STAYAWAY COVID. CONTACT TRACING FOR COVID-19

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In a pandemic, contact tracing is crucial to interrupt transmission chains. However, the traditional way of doing this has limitations that can be overcome by a digital tool if properly adopted by the population and integrated with health services. STAYAWAY COVID is the INESC TEC's response to this challenge.

A step ahead of the virus

A radar attached to your mobile phone

Contact tracing beyond your memory

A virus is a parasite whose sole purpose is to multiply and dominate the world. To do so, it depends on seizing the cells from living beings, the hosts, which provide the necessary conditions to copy its genetic material and continue its path of infection and replication. In order to conquer to world, a single host - regardless of how vulnerable and collaborative it is - is not enough; the virus needs to infect more and more hosts.

Defeating the virus means preventing its replication. This battle is fought by the immune system of each host; however, and until we are totally immune to it, we can only minimise its transmission. In this sense, and in order to avoid yet another indiscriminate lockdown nationwide, the contact tracing performed by healthcare services in any infectious outbreak is crucial, in addition to all the other individual prevention measures we adopt. In the case of COVID-19, and since the virus is particularly tricky - it renders us silently infectious for a few days, before any symptoms appear, and even though we never feel anything, it can keep us that way for a couple of weeks - and we still don't have the capacity to test the entire population on a regular basis, the fast detection of those who have been exposed to infected individuals is quite important.

Traditional contact tracing relies on the experience of infectious and contagious patients, in order to identify people who have been exposed to them recently.

Based on this identification, the teams of healthcare professionals contact people individually, and carry out their clinical follow-up. The process is demanding and time consuming, so it is difficult to scale up.
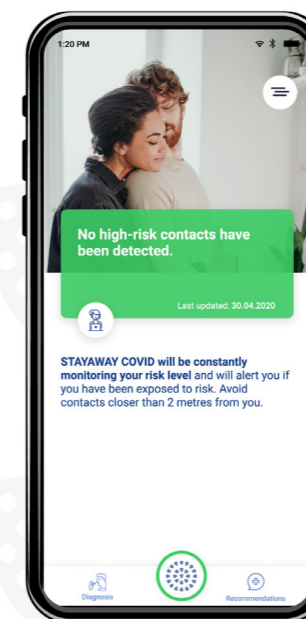
The goal of the STAYAWAY COVID is to complement traditional contact tracing, thus making it independent of our experience, and allowing each one of us to assess our own risk of exposure to those infected with COVID-19. Each day, the application installed on the users' smartphones assesses their risk of contact with people whose infection has been confirmed by the National Health Service. At the moment, a contact lasting more than 15 minutes, and at a distance of less than two meters, is considered a close contact. After identifying a close contact over the previous 14 days, the application suggests the user to self-isolate and contact the healthcare authorities.

Conceptually, it is quite simple to explain how STAYAWAY COVID works. Each mobile phone generates a random numeric code without any relation to the device or the user. These codes are all different. Each mobile phone broadcasts its code several times a second, which is then received by other devices that have the application, within a range of a few dozen meters. The mobile phone that receives the code is able to estimate, with reasonable precision, whether the devices that broadcast the code were less than two meters away.
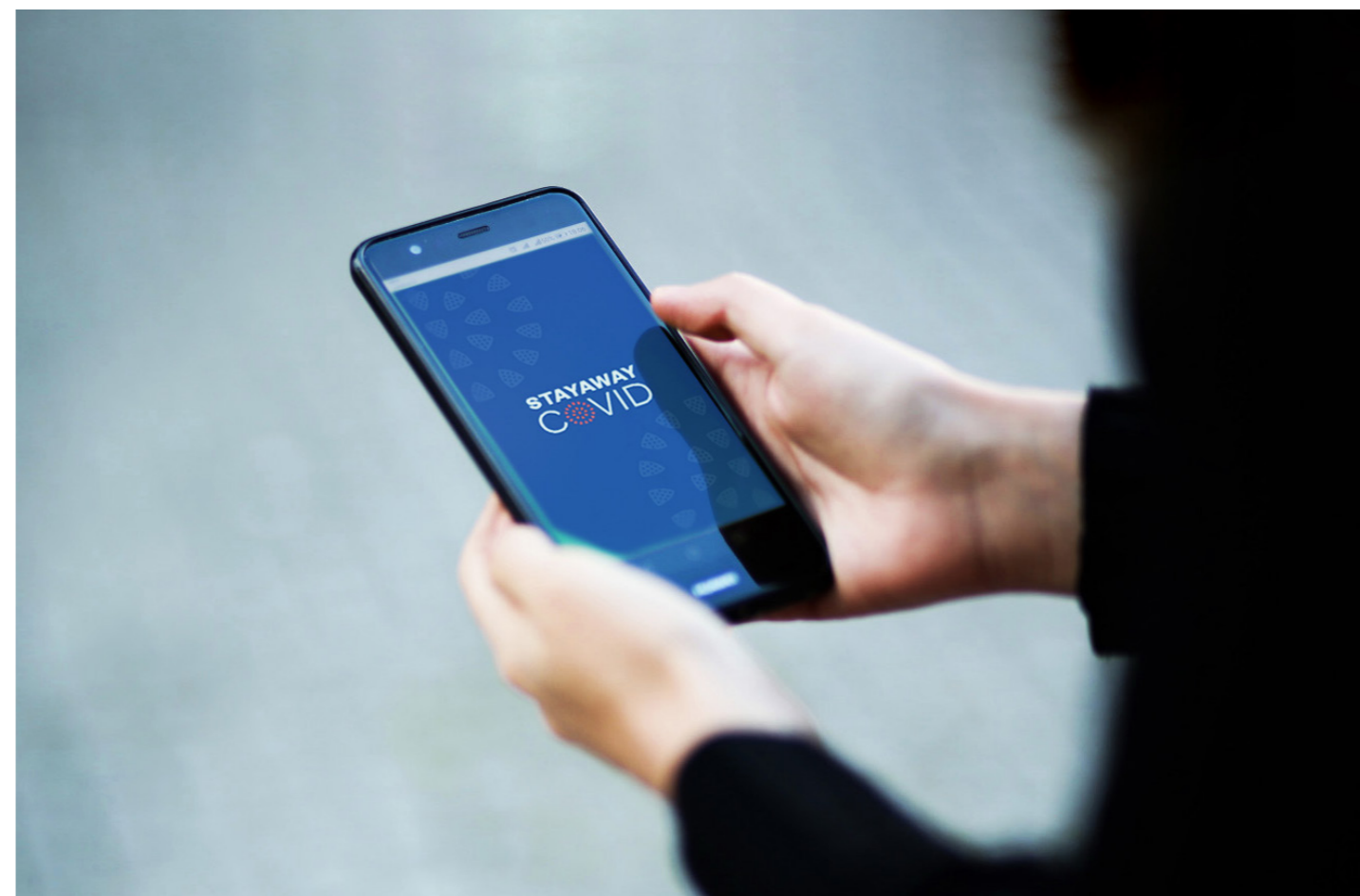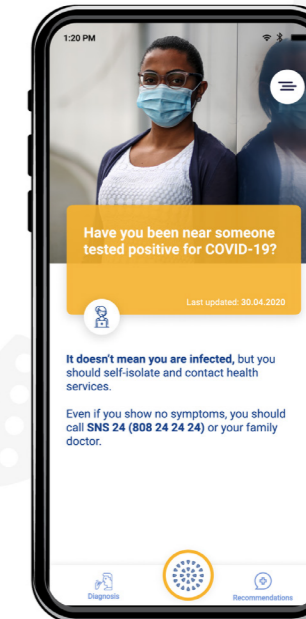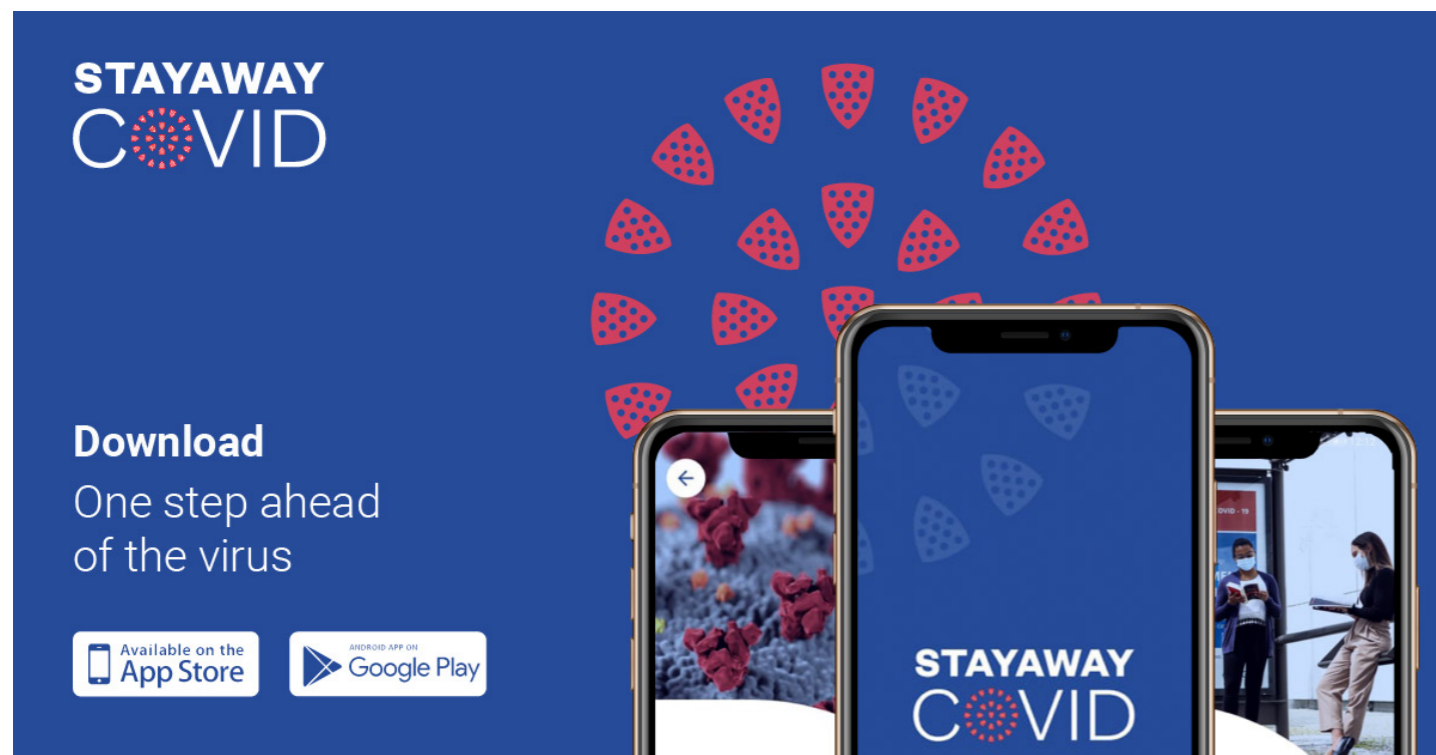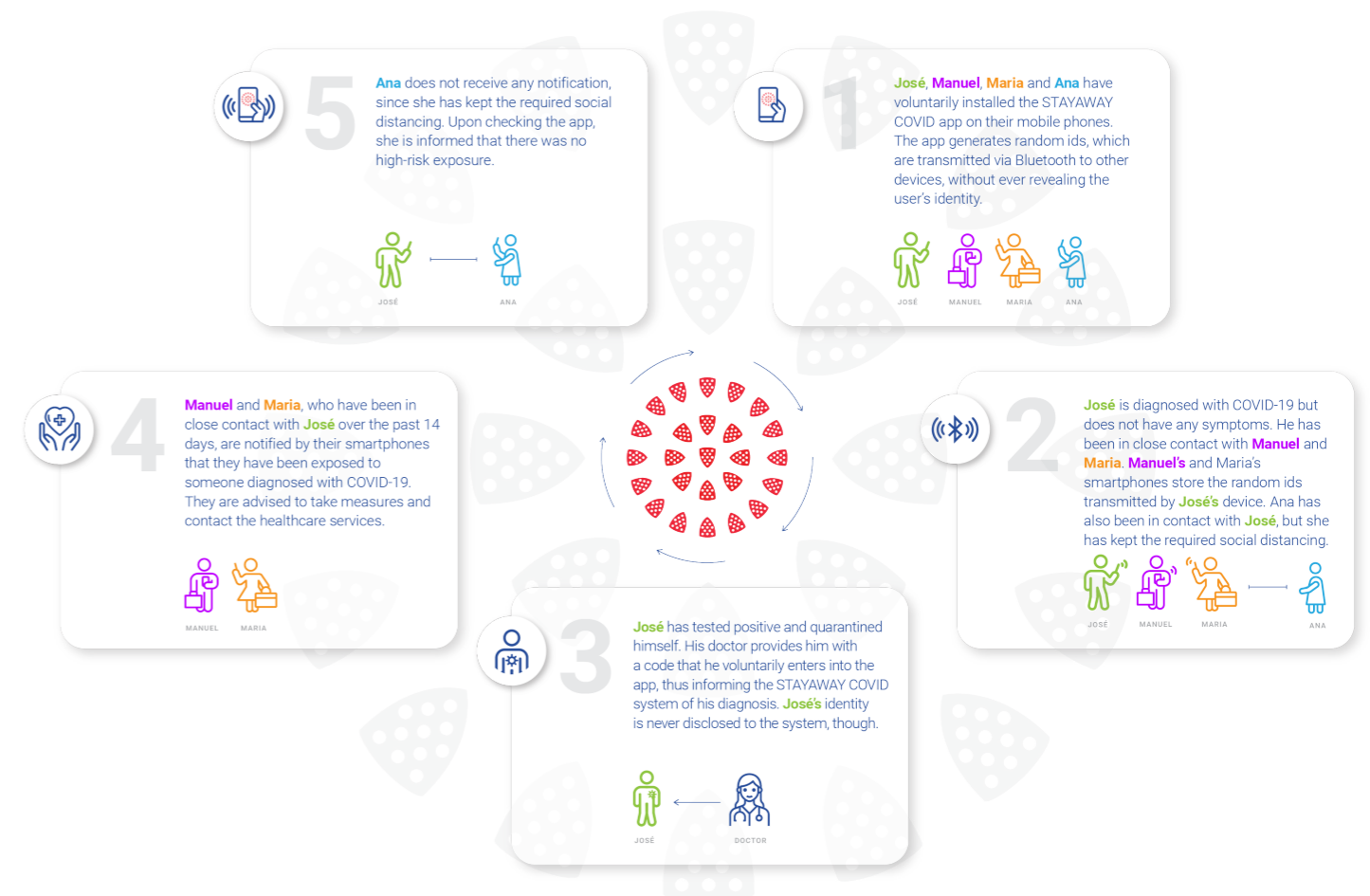
In this case, it keeps the codes of devices that were close for more than 15 minutes; the other codes are discarded. At the end of the day, each mobile phone identifies the codes issued by devices that were close. In this sense, if the application determines that one of the codes saved is associated with a mobile phone whose user was diagnosed with COVID-19, it immediately displays an alert message. For everything to work correctly, the user diagnosed with COVID-19 must allow the application to broadcast the code issued by his/her device over the previous weeks, so it becomes available to all. All of these codes are anonymous and unintelligible, and do not reveal the identity or any other information about the user. In practical terms, STAYAWAY COVID's architecture, development and operation are much more elaborate. The biggest challenges in the implementation of the system were the analysis and decision-making regarding different trade-offs. It became necessary to find a balance between available technology, usability and "digital inclusion", as well as the various aspects of system security and data involved. In terms of architecture, INESC TEC's solution adopts a distributed computing and storage model that aims to store and

process data partially on each mobile phone, instead of enabling data processing in a global way. Although it is an important way to ensure data privacy, this option hinders scientific, epidemiological and other types of analyses that are equally essential. Regarding security, in addition to following the best development and implementation practices, the team responsible for developing the app adopted specific techniques to address this question. An example is the frequent changes in the code that each mobile phone broadcasts. In fact, this code is not always the same, it changes every 10 minutes. This way, it is possible to mitigate the risk of having someone maliciously observing the code, which could lead to the user-code pair identification. Usability is a constant element in the various parts of the system design. A procedure that reflects this is the way the system seeks to ensure that only users who have been diagnosed with COVID-19 share their codes. The process of validating that the shared codes actually correspond to an infected user is done through a code, which the patient receives from the healthcare authorities, and voluntarily introduces in the application. It is a simple process, but somehow prone to issues concerning

5 Ana does not receive any notification, since she has kept the required social distancing. Upon checking the app, she is informed that there was no high-risk exposure.

JOSÉ — ANA

1 José, Manuel, Maria and Ana have voluntarily installed the STAYAWAY COVID app on their mobile phones. The app generates random ids, which are transmitted via Bluetooth to other devices, without ever revealing the user's identity.

JOSÉ MANUEL MARIA ANA

4 Manuel and Maria, who have been in close contact with José over the past 14 days, are notified by their smartphones that they have been exposed to someone diagnosed with COVID-19. They are advised to take measures and contact the healthcare services.

MANUEL MARIA

2 José is diagnosed with COVID-19 but does not have any symptoms. He has been in close contact with Manuel and Maria. Manuel's and Maria's smartphones store the random ids transmitted by José's device. Ana has also been in contact with José, but she has kept the required social distancing.

JOSÉ MANUEL MARIA ANA

3 José has tested positive and quarantined himself. His doctor provides him with a code that he voluntarily enters into the app, thus informing the STAYAWAY COVID system of his diagnosis. José's identity is never disclosed to the system, though.

JOSÉ DOCTOR

STAYAWAY COVID

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of the virus

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ANDROID APP ON Google Play

security against fraud. Technically, the team could resort to several options to make this process more secure, but the impact on the users' usability and freedom did not justify them. The development of STAYAWAY COVID has been directed by a constant cost-benefit analysis by all stakeholders.

Unlike traditional tracing, in which healthcare services actively seek high-risk cases, STAYAWAY COVID allows high-risk cases to seek help in a timelier manner. Digital contact tracing is being used for the first time in a pandemic, influenced by the still limited knowledge

about the disease, and the only technology that can be used massively and free of charge to estimate how close two people were, in the broadest and wide-ranging situations - Bluetooth. We are only starting to evaluate the app's accuracy and effectiveness, despite the scarce operational information provided by the system. If the results follow the current good indicators, this tool could actually enable (on the short-run) a selective lockdown that promotes a tolerable coexistence with the virus, until we eradicate it. The future will certainly redefine traditional contact tracing.