

Petlify: A prototype of hardware and mobile application, to reduce nomophobia in a controlled and conscious way, in young students or workers

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Abstract

This article first analyzes the growing problem of nomophobia, taking as its main actors a small group of young students or select workers, through the use of surveys, creation of user profiles and empathy map. Subsequently, an alternative solution is proposed to reduce this problem in a conscious and controlled manner in this specific population, being a mobile app prototype as a stimulus through the use of virtual pets, in conjunction with a hardware case that takes the heart rate and counts the times that the device is lifted being these physical symptoms present in nomophobic people, finally a usability evaluation is carried out in order to validate the proposed prototype (UX, UI) taking into account different aspects, from design and navigation to operation and utility.

Keywords

Nomophobia, Phubbing, Mobile Apps, Empathy Map, Usability.

1. Introduction

Engineering is based on finding solutions to social problems and thus allowing a solution or an aid mechanism to facilitate or improve society, but what happens when this generates a new problem? Cellular devices were the solution to the little portability that was had in fixed telephony and the complication of not being able to communicate with a certain person no matter where they are. With the rapid evolution from analog to digital cellular technology, the sophistication of microprocessors and microcontrollers within cellular devices included many other functions such as text messaging, MMS, short-range wireless communications, video games, digital camera, access to the Internet, among others, thus emanating the smartphone as we know it today. The smartphone has officially become the most popular technology in history despite being only a couple of decades old, being the device that has spread the fastest in the world (1). A somewhat expected result, due to what it offers its users, between comfort, entertainment, organization, knowledge in general anywhere, at any time, it has generated numerous new jobs in all professional fields and the list is constantly growing with its new models annuals and updates. That is to say, they have become a connection with the entire world and "an extension of ourselves", with the latter not only has stimulated technology markets worldwide but has also triggered a series of social problems or disorders. of behavior in almost all its users, this last situation, taken advantage of too much by large technology companies, which unethically use the so-called "engagement" to build loyalty and commit their users to their devices, products, or applications. If behavioral disorders are analyzed, due to the excessive use of the smartphone, we must talk about "nomophobia" which can be translated into an addiction that leads in many cases to social isolation,

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since there is only a connection with a virtual world, but what happens if that connection is cut? People begin to present physical and psychological problems such as anxiety, nervousness, tachycardia, obsessive thoughts, headaches and stomach aches, stress resistance and even panic attacks. And all of them are typical of a situation of dependency or addiction. (2) It is because of the aforementioned, that it becomes necessary for companies dedicated to technology and developers in general, to take more account of ethics, creating less invasive strategies, decreasing or completely changing the use of dopamine to generate "engagement" with the user. In this document, this problem and its main actors are analyzed, being these a small group of select people, through the use of surveys, creation of user profiles and empathy map, likewise, a design proposal is exposed to contribute in the solution to this problem and finally the solution is validated by participating users belonging to the target population.

2. Methodology: User Profiles

2.1. Characterization.

Defining the case study in which Nomophobia or digital addiction is a problem that does not seem to stop in the short term, the generation between the years 1990 and 2000 is taken into account, which was the generation that was born in the beginning of the digital revolution and that today makes use of applications and social networks as part of their daily life more easily. In order to reduce this population, being more specific in the study and empathizing with them, we chose a more geographically reduced population, speaking of Colombian university students and graduates residing in the city of Popayán who are between 18 and 25 years old, who do use of mobile devices such as cell phones for a considerable time during the day.

2.2. Identification of user profiles.

In order to identify and empathize with the main actors within the problem and thus carry out the empathy map, with the corresponding user profiles, two procedures were carried out. The first procedure used was a survey in google forms based on the Smartphone Addiction Scale (SAS). The SAS is a measure of 48 items of addiction to smartphones (3), which is made up of 6 subscales:

- Disturbance of daily life.
- Positive anticipation. Retreat.
- Relationship oriented to cyberspace. Excessive use.
- Tolerance.

Items are rated on a 6-point Likert-type scale ranging from "strongly disagree" to "strongly agree". After receiving the virtual survey and giving their informed consent, the participants are asked to complete the aforementioned scales. For our particular case, we made several changes to the SAS, the first of which was about the order of presentation of the scales, which was not random for each participant, this in order to organize sections of questions that have similarities between yes (these sections are not explicit, which makes them not perceptible by the participant), these sections were:

- Satisfaction section: Where the participant indicates their satisfaction in the personal use of smartphones on a daily basis (questions 1 to 6).
- Frustration section: Where the participant indicates their frustrations and problems in the personal use of smartphones on a daily basis (questions 7 to 14).
- Information section: Where the participant indicates slightly more general information in slightly simpler questions, on the personal use of smartphones on a daily basis (questions 15 to 24).

It is organizing the questions in these sections that will make the analysis of the answers a little more orderly when collecting the information from all the participants. Consequently, some questions posed in the SAS were discarded, this due to various reasons, some questions had similar meanings or contexts or clearly the same, so it would only lengthen and make the survey more boring for the participants, in addition to providing repeated or irrelevant data. Some questions, for personal consideration, slightly exaggerate the context under which the inquiry is being made, which, when removed, allows participants to answer a little more honestly and not only negatively due to the extravagance of the

statement of the question. question, which can overwhelm the reader. Finally, questions that do not represent relevant data for the investigation were discarded. Taking all this into account, the questions and instructions in the first whole that were asked to the participants through the link "<https://forms.gle/L5FEUPnXAunk193A7>", were:

2.2.1. Demography

The total number of people surveyed was thirteen, in the survey, there was a demographic section where only the name, sex and occupation of each student were considered as relevant data, in this report, the names will be discarded of the participants due to their consent. As we can see the number of men and women in the very similar participating population, with 53.8% men and 46.2% women, half of all participants are full-time students, 25% study and work at the same time, 8.3% only have a part-time job and 16.7% work full time.

2.3. Instructions:

The Smartphone Addiction Scale , SAS (Modified) Please indicate the degree of satisfaction or the degree to which you agree with each question, using this scale:

- 1 = Strongly disagree.
- 2 = Disagree.
- 3 = Somewhat disagree.
- 4 = Somewhat agree.
- 5 = Agree.
- 6 = Totally agree.

2.4. Satisfaction section:

As previously indicated, in this section the participant indicates her satisfaction with the personal use of smartphones on a daily basis. It consists of six questions:

1. You usually feel calm, pleasant, excited, or comfortable while using your smartphone.
2. You feel safe when using your smartphone.
3. You can usually de-stress when you're on your smartphone.
4. Sometimes there's nothing more fun to do than use your smartphone.
5. Feeling more liberal when using a smartphone.
6. Feel great meeting more people through the use of a smartphone.

2.4.1. Results:

Table 1
Section of satisfaction questions

Satisfaction	1	2	3	4	5	6
Question 1	0	0	0	7,7 %	38,5 %	53,8 %
Question 2	0	0	0	30,8 %	38,5 %	30,8 %
Question 3	0	0	0	46,2 %	23,1 %	30,8 %
Question 4	7,7 %	23,1 %	15,4 %	15,4 %	38,5 %	0
Question 5	0	7,7 %	30,8 %	46,2 %	15,4 %	0
Question 6	0	23,1 %	23,1 %	23,1 %	15,4 %	15,4 %

Broadly speaking, as we can see in Table 1, there is a common feeling of comfort in the use of mobile devices, although opinions are somewhat divided regarding their use in moments of boredom,

the feeling of freedom that they generate and agreeing with strangers who also use mobile devices or social networks, it can be seen that the percentage with a positive trend is also the majority. These results are expected, since they can be observed observationally on a daily basis with the people we know and who meet the characteristics of this target population.

2.5. Frustration section:

As previously indicated, in this section the participant indicates their frustrations and problems in the personal use of smartphones on a daily basis. It consists of eight questions:

7. You have had difficulty concentrating in class, while doing homework, or while working due to the use of your smartphone.
8. You have experienced dizziness or blurred vision due to excessive use of your smartphone.
9. You have felt pain in your wrists or neck when using your smartphone.
10. You have been feeling tired and not getting enough sleep due to excessive use of your smartphone.
11. I couldn't stand not having a smartphone.
12. I have felt impatient and irritable when I am not holding my smartphone.
13. I have kept my smartphone in mind even when I am not using it.
14. I get irritated when I'm disturbed while using my smartphone.

2.5.1. Results:

Table 2
Frustration questions section

Satisfaction	1	2	3	4	5	6
Question 7	15,4 %	7,7 %	7,7 %	15,4 %	23 %	30,8 %
Question 8	38,1 %	0	15,4 %	7,7 %	15,4 %	23 %
Question 9	7,7 %	30,8 %	7,7 %	15,4 %	30,8 %	7,7 %
Question 10	7,7 %	0	7,7 %	23 %	15,4 %	46,2 %
Question 11	23 %	0	30,8 %	38,5 %	0	23 %
Question 12	7,7 %	38,5 %	15,4 %	23 %	15,4 %	0
Question 13	15,4 %	23 %	30,8 %	7,7 %	0	23 %
Question 14	0	23,1 %	23,1 %	23,1 %	15,4 %	15,4 %

As we can see in table 2, there is a positive trend towards the excessive use of smartphones, generating concentration problems, physical problems and frustrations in its users, for this the percentages that represent this positive trend will be grouped and thus more easily analyze the perceptions of the participants. We can analyze all of this in more detail through the signs that health professionals look for when diagnosing substance abuse. These signs are very similar to the six signs of smartphone addiction, which include: salience, euphoria, tolerance, withdrawal symptoms, conflict and relapse (4). Looking at each question in this section, we can see that 69.3% have had difficulty concentrating while performing productivity tasks in their professional field, 61.6% would not bear not having a smartphone, 53.9% have ever felt pain in the wrists or neck when using their smartphone, 84.6% have felt tired and did not sleep enough due to excessive use of their smartphone and finally, 48.8% have experienced dizziness or vision blurred due to excessive use of your smartphone. All these items, to a greater or lesser extent, have been related to "Conflict" which indicates that smartphones have caused problems in daily life. 53.9% have felt impatient and irritable when they are not holding their smartphone, just a 30.8% have had their smartphone on their mind even when they are not using it and only 30.8% get irritated when they are disturbed while using their smartphone, demonstrating a lower presence of "withdrawal symptoms", where people feel panic when not they can find your phone.

2.6. Information section:

As previously indicated, in this section the participant indicates slightly more general information in slightly simpler questions, on the personal use of smartphones on a daily basis. It consists of ten questions:

15. I have taken my smartphone to the bathroom even when I am in a hurry to get there.
16. I constantly check my smartphone so as not to miss conversations between other people on Twitter or Facebook.
17. I often check SNS (social networking service) sites like Twitter or Facebook right after waking up.
18. I prefer to search from my smartphone to ask other people.
19. My fully charged battery does not last a full day.
20. I usually use my smartphone longer than I intend to.
21. I have felt the need to use my smartphone again right after I stopped using it.
22. I have tried over and over again to shorten the usage time of my smartphone, but I fail every time.
23. I have always thought that I should shorten the time I use my smartphone.
24. People around me tell me that I use my smartphone too much.

2.6.1. Results:

Table 3

Section of information questions

Satisfaction	1	2	3	4	5	6
Question 15	0	0	7,7 %	30,8 %	23 %	38,1 %
Question 16	30,8 %	0	7,7 %	30,8 %	15,4 %	15,4 %
Question 17	23 %	0	23 %	7,7 %	38,1 %	23 %
Question 18	0	15,4 %	0	46,2 %	15,4 %	30,8 %
Question 19	15,4 %	23 %	0	23 %	23 %	30,8 %
Question 20	0	0	15,4 %	15,4 %	46,2 %	30,8 %
Question 21	0	15,4 %	7,7 %	38,1 %	38,1 %	0
Question 22	0	23 %	0	30,8 %	30,8 %	15,4 %
Question 23	7,7 %	15,4 %	7,7 %	7,7 %	38,1 %	23 %
Question 24	7,7 %	30,8 %	23,1 %	15,4 %	7,7 %	15,4 %

As we can see in Table 3, there is a similar behavior to the previous sections, where some signs of cell phone addiction are confirmed again, 92.3% of the participating people have taken their smartphone to the bathroom even when they have it. in a hurry to get there, 61.6% have constantly checked their smartphones so as not to miss conversations between other people on Twitter or Facebook and 69.3% usually consult SNS (social networking service) sites such as Twitter or Facebook just after waking up, which indicates that it is linked to the signs of "prominence", that is, when smartphones are considered or held as a constant companion, and in turn, signs of "Euphoria", where the smartphone is used numerous times when it shouldn't, or it is preferred to spend time with the smartphone than with loved ones or during a meeting with them. Finally, 92.4% prefer to search from their smartphone to ask other people, 61.6% do not have a fully charged battery last a whole day, 84.7% of those surveyed usually use their smartphone more time than intended, 77% have felt the need to use their smartphone again right after stopping using it, 77% have tried again and again to shorten the time I use my smartphone, but have failed every time , 63.9% think that I should shorten the time I use my smartphone and finally, only 38.5% have been mentioned that they use their smartphone too much. This is largely consistent with the other signs of cell phone addiction, "tolerance" where the person believes that you are using your phone more and more, and "relapse", where people have ever tried to stop or reduce use. from your smartphone but have failed.



Figure 3: Empathy map of user profile 3.

4. Design Proposal

One of the most important aspects that we can rescue from the surveys and interviews orchestrated in the previous report, is the perspective of the participants in favor of the use of technology or mobile devices, these devices are already part of everyday life, of their day. a day. Therefore, it is a bit more complicated to propose a solution based on the eradication or non-use of the devices, but rather a more adequate use or an alternative that allows “softening” the impact of reducing their use. After all, as one of the current tech giants Elon Musk mentions in one of his interviews, “It’s about how much smarter you are with a phone or a computer than without it, you’re actually much smarter (when you know it). have), you know you can answer any question, if you’re connected to the Internet practically instantly. Any calculation your phone does in its memory is essentially perfect, it can seamlessly remember (save) videos, photos, and it does everything perfectly. That is that your phone is already an extension of you, you are already a cyborg.”(5). Bearing this concept in mind, the objective of our design proposal is as such to create a solution based on hardware and software, which facilitates the transition from an excessive use of mobile devices to a reduced, conscious and controlled one, by of the previously defined target population (Young Payanese university students between the ages of 18 and 25). Thus also achieving to a great extent reduce the so-called “pain points”, that is, persistent or recurring problems that can occur during the interaction and can bother, annoy and interfere negatively with users. (6). To achieve this, we will focus on proposing a distraction strategy and a controlled focus on activities that are productive for the user, from working, doing work or exercising. As in any therapy, the use of diaries is essential, however, in this case it will not be the users who record their data, the software itself will show them records of their daily use of the mobile phone, thus increasing the the person's ability to concentrate on their behaviors, making them aware of how much time they spend using the telephone, for what reasons they do so, and how they achieve their self-imposed goals. Finally, it is pertinent to describe and exemplify the proposed solution in more detail, in the first version shown below the operation of the device is described in detail, it will show a prototype sketch based on mockups and the early phase design of the device. hardware to implement.

4.1. Operation and main concept of the solution idea

For our solution idea, a system with two main components is proposed, one in hardware and the other in software. In simple words, the software component consists of an organization and productivity application, which acts accordingly and in conjunction with the hardware component, which is a cell phone case with the ability to take the heart rate of the person holding the cell phone. , as well as register the times that it takes it and its speed in a certain time by means of an accelerometer. In the mobile application, a main interface will be presented, which will work to view statistics and as a glider. Finally, a "scanning" mode (productivity mode), which contains the main functionality of the system.

4.2. Prototype

Once the operation and main concept of the solution idea has been explained in more detail, it is pertinent to show a prototype of both the hardware and the software to help us understand a little better the operation of the system.

4.2.1 Software

The software clearly consists of the mobile application, therefore, this prototype consists of conceptual mockups of the interfaces.

4.2.2 Hardware

The components that are part of the hardware part of the design are, first of all, the cell phone lining made of silicone material, however, it seeks to have a variety according to the tastes of the user in order to have greater aesthetics for the owner of the device. Continuing with the electronic characteristics, there are 4 components with which the measurement of the heart pulse is carried out in the first place by means of the electrodes located on the lining in the direction of the location where the hands are placed to interact with the device as shown. There are 4 electrodes to use which are connected to the Arduino Lilypad and can be seen as four white circles with a green ribbon in the center; The following device is the Hc-05 Arduino Bluetooth Module with which the link is made with the cell phone and the application previously described in the software, finally there is the Arduino lilypad with which the electrodes and the Bluetooth module are interconnected. and in turn the type c charging port with which the lining is loaded, thus allowing its use and making the connection of the cell phone with the lining.

Components

The components necessary for the development of the project are listed in Table 1, divided by hardware components, necessary for the creation of the heart rate reader sleeve, and software, necessary for the development of the mobile application and all its functionalities.

Table 4

Component required for the system.

Software	Hardware
Development Framework like Flutter	pc
Database licenses	Arduino LilyPad
Hosting and domain services	Port C
An apple developer license to be able to upload the application to the AppStore	Hc-05 Arduino Bluetooth Module
An android developer license to be able to upload the application to the PlayStore	heart rate sensors

5. Usability Assessment

Identification of funding sources and other support, and thanks to individuals and groups that assisted in the research and the preparation of the work should be included in an acknowledgment section, which is placed just before the reference section in your document.

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5.1. Assessment Description

Usability Scale System, whose main characteristic is to consolidate and synthesize user responses in a fast, accurate and reliable way compared to other usability evaluations. The system consists of ten questions, a 5 point scoring system which ranges from strongly agree to strongly disagree, and a quick scoring algorithm which is on a scale of 0 to 100, in which if the overall score it is between 68 and 70.5 which means that it is good, close to excellent. The questions to determine are the following:

1. I think I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. I find the system quite easy to use.
4. I think that I would need the support of a technician to be able to use the system.
5. I think that the different functions of the system are very well integrated.
6. I think there was too much inconsistency in the system.
7. I imagine that most people would learn to use the system quickly.
8. I felt somewhat uncomfortable using this system.
9. I felt very safe using this system.
10. I need to learn many other things before I can use the system correctly.

Score and calculation of the usability scale of the system Taking each of the evaluation questions into account, the following steps are carried out:

1. Step 1: Convert the scale to numbers
 - 1 point: Totally disagree.
 - 2 points: I disagree.
 - 3 points: Neutral.
 - 4 points: Agree.
 - 5 points: Totally agree.
2. Step 2: Make the corresponding count
 - For odd questions, 5 is subtracted from the sum obtained from the points.
 - For even questions, 25 is subtracted from the sum obtained from the points.
 - The total in percentage is given as:

$$\text{Total} = (\text{impares} + \text{pares}) * 0,25 \quad (1)$$

If the percentage is less than 50% it is inefficient in terms of usability.

5.2. Findings

The survey was carried out through a google form <https://forms.gle/HtZCASC1MdDkoE5x6>, where a response from ten individuals was obtained where the following results can be observed for each of the questions posed by the usability evaluation.

As can be seen, the response given by the majority of users is in total disagreement about whether prior knowledge must be obtained before using the system correctly; A total value of 14 points is obtained from this question.

In this way it is obtained in total points:

- The result given in the odd questions is:

$$\text{impares} = (25 + 37 + 35 + 34 + 34) - 5 = 160\text{puntos} \quad (2)$$

- The result given in the even questions is:

$$\text{pares} = (20 + 11 + 12 + 9 + 14) - 25 = 41\text{puntos} \quad (3)$$

- The total in percentage is given as:

$$Total = (160 + 41) * 0,25 = 50,25 \% \quad (4)$$

Therefore, it is defined that the application made is defined as an efficient state and accepted by the individuals who tested it.

6. Conclusions

- The empathy map makes it possible to significantly reduce the level of uncertainty for the introduction and development of products in the market; Therefore, it is clear that the need as a guide for creativity and the creative and innovative process of every developer must be immersed in the deep knowledge of understanding consumers, putting themselves in the client's place in their minds and identifying opportunities. , as well as finding the best strategy to optimize resources, knowledge and time and create the product that best suits the needs of the client and makes them happy.
- Human perspectives are ambiguous and in many cases it becomes so cloudy that people do not usually understand that there is a real problem about the addiction that is being applied from the youngest to the elderly who want to adapt to the addiction. new technology or in the same way they are already addicted to older technologies such as the television.
- The excessive use of mobile devices has triggered a series of social problems or behavioral disorders in society. This situation is taken advantage of by large technology companies, which unethically use the so-called "engagement" to build loyalty and commit their users to their devices, products or applications.
- One of the most important perspectives of the target population is their position in favor of the use of technology or mobile devices, these devices are already part of daily life, of their day to day, despite presenting problems to control the times of their use.
- With the proposed system, it seeks to create a friendlier transition from the excessive use of the mobile device, to the controlled and conscious use of it, through strategies that help the user to find out about their problem and at the same time to solve it in an efficient way. more didactic with the "virtual pet" and more rigid with the sensors that belong to the cover.

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