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Research on the Design of Arduino-based Interactivedevice for College Students' Emotional Healingdepartment Experience

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Abstract: ***This study explores the design strategy of the emotional healing experience interaction device for the emotional health problems of contemporary college students. With the help of common technical means in the field of emotional interaction research, utilizing the relevant research methods of interaction design, based on the Arduino platform, the design of the healing experience interactive device is studied from the dimensions of software and hardware, combining the visual, auditory, tactile and other channels of cross- feedback, and clarifying the experience design strategy of the emotional healing experience interactive device and the process of shaping a positive psychology, and finally displaying physical Finally, the physical product is demonstrated and the test feedback of actual experience is obtained[1]. The study will help to understand the emotional psychology and interactive needs of college users in time, and try to guide the positive development of their emotional state.***

Keywords: Healing experience design, Interactive installations, College students' emotional health, Arduino platforms**.**

1. Introduction

According to China National Mental Health Development Report (2019-2020), youth aged 18 to 34 are the most anxious group among adults, and the prevalence of depression among college students in China is between 15% and 40%, which is significantly higher than that of the general population of 5% to 6%, and the prevalence of depression among college students in China in the past 10 years is between 8.00% and 74.00%, and has shown an increasing trend in the past few years, and their emotional The current situation of their emotional health is not optimistic.

However, at present, most of the interventions for college students' emotional health are based on online APPs and offline psychological counseling, and the functional modes include popularization of science, chatting, counseling, stress reduction, audio, etc., which are all passive modes, and there is a relative lack of healing modes that can arouse college students' spontaneous positive emotions through positive feedback interactive experiences [1]. Therefore, this paper proposes an Arduino-based interactive device design for college students' emotional healing experience, hoping to try to prevent and channel the negative emotional problems caused by various factors by adopting a positive emotional healing interactive device.

2. Overall Design of the Interaction Device

2.1 Emotional Needs

As a highly educated group in China, the emotional health of college students, who account for a relatively large proportion of the total number of students in China [2], is crucial to the development of individuals and the future of the motherland. Based on the current social situation, it is worthwhile to pay attention to the emotional experience of college students, so as to promptly relieve and regulate their depression and mania caused by academic pressure, future workplace pressure and interpersonal relationship pressure, which is a worthy direction for research in the field of interaction design.

2.2 Healing Experience

Healing design belongs to the category of healing culture and is one of the application fields of healing culture [3]. Healing experience device design takes the device as a carrier and the process of using it as a way of healing, in the process of using it, through mobilizing the user's emotional, psychological and cognitive resources, the user obtains positive experiences such as a sense of pleasure, satisfaction and achievement, so as to give him solace and satisfaction, enhance the individual's subjective sense of well-being, and heal the user's mind [4].

This new generation of user-centered, user-instinct-based "meaningful interaction" is more in line with the logic of people's communication and behavior, combining "temperature" from the level of emotional experience with emotional interaction [5]. The emotional "healing" device based on emotional interaction technology [6] can enhance information interaction and emotional communication in a more intimate way, soothe the user's emotions, and make the user experience more delicate emotions, and at the same time, the visual, tactile, auditory and other multi-experience modes experienced in the process of using the device can enhance emotional At the same time, the visual, tactile, auditory and other multiple experiences experienced in the process of using the device can enhance the effectiveness of emotions, thus alleviating the bad emotions of college students and realizing the goal of comprehensively improving the emotional health of college students [7].

2.3 Program Design

The process of "healing" is divided into two levels: firstly, the appearance characteristics of the device will affect the user's intuitive feeling after the first contact with the device; secondly, the interaction characteristics of the device will affect the user's emotional experience in the process of using

the device [8], and at the same time, this interactive experience will affect the user's memory and favorability of the device in the long run, and affect the user's emotional state and psychological state in the long-term use process. Secondly, the interaction characteristics of the device will affect the user's emotional experience in the process of using the device, and this interaction experience will affect the user's memory and favorable impression of the device in a longer period of time, and affect the user's emotional and psychological state in the process of long-term use. Therefore, this study will analyze and research the design of the healing experience device based on the user's whole-process experience of the device, from the two aspects of appearance features and interactive experience, as well as the three elements of natural emotional experience, immersive interactive experience, and continuous interactive experience.

2.3.1 Appearance features: gracious styling

The appearance of the healing device is the first impression presented to the user, allowing the user to evoke an emotional experience and feel the power of the design to heal the soul at first sight or touch. For physical devices, to create a natural emotional experience, it is necessary to combine color emotion and natural imagery in the appearance design: in terms of color, use low-saturated warm colors or white. Let the user feel close, relaxed and warm, rather than cold, nervous or vigilant; in the shape, the use of natural forms and geometric forms, with natural imagery modeling devices can quickly evoke the user's emotions. Whether imitating natural flowers, plants, trees or animals, it can bring users emotional comfort from nature. Rounded corners are used in the details as much as possible to show the simplicity and roundness of the device, rather than the chaos and sharpness, while in terms of materials, skin-friendly, soft and gentle materials are mainly used to highlight the natural and friendly "healing feeling".

2.3.2 Interactive experience: self-stimulation

Feedback design is a very important part of the device interaction process. When a user interacts with a device, the operational status of the device needs to be communicated to the user through feedback. Good feedback design allows users to clearly perceive that their actions are being received and operated, and thus feel satisfied and accomplished. By means of design, we can help users enter into a state of mindstream, immersed in the process of using the device, and gain a sense of meaning after using it for a period of time: we can design the immersive "input" for the process of using the device, and show the "meaning" of the immersive input for the result of the device's use. The "significance" of the immersion is shown in the results of the use of the device. skin-friendly, soft and gentle materials are mainly used to highlight the natural and friendly "healing feeling".

In the design of healing device experience, multi-sensory feedback can be used to create an immersive interactive experience, so that the device can have a clearer "dialog" with the user, clearly convey the device's operational information, and let the user feel the meaning of the interactive behavior [9]. Combined with multi-sensory interaction and associative design, the device generates a sense of pleasure and satisfaction in the process of initial or repeated use, and achieves a continuous interactive experience, providing users with an emotional experience in the short term, and enhancing their positive emotions in the long term.

3. Hardware Design

3.1 Form Design

After the modeling selection, we finally decided to use the soft image of jellyfish, which comes with a sense of quiet atmosphere, as the basic appearance of the device, and chose white, skin-friendly and soft fabric material as the surface of the device, which makes the device look friendly, comfortable and warm to touch, and constitutes an aesthetic interactive scene experience.

3.2 Device Design

The development board used in this device is Arduino NANO, which also needs to be paired with hardware devices such as HC-SR04 ultrasonic rangefinder module, DF9-40 flexible thin-film pressure sensor, RP-C5LT30-LF5 thin-film pressure sensor, WS2812B Dazzling Color Light Strip, DFPlayer Mini MP3 module, and a small speaker.

Using the FNIRSI-1013D digital oscilloscope to sample the operating frequency of each component in real time (Figure 1), the measured waveform images and data are displayed. The monitoring results show that the sum of the scanning time factors of all components is not greater than 200ms (as shown in Table 1), so in the design of the entire device system to 1000ms as the time interval of the interactive action of a sampling cycle.

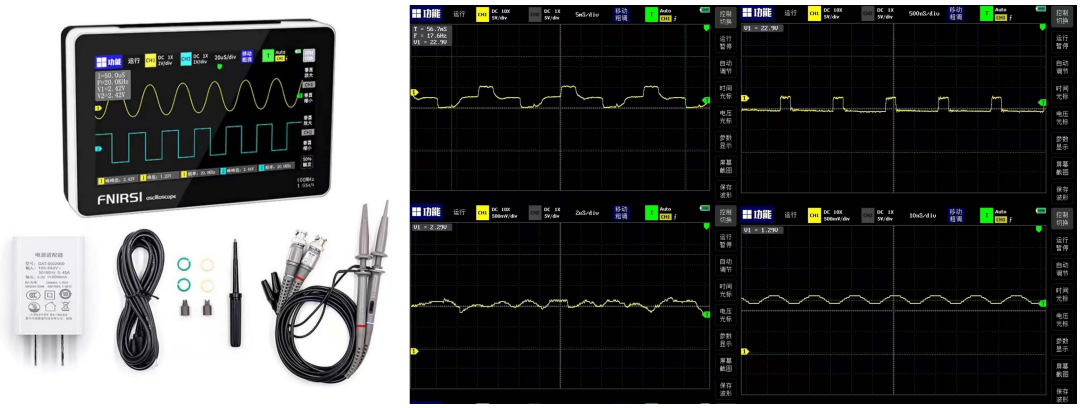

Figure 1: FNIRSI-1013D digital oscilloscope and main

Table 1: Scan time factors

Component Name	DIV
DF9-40 Pressure Sensor	5ms
RP-C5LT30LF5 Pressure Sensor	2μs
HC-SR04 Ultrasonic Sensor Module	500ns
DF Player Mini MP3 Module	10ns
XH2.54 Small Horn	100ms

3.2.1 Main controller

The Arduino NANO development board was chosen as the main controller considering the portability and late packaging used for the hardware part of the device.

3.2.2 Trigger mechanisms

The working principle of the thin film pressure sensor in Arduino is to detect the pressure signal by measuring the resistance change of the thin film sensor, this device uses the DF9-40 flexible thin film pressure sensor with the range of 0 to 500g and the RP-C5LT30-LF5 thin film pressure sensor with the range of 5 to 600g to feel the user's touching interactions and triggering interactive behaviors of the device, respectively.

The Ultrasonic sensor module automatically sends eight 40khz square wave, automatically detect whether there is a signal to return, there is a signal to return, through the IO output a high level, high level duration is the ultrasonic from the time of launching to the return of the time, so as to sense the distance. This device uses HC-SR04 ultrasonic distance measuring module to sense the distance of the user's proximity to the device as a trigger signal.

Figure 2: Device sensor

3.2.3 Feedback mechanisms

Light effect: the device selected 5V-WS2812B dazzling color light strip to achieve the lighting effect, with the light strip of different colors, brightness, flashing action, gradient mode of the dazzling color lighting changes as a visual interaction feedback on the reception of different forms of sensor-triggered interaction. Sound: The device utilizes a DFPlayer MiniMP3 module directly connected to the speakers, which is used to play the appropriate auditory feedback after the user triggers the interaction.

4. Software Design

4.1 Arduino Software Design Platform

Arduino is a family of microcontrollers consisting of an open source hardware platform and a software development environment for writing programs [10]. Based on the C/C++ programming language and cross-platform compilation, Arduino allows you to create programs that interact with the physical world and develop program modules that can sense and respond to sound, position, touch, light, and heat. Due to its open source, cross-platform and cost- effective nature, the Arduino is now widely used in musical instruments, light sculptures, games, and interactive installations. Using the Integrated Development Environment (IDE) on the Arduino, programs can be created, code can be written and edited in the IDE, sent to the Arduino motherboard via upload, and the board executes the written code. Since the development board can only be controlled in response to electrical signals, it needs to be connected to the trigger- feedback mechanism element of the hardware part of the device to enable interaction with the real world.

4.2 Arduino Main Programming

When designing the interaction mode of the emotional healing system experience, the device firstly designs the interaction mode that users are most accustomed to around the core function, so that users can start using the device without any obstacles. Trigger actions of the device: 1) Proximity trigger. The user is close to the device to trigger the light feedback. 2) Touch action trigger. The user triggers the feedback by touching the main position of the device. As the device is set up as a soft jellyfish, and the soft whisker-like tentacles and the light effect changes during the process of moving towards the device have a strong behavioral guidance effect on the user, so approaching and touching become the user's first reaction to trigger the device without any obstacles. Secondly, a multi-sensory channel of interaction is designed by combining the senses of vision, touch and hearing, in which design techniques such as association, memory and narrative are used to evoke the interaction between the user and the device at the cognitive level. The feedback action of the device: 1) After receiving the distance trigger, when the user stands in the distance, the jellyfish will emit a slow and weak light source, and as the user gradually approaches, the frequency and brightness of the jellyfish's light flashes will gradually increase, which is heart-warming and makes the interaction of the human mind undulating and touching. 2) After receiving the trigger of the touch action, it will produce the gradient flashing effect of the jellyfish's hand, and meanwhile, the speaker plays the deep sea soothing sound effect. 3) sound effect. Based on the frequency, efficiency and scenarios of the user's interaction with the device, we design a multi-dimensional, clear and unambiguous feedback, i.e., when the user interacts with the jellyfish interactive device, approaching the device or stroking the device, the device produces a progressive visual effect and an ironic auditory

feedback, so that the user can use the device fluently, trigger the device positively, and then receive the pleasure of the unambiguous feedback rather than feeling confused.

5. Testing and Feedback

5.1 Physical Installations

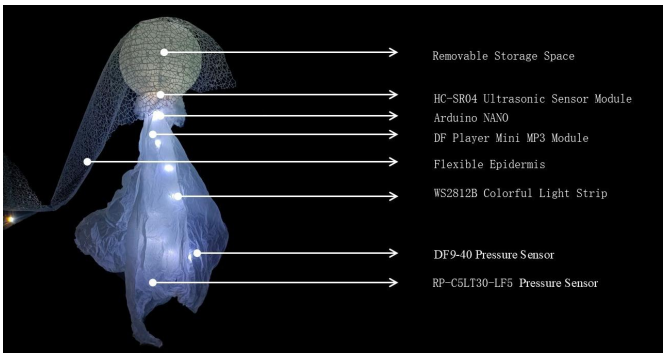

Figure 3: Physical diagram

5.2 Experience Test

In order to verify that the interaction of the emotional healing experience device has a certain degree of healing, this study adopts a combination of watching the effect demonstration video, actually experiencing the interaction device and the questionnaire to measure the possibility of healing, so that the evaluation subjects first watch the effect demonstration video or actually experience the interaction device, and then answer the questionnaire. The target population was mainly undergraduate students, and the questionnaires were distributed online and offline to collect samples. A total of 200 questionnaires were distributed and 194 samples were collected.

The content of the questionnaire, in addition to the basic information, also includes questions about the subject's mood changes, the subject's attraction to the device, and the comfort level of the device.

In the results of the questionnaire, it can be seen that the majority of people have pressure in their lives, and among the 194 samples, 11.92% of the people think that the pressure is too much, and the pressure makes them tired; 26.42% of them think that the pressure in their lives exists, and although it is very difficult, they can cope with it; the rest of the people think that there is no pressure in their lives, or that the pressure exists but it does not have much effect on their lives. In the questionnaire data, it can be found that the attraction of the device's light and sound is relatively strong, and the people who are attracted to it occupy 94.83% of the sample size, which basically verifies the interactivity of the device and the certainty of the interaction effect of the device among the college student population.

Five sets of data can be analyzed to obtain that through the interactive device emotional healing experience, people's mood will become kind and relaxed from the general calm, producing an interesting and comfortable mental activities, turning the original negative emotions into positive emotions, realizing relaxation and decompression, and increasing the sense of well- being. Verify that this device has the possibility of emotional healing among the college student user population.

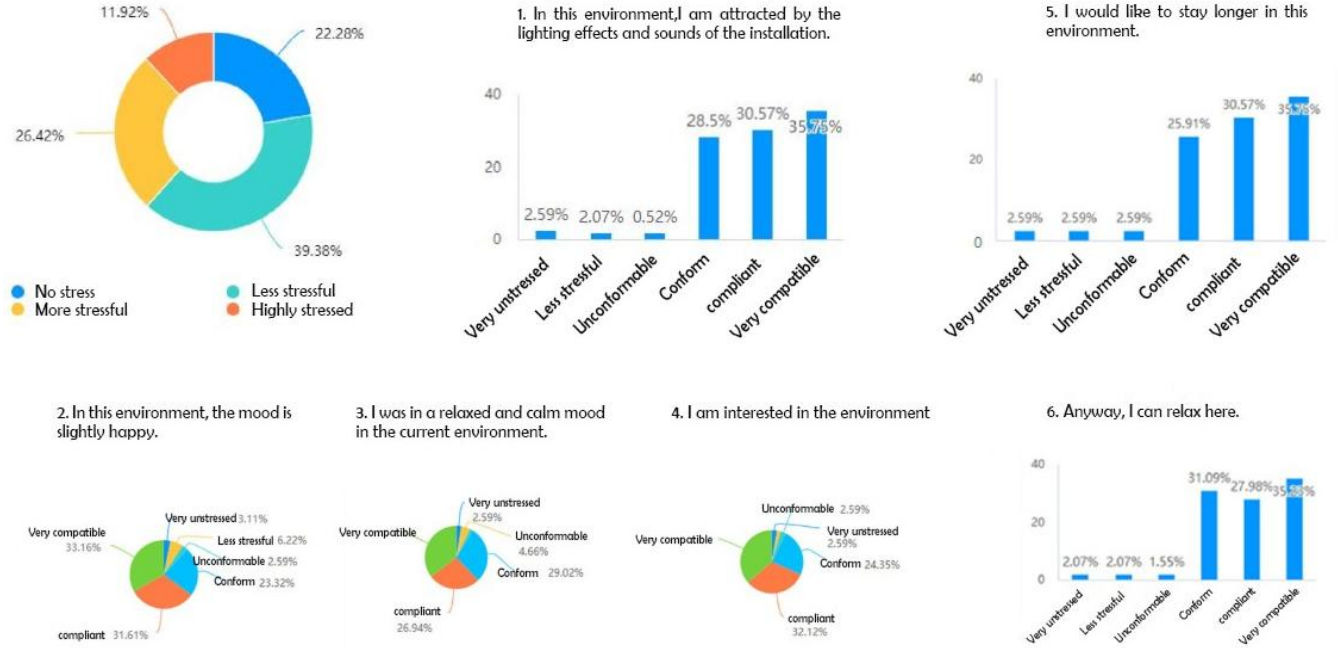

Figure 4: Experimental statistical results

5.3 Practical Feedback

In the whole cycle of the actual interactive device emotional healing experience, in the early stage of the experience, the soft and natural appearance of the jellyfish and the visual, auditory, and tactile rewards attract college users to approach and touch the device to generate interactions, which stimulates emotional experiences and attracts them to use the device and generate action goals; in the middle stage of the experience, random behaviors such as obtaining different lighting and sound effects by touching the device, throwing emotional writing notes to the jellyfish head, and other immersive experiences promote the continuity of college users' behaviors. In the middle stage of the experience, the random behavior of getting different lights and sound effects by stroking the device, throwing emotional writing notes to

the head of the jellyfish, and other immersive experiences promote the continuity of the behavior of college students; in the late stage of the experience, the transparent and individually removable head of the jellyfish visualizes the results of the users' long-term accumulation of behaviors, which inspires the users' willingness to experience the device and their behaviors for the next time, and the lyricism and changes in emotions over a period of time make college students sense the value of their own behaviors, so as to continuously gain a sense of achievement and happiness, and gradually The negative emotions are gradually dissolved, helping college students to shape a positive state of life and form a positive personality.

6. Conclusion

Based on the social background, with the help of common technical means in the field of emotional interaction research, this study utilizes the relevant research methods of interaction design, starting from the emotional health problems of contemporary college students, clarifies the experience design strategy and positive psychology shaping process of the emotional healing department experience interactive device, promptly understands the user's emotional psychology and interaction needs, and finds a more accurate and reliable design opportunity point to form a more friendly, natural health device and benign human-computer interaction experience, enhance the application carrier and core value of emotions, and guide the positive development of users' emotional state.

The study proposes specific design strategies from the software and hardware dimensions of the device design for the three phases of stimulating positive emotions at the initial stage of device use, maintaining positive experiences in the middle stage, and shaping positive perceptions in the long term, and shows the physical results of the device and the actual experience feedback from the questionnaire statistics. In the follow-up research, this topic will be combined with the target population to conduct more specific and in-depth research, to broaden the scope of practical application, to enrich the way of experience assessment, and to form more systematic research results.

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