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Guard Dog: A College Students Personal Touch Sanitizer

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Abstract. During the epidemic, college students are prone to anxiety and depression, and long-term anxiety and depression will lead to a decline in resistance. There are a lot of bacteria in the office environment that college students use daily, and college students with low resistance become vulnerable groups. In this article, we introduce the Guard Dog, a sterilizer that embeds UV disinfection protection into the office environment to sterilize personal contact items for college students in their daily work and study. In this preliminary study, the aim was to explore suitable interaction designs that provide opportunities for technology to be embedded in the existing college student office environment. Preliminary results show the importance of IoT in the daily interactions of college students. Students participating in the trial validate the flexibility of digital protection. Finally, we discuss that these daily activities enhance student protection, which demonstrates an opportunity to build personal sanitization protection between college students and the office environment.

Keywords. College Students, Disinfection Protection, Resilience, Daily Work, IoT, Experience Design, Appropriate Interaction Design

1. Introduction

Anxiety and depression are important issues that affect the mental health of college students [1] . Long-term anxiety and depression will reduce people's resistance. There are a lot of bacteria in the shared electronic equipment in the office environment [4] . College students with low resistance become vulnerable. Infected groups [1] , during the COVID-19 pandemic, encouraging students to carry out protective disinfection work, providing a safe working and living environment can enhance students' confidence in fighting the epidemic and reduce the risk of illness [3,5] . In this article, we introduce Guard Dog , a concept that integrates sensors with a personal item disinfection device designed to sanitize items that students come into contact with while in the office. Guard Dog includes a sterilizer with sensors and a mobile phone app (see Figure 1). We conducted a pilot study with 4 students, which provided initial insights into students' use

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of tabletop sterilizers to sterilize items, and it also offered the potential to guide students through sterilization through a mobile phone app. We offer suggestions for future research on smart desktop sanitizers for college students.

Figure 1. Guard Dog design for sanitizing personal contact items for college students (left: sanitizer, right: app)

2. College students, school environment and, disinfection protection and human-computer interaction

2.1. College students and school environment

University is a key development period in life [8] . College students are generally under great pressure [3] . Anxiety and depression have a high incidence rate in college students. College students in anxiety or depression state have low mental health and resistance. Low [1] , easy to be infected with bacterial diseases [2,3] , the current COVID-19 pandemic has made college students a special group, their study life has been changed, online learning, restricted going out, mental and physical health are further improved drop [6,7] . It is recognized that the office environment is contaminated with bacteria [9] , computer keyboards, mice and work surfaces may be contaminated with bacteria, and the number of bacteria in multi-user environments is higher [9,11,13] , Al-Harmoosh et al. (2019) showed that bacteria from doorknobs and keyboards in university public areas are one of the main sources of cross-transmitted bacteria and bacterial infection in the university environment [10] . The research results of Markus Egert et al. (2014) indicated that there are pathogenic bacteria on the smartphone screen of college students [14] , because the smartphone is a high-frequency device, and the smartphone screen is affected by bacteria from humans, when people come into contact with public facilities , the bacteria on his hands will be brought to the smartphone screen [15] , and the smartphone has become a source of bacterial infection. The findings of Hadi Eslami et al. (2020) suggest that reducing hand contact with objects and sanitizing surfaces during the COVID-19 pandemic can reduce the amount of COVID-19 virus on surfaces and slow the speed of transmission [16] . Disinfection activities in most schools are unable to provide appropriate cleaning agents and disinfection isolation time [11] . With the movement of people, other bacteria will be brought into the environment, and there are limitations in disinfection activities in schools. A series of studies have shown that there are cross-spreading bacteria sources in the public environment of universities, while the disinfection activities of schools have limitations, college students exposed to the public environment are easily exposed to bacteria, the smartphones and office equipment used

by college students carry disease-causing bacteria, and college students There are people who are susceptible to bacteria in the group, and it is necessary to improve mental health. At the same time, disinfection of personal contact items is very important.

2.2. College students and disinfection protection

Encouraging students to actively carry out protective activities can reduce their risk of disease [3] . Using hand sanitizer to clean hands during the COVID-19 pandemic can prevent the spread of the virus [16] , but after students touch smartphones and other devices after completing hand cleaning, their hands will re-attach bacteria, while cleaning hands Personal contact items should be cleaned. At present, the main disinfection equipment used by students is alcohol spray and other disinfection reagents. Although they have disinfection effects, they need to consume human resources, and there are irritating disinfectant residues that affect human health [17] . College students are using these When using reagents, the pungent odors they bring can disturb others, and the widespread use of these reagents can leave a lot of chemical residues in the environment. Ultraviolet disinfection is easy to operate, fast, inexpensive, has no chemical residues, and has sterilization and disinfection effects [17] [18] . Although the disinfection range is small, it is suitable for the disinfection of personal contact items. Ultraviolet disinfection can eliminate Covid-19 germs and deal with the spread of infectious germs [19] . Relevant work shows that UV disinfection can currently support college students in disinfecting personal contact items.

2.3 College Students and Human-Computer Interaction

Ma Xing et al. (2021) showed that college students in the digital age have digital communication skills and are proficient in the use of digital tools and technology [20] , contemporary college students enjoy the Internet of Things life [21] , and the Internet of Things interaction of daily necessities It can increase the enthusiasm of college students. The use of smart phone applications is a part of college students' life [22] . Using smart phone applications as the access terminal can bring affinity and ease of operation to college students [23] . We will therefore explore the embedding of smartphone applications into routine personal contact disinfection activities.

3. Guard Dog: Disinfection protection for the Internet of Things

3.1. Disinfection of daily life

Guard Dog is a desktop personal sanitizer that sits on a desk surface and invites college students to sanitize personal items in their daily lives. Guard Dog is a bionic puppy with a smooth back that is pleasing to stroke [24] and includes a puppy-shaped sterilizer and a mobile app (see Figure 2) , is both a sterilizer and a desk lamp. The front and back of the sterilizer cover correspond to LED lighting and UV lamps. During the period when the disinfection function is not used, college students can also use the lighting function to assist work. The internal chip sensor will record the items that college students have sterilized, record and send it to the smartphone app, reminding college students of the items that need to be sterilized frequently. During the use of the lighting function, the

effect of the lighting light will be adjusted according to the ambient light to protect college students. vision.

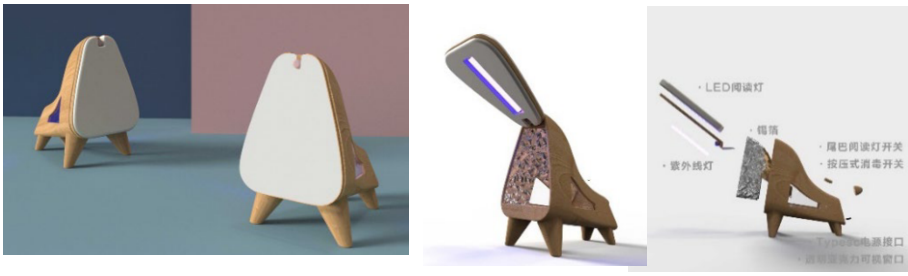

Figure 2. Styling and composition of Guard Dog

3.2. Interaction Design

Guard Dog provides college students with personal protection for disinfection through appropriate interaction design. The Guard Dog interacts in three ways: 1) the feedback light on the Guard Dog's lid, 2) the buttons on the back of the Guard Dog and the knob on the tail, 3) the smartphone app. The process for college students to complete the disinfection of items is very simple. Put the mouse, pen and other items into the Guard Dog, close the lid, press the button on the back, the UV light inside the Guard Dog will light up, and the internal reflective surface can protect all surfaces of the item. When exposed to ultraviolet light, you can know whether the disinfection is carried out by observing the transparent acrylic plate on the side. The ultraviolet lamp can complete the disinfection work in one minute. When disinfecting the keyboard or table surface, just turn the cover of the Guard Dog to irradiate the keyboard and the surface. The surface of the table, because UV light is used , does not generate ozone, and as long as the human body is not exposed to UV rays, there will be no side effects. The other side of the cover of Guard Dog is an LED lamp, which provides lighting. In daily work, Guard Dog is also a table lamp for college students. The light and dark can be adjusted by rotating the knob at the rear of the Guard Dog. The multi-angle adjustment of the cover allows college students to adjust the light source to suitable angle. Guard Dog encourages college students to sanitize their personal smartphones, with built-in wireless charging that also sanitizes smartphones when college students use Guard Dog to charge them.

3.3. IoT and Applications

Guard Dog encourages college students to use smartphone apps and sanitizers for IoT connectivity. When college students use their smartphones on campus, the app will record their movements. When college students return to the office after staying in public places, the cover of Guard Dog will emit a red warning light, reminding college students that they have been in public places and need to do it. Disinfect your belongings and clean your hands to prevent foreign bacteria from contaminating the office environment. The app will record the college student's office hours, remind him to sanitize the mouse and keyboard when the college student leaves, and the app will also record the college student's sedentary time, when the sedentary time is too long, the Guard Dog's lid will emit a gradient light reminder College students leave position for relaxation exercise. Guard Dog's built-in camera sensors monitor changes in the surrounding environment,

record people walking by, and analyze whether the desktop is contaminated with bacteria, and notify the college student through the app, prompting him to disinfect the desktop when he arrives at the office. We also added a social interaction function to the Guard Dog app, so that college students can share their disinfection and protection mood, and the social interaction that college students encourage each other can promote interpersonal interaction and enhance the adaptability of college students [7] .

4. Pilot study

We aim to study the potential of college students to use personal item sterilizers and receive initial feedback from college students on the prototype. We organized a pilot study, which was conducted in an agricultural university in Guangzhou, and we recruited 4 undergraduate college students A , B, C , D (2F , 2M , mean age = 22). All participants (PA , PB , PC , PD) were aware of the study objectives and study settings, and the entire process was recorded with the consent of the participants.

The study was done in a college student's office and on a college campus, where participants felt relaxed and less distracted in a familiar environment, see Figure 3. The research consists of three phases: 1) an initial exploration and introduction of the prototype, 2) the use of the prototype, and 3) an exit interview . We briefly introduced and explained Guard Dog and had participants install the app. Participants then had two hours of free time, after which they would return to the office and have one hour to use the Guard Dog independently. During this 1 hour, we will record participants' interactions with Guard Dog and conduct semi-structured interviews with participants' feedback on Guard Dog in the form of questionnaires .

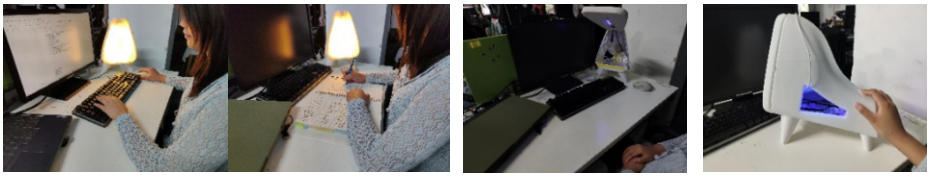

Figure 3. Participants interact with the prototype during the pilot study

5. Preliminary findings

As shown in Table 1 (7-point Likert scale), all participants showed a high willingness to use Guard Dog. When we asked participants how they felt about using Guard Dog, PA said: " I basically don't sanitize my smartphone because it's too much of a hassle to clean my smartphone with alcohol. Bacterial, sanitizing a smartphone with Guard Dog is fast, I pressed the button and waited a minute to complete the sanitization, and I can still observe the progress of the sanitization through the acrylic board." PC said: "I basically do it every day. Sanitize my smartphone before going to bed, Guard Dog's app tells me the importance of always cleaning my smartphone and keyboard, Guard Dog is like my personal bodyguard." P D said: " Guard Dog's desk lamp function is perfect for me, I have The habit of working with a desk lamp, the Guard Dog is my desk lamp when not in use." The participants also gave us some suggestions. Both PB and PD want Guard Dog to detect the number of bacteria on the surface of items. PB said: "My mouse has

always looked clean and the Guard Dog app will tell me the mouse is about to be sanitized, but I wish the Guard Dog app would tell me how dirty my mouse is so I can be more positive Actively using Guard Dog. PC said: "I was pleasantly surprised that Guard Dog can sanitize my keyboard, but keyboard sanitization requires a human effort, and it would be better if Guard Dog could do the sanitization before I got to the office. P A added, "If I'm busy with my work, I might arrive at the office and start my work, so I miss sanitizing the keyboard." Overall, all participants were willing to use the Guard during college life Dog, our findings suggest that Guard Dog is a partner in supporting college students to effectively sanitize personal contact items.

Table 1. Participant Questionnaire Results

Question	P A	P B	P C	P D	Average
Would you like to use Guard Dog in your school? (1: not willing - 7 : willing)	6	7	7	6	6.5
Are you easy to use Guard Dog? (1: Difficult - 7 : Easy)	6	6	6	6	6
Guard Dog useful for IoT with smartphones? (1: Useless - 7 : Helpful)	7	6	7	6	6.5
What do you think of Guard Dogs real -time feedback? (1: Useless - 7 : Helpful)	6	6	7	5	6
With Guard Dog, are you confident against COVID-19 ? (1: not confident - 7 : confident)	7	6	6	6	6.25

6. Limitations and future work

We found certain limitations in our research. First of all, due to the impact of the epidemic, we only conducted research and analysis on the relevant research on the university environment contaminated by bacteria, and did not find experts as representatives of the environmental knowledge of the university contaminated by bacteria. With the help of experts, we may discover other important factors. Secondly, due to the limitation of the epidemic, our research pilot only found 4 participants, among which there were also a lack of college students with anxiety and depression, and we lacked the feedback and suggestions on the use of Guard Dog by college students with anxiety and depression.

The future, we will further improve the system functions and expand the disinfection coverage of Guard Dog. Taking into account the recommendations of the pilot study, we will install more sensor chips, so that Guard Dog can detect the amount of bacteria on the surface of objects and make users feel more realistic. Finally, we will try to recruit more users.

7. Conclusion

In this article, we introduce the Guard Dog, a tabletop sanitizer that helps college students understand bacterially contaminated surfaces in college environments, inviting college students to sanitize personal touch items. The IoT function of Guard Dog encourages college students to actively participate in the disinfection work, and the connection with the personal smartphone can effectively record the individual's movement trajectory and

bring more targeted protection. We believe Guard Dog is playing an active role in stopping the spread of bacteria during the COVID-19 pandemic. We encourage future research into techniques for disinfecting personal contacts of college students.

8. Acknowledgment

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