Booking



II. Check In Intent Booking



III. People Traffic Report

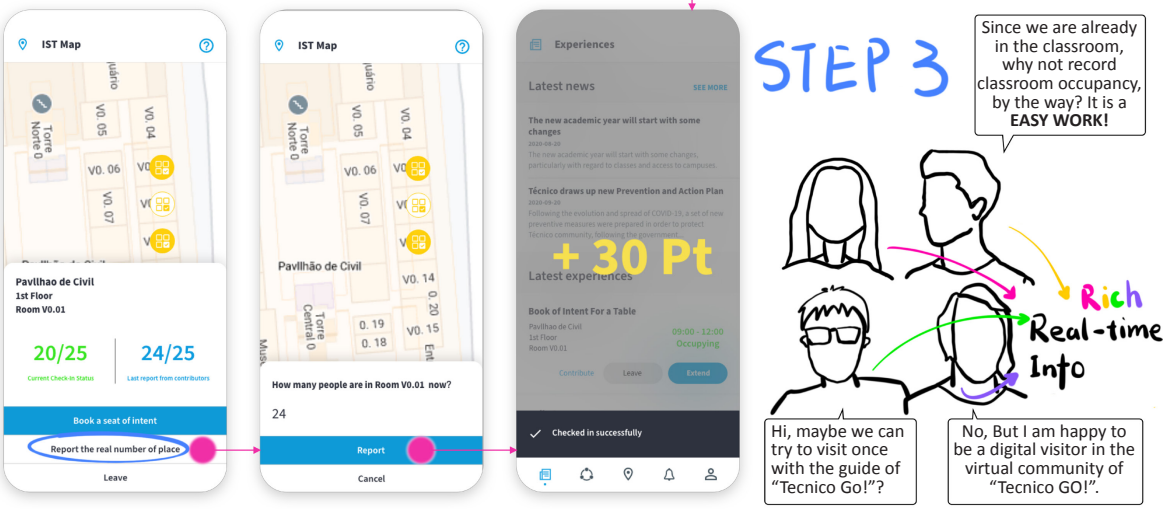


Figure 14. The hi-fi interfaces about intent-booking, check in and crowdsensing report.

IV Achievements

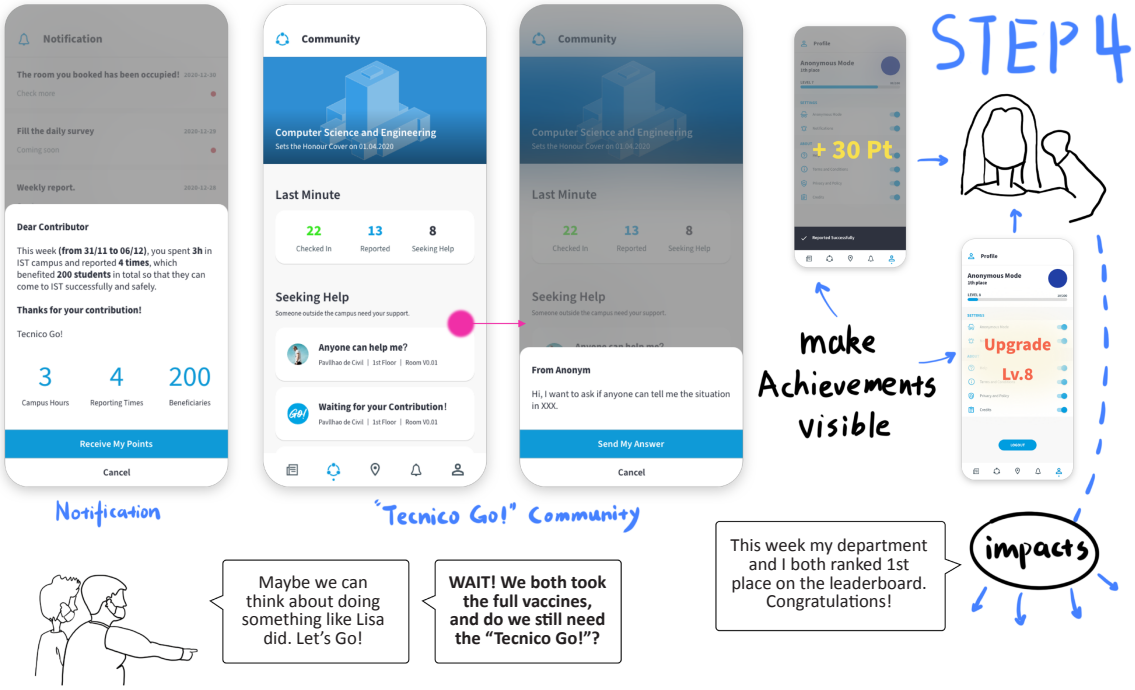
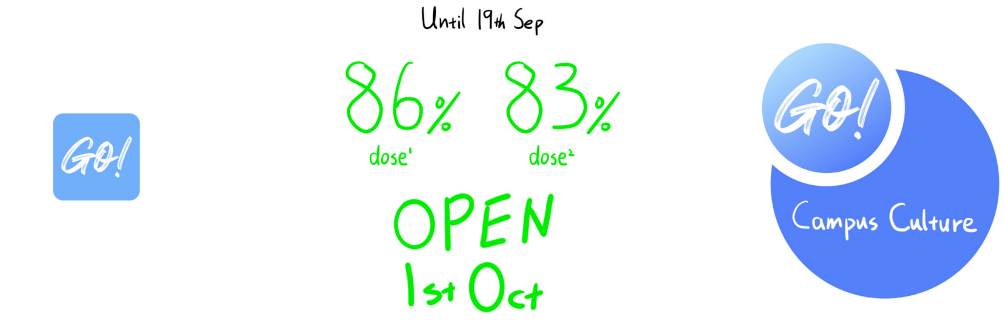


Figure 15. The hi-Fi interfaces about the mechanism of achievements.

9 Conclusion



Pandemic Design: Tecnico Go!

Pandimic enveronment has been changing (DGS.pt 2021)

Potential normalisation as a part of campus culture converted from Pandemic Design Mode

Figure 16. Potential conversion from the pandemic design outcomes.

In summary, while many mobile applications to combat COVID-19 flourished in a relatively short amount of time, the vast majority were mandated by government and health authorities and developed for contact tracing and symptom monitoring (John Leon Singh, Couch & Yap 2020). Currently, several specific apps cater to students and their needs, none of which came to our attention at writing, and these apps were emerging sometime after our studies.

Nevertheless, we take this pictorial to describe our process and outcomes on applying user-centred design methods to understand and serve the university students community greatly affected by the social distancing measures in their lifestyles and learning processes. Last but not least, the crowd-sensing enabled service can still work for promoting campus culture and participation, even if our targeted community will be released eventually from the COVID-19.

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