Project Courier: Heartbeat Related Messaging

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1. INTRODUCTION

The goal of this project was to evaluate whether the use of a novel human-computer interface method in the form of a heartbeat sensor would be both viable and acceptable to a user when accessing a simple internet chat interface. Additionally, the usage of emojis was also observed. A future project based on this research would be creating an application that could automatically send emoji replies based on a user's heartbeat and the content of the current messages being discussed.

2. PRODUCT DESCRIPTION

Our product is a simple chatroom interface that allows multiple users to enter the room using usernames they have created. In the chat, they can send normal text messages, as well was send emoji messages to other users. The entire time, a small Velcro strap is attached to the user's right index finger. The strap contains a pulse sensor that is continually monitoring the user's heartbeat and displaying it on a separate screen.

Upon first entering the website, the user is presented with a simple login screen that asks them to create a username (see Figure 1). Any username is acceptable, and the user can log in either by clicking on the button below the text box or by hitting the enter key on their keyboard. After they have created the username, they enter the chatroom (see Figure 2). Along the bottom of the screen is a textbox where a user can enter text, and they can send it either by clicking on a 'send' button to the right of the textbox, or by hitting the enter key on their keyboard. Above the textbox is a box which lists all the chats, with new chats appearing under old ones, and the oldest ones disappearing above the top of the screen. Each chat entry shows the username of the person who sent the chat on top, with the contents of the chat directly below that. When this occurs, a scroll bar appears on the right-hand side of the box, allowing the user to scroll and see the entire chat history. Emojis can be sent using the format ":emoji name:", for example :smile: or :eggplant:, then hitting the enter key or pressing the send button as per usual. Emojis can be either paired with normal text or sent on their own.

The pulse sensor consisted of an off the shelf hobbyist pulse sensor purchased from sparkfun.com and attached to an Arduino microcontroller (see Figure 4). The sensor itself emits a small green light, the intensity of which is then read in order to gather data about the user's pulse. This data is displayed on a separate screen while the user is interacting with the chat application (see Figure 3). A future iteration of this project would not display the pulse data, but merely measured in the background in order to automate emoji sending.

The features that were specifically evaluated were the login interface, the chat interface, the emojis, as well as the pulse sensor.

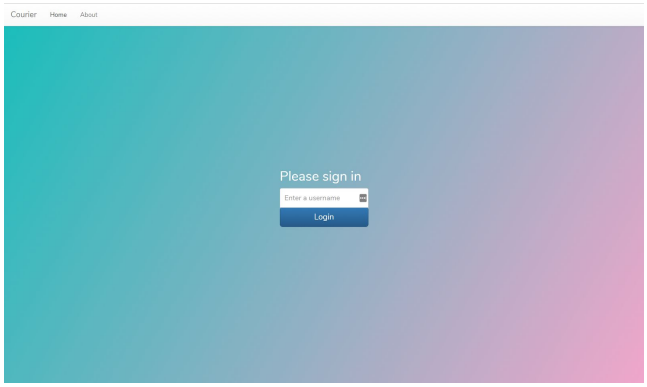

Figure 1. The initial login screen presented to the user

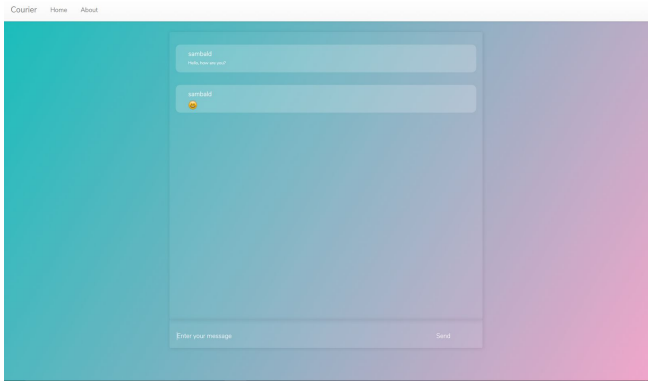

Figure 2. An example of the chat interface with smile emoji

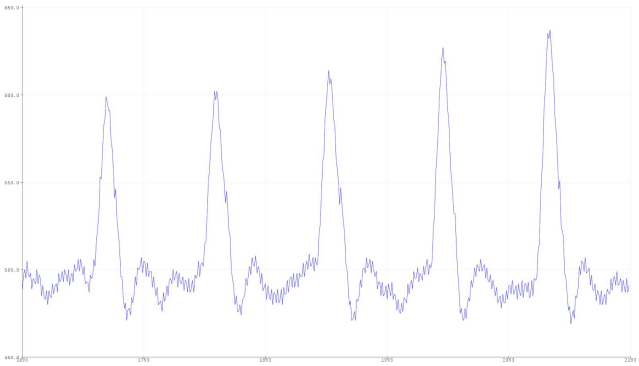

Figure 3. A view of typical heart beat sensor data

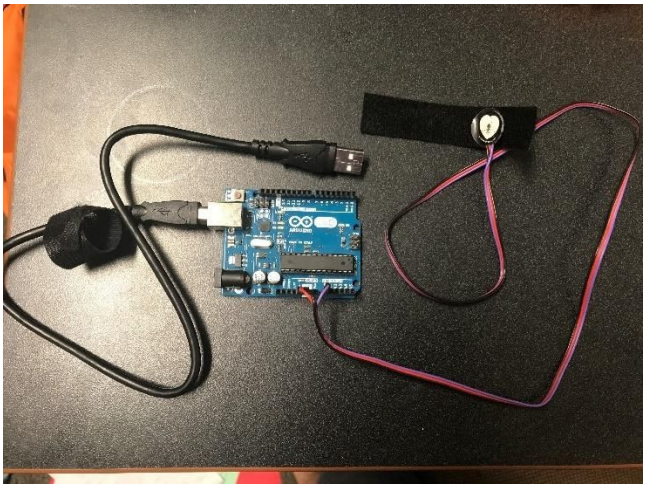

Figure 4. Our pulse sensor setup

3. EVALUATION

The main research questions we wished to answer were:
1) Can the user successfully navigate our login interface?
2) Can the user use as well as enjoy our chat interface?
3) Does the user enjoy our current method of emoji implementation?
4) Will the user be open to a pulse sensor monitoring their heartbeat and potentially automating replies to messages?

Our research hypothesis was:
1) The user will experience changes in heartrate that are noticeable enough while chatting that could be used to automate replies with emojis to various messages.

4. Procedure

The way we conducted this study was as follows: A subject approached our two-monitor testing station. They were first given an informed consent form to read and sign. After completing this, the subject had the pulse sensor placed on their right index finger using a small Velcro strap, and they were told to use both hands normally, as that would not hinder the sensor data at all. The pulse sensor (https://www.sparkfun.com/products/11574) was attached to an Arduino Uno (https://www.sparkfun.com/products/11021), which was in turn attached to a Microsoft Surface Pro 3. On a Macbook Pro that was facing the user, Google Chrome was open to the login interface was displayed, and on the Surface the pulse data was displayed, in view of both the testers as well as the subject. In order to use view this, code provided by the pulse sensor manufacturer was being run via Arduino software on the Surface. The subject was then told to login to the interface. After completing that task, they were instructed to send some simple chats. Two other testers were also in the chat room on laptops situated out of sight of the subject, and they conversed with the subject during the study through the chat interface, with the goal being to create a heartrate change. The user was offered help sending the simple chats if need be, and given full instructions in how to send emojis, as that was not immediately intuitive to the user. During this entire time, observational notes were being taken on ease of login, comments on the heartrate sensor, ease of chat interface usage, ease of emoji usage, and heartrate data. After several minutes of using the chat interface, the chat was ended and the subject was asked a series of evaluation questions from a tester, which will be discussed in our data collection and analysis section. After this, the subject was sent to another, separate computer to manually fill out a questionnaire based on their experience using the program. During the duration of the study, if another participant was waiting to partake in the study, they were distracted by another tester so as not to gain prior knowledge to how the interface functioned.

5. Data Collection

The three main data collection methods used were observational notes, evaluation interview, and questionnaire. All data was kept anonymous throughout. The observational notes were written down by the main tester at the two-monitor station, as the other testers were either engaged in sending messages or in distracting the next subject. The evaluation interview was also conducted by the tester at the two-monitor station, and for ease of data collection and analysis was done via a Google Form, with the evaluator being the one filling out the form, not the subject. The questionnaire was also conducted via a Google Form, but in this case the subject was the one who filled out the form. Both were administered after the user had completed testing of the interface. The raw data is shown below in Figures 6-11.

The evaluation interview questions are as follows:
1) How much did you enjoy using the application as a whole? (this is on a Likert scale of 1 to 10, with a 1 being the subject hated it and a 10 being the subject loved it)
2) Do you think the heartbeat sensor was cool? (this is on a Likert scale of 1 to 10, with a 1 being the subject thought it was super lame and a 10 being the subject thought it was really cool)
3) Would you be a fan of your heartbeat being used to automatically send messages based on your mood? (this is on a Likert scale of 1 to 10, with a 1 being the subject thought it was creepy and would not use it and a 10 being the subject would use it all of the time)
4) Would you use this application again with your friends? (this is on a Likert scale of 1 to 10, with a 1 being the subject would never use it and a 10 being the subject would use it all of the time)
5) Should train GIFS be added to this application? (the answers to this question were Yes, No, and Maybe)
6) What could be improved in this application? (this was an open ended question, with the answers being written down)

The questionnaire (see Figure 5) questions were also presented with a Likert scale, with a 1 being best, 2 being good, 3 being neutral, 4 being bad, and 5 being worst. The questions were as follows:
1) How likely will you recommend our product to your friends and family?
2) How easy was it for you to figure out how to login?

3) How easy was it to send message to another person?
4) How easy was it to find emoji, from the available one, to send?

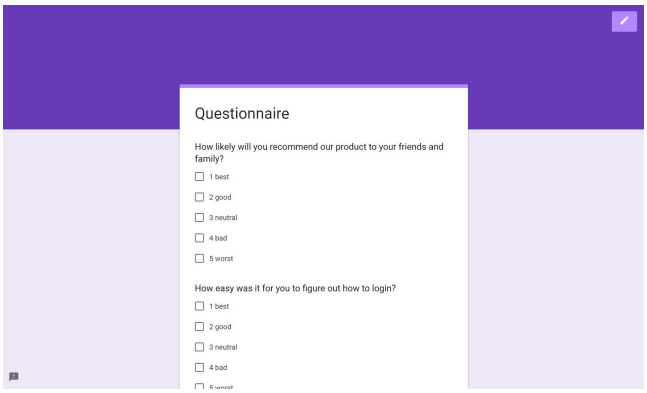

Figure 5. Subject view of post testing questionnaire

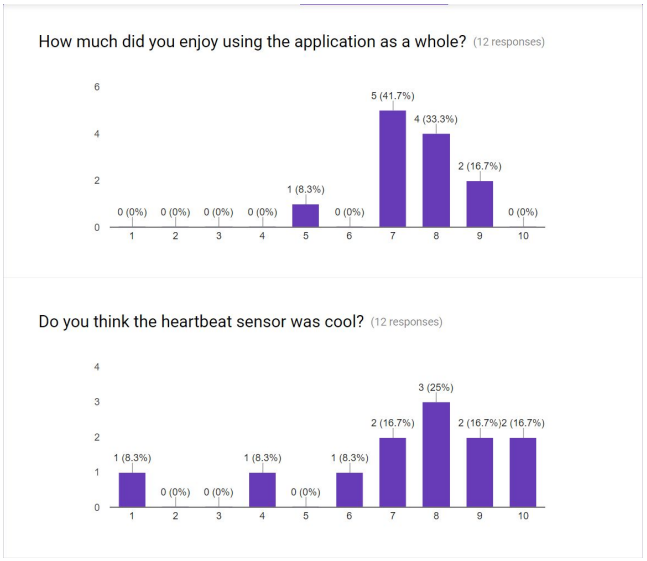

Figure 6. Questions 1 & 2 of evaluation interview

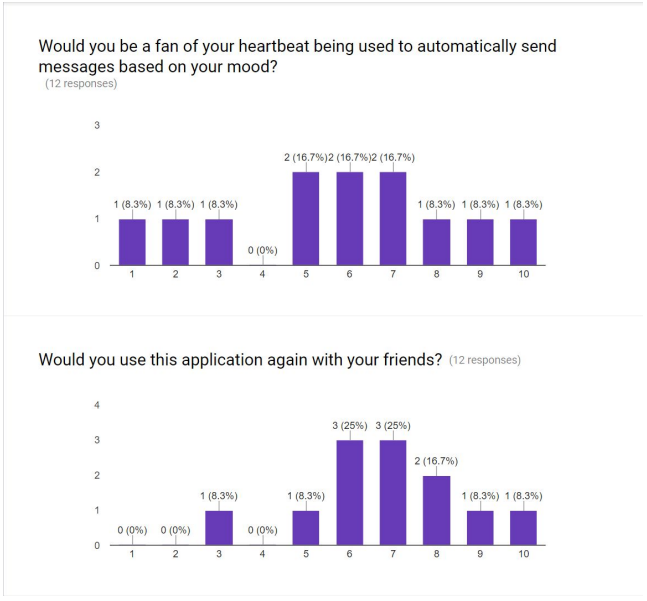

Figure 7. Questions 3 & 4 of evaluation interview

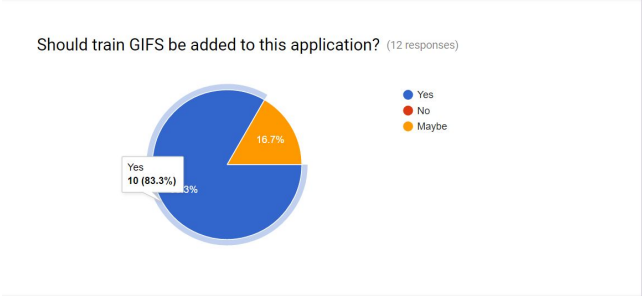

Figure 8. Question 5 of evaluation interview

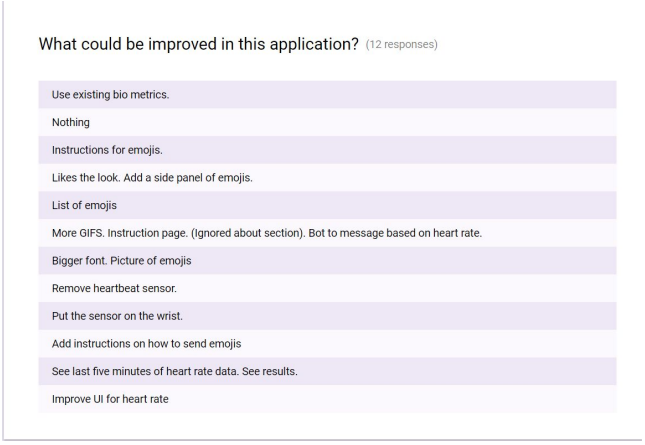

Figure 9. Question 6 of evaluation interview

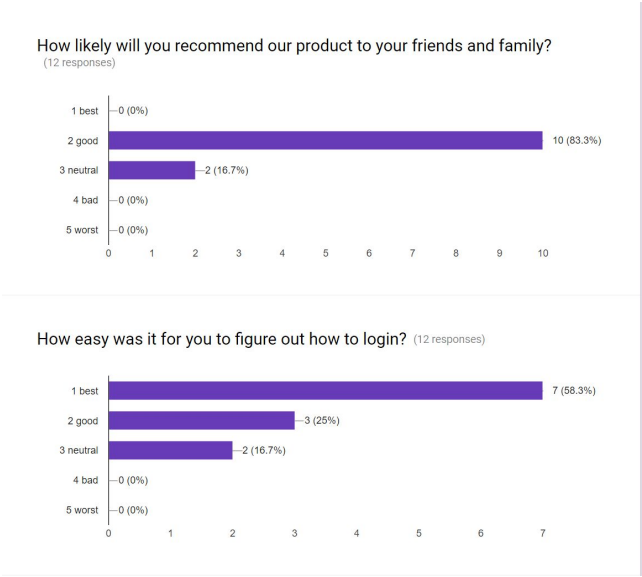

Figure 10. Questions 1 & 2 of questionnaire

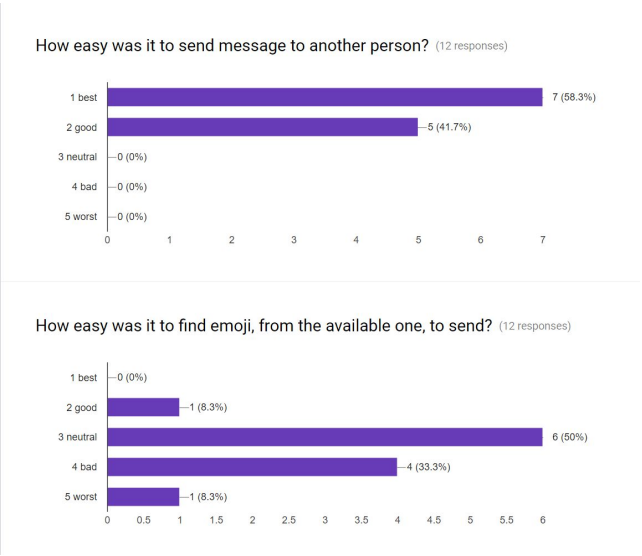

Figure 11. Questions 3 & 4 of questionnaire

6. Analysis

We analyzed the data by looking at the observational notes, and looking at the mean scores of our question results. Mean scores are calculated by multiplying the rating of a question times the number of respondents, adding up all the ratings for the question, and then dividing by the total number of subjects (in our case, 12). If a certain question had a mean score of > 50% positive (positive being anything better than neutral, ie a 3 for the questionnaire and a 5 for the evaluation interview), then that meant the feature was successfully/enjoyably used. This same > 50% satisfaction rating was also applied to the observational notes, which were rated by the testers as being either positive or negative for the tested features.

7. RESULTS

Based on our data analysis, we can clearly answer both our research questions as well as our hypothesis as follows:

1) Can the user successfully navigate our login interface?

The questionnaire data here (Question 2 on the questionnaire) showed an average score of satisfaction as a 1.58, with a 1 being the best, 3 being neutral, and 5 being the worst. As a score of only <=2.99 was needed here, this was definitely successful! In fact, no users rated this question as anything worse than neutral, with the majority of users actually rating it a 1. Observational notes confirm that most users were able to quickly progress through the login interface, with only a few asking clarifying questions such as if they could enter any username or if specific criteria were needed. No users suggested any improvements as being necessary for the login interface. In summary, yes.

2) Can the user use as well as enjoy our chat interface?

In order to answer this question, we need to examine several different parts of the questionnaire and evaluation interview. As the most important question would have to be ease of sending messages, lets examine that one first (Question 3 on the questionnaire). Ease of sending messages showed an average satisfaction score of 1.42, with a 1 being the best, 3 being neutral, and 5 being the worst. As a score of only <=2.99 was needed here, this was definitely successful! In fact, no users rated this question as anything worse than good, with the majority of users actually rating it a 1. As the chat feature is the premiere feature of the program, two other useful questions would be the enjoyability of our program as a whole and recommendation of our program (Questions 1 on both the evaluation interview and questionnaire). The average enjoyability score was a 7.5, with anything greater than a 5 being considered successful. The average recommendation score was a 2.17, with anything less than 3 being considered successful. Therefore, it can be determined that users were able to both use as well as enjoy our chat interface. Observational notes back up this data, as many subjects were laughing during the testing, with no one showing anger or distress at the chat interface. Additionally, no subjects listed it as an area of improvement, besides 1 who wanted a larger font size. In summary, yes.

3) Does the user enjoy our current method of emoji implementation?

This question can be answered by looking at Question 3 from the questionnaire, as well as the list of improvements and observational notes. The average satisfaction score for ease of emoji usage was a 3.42, with anything above a 3 being considered unsuccessful. In fact, no user gave it a 1, which was the best, with most users rating it neutral or bad. This can be confirmed from the list of improvements, which show 5 out of our 12 subjects offering improvements to the emoji interface. Additionally, observational notes showed that the most struggles occurred while attempting to send emojis, with many subjects having to be instructed several times as to the correct formatting. However, after they succeeded, subjects seemed to enjoy having the emojis, they just wished it was easier to send them. In summary, no.

4) Will the user be open to a pulse sensor monitoring their heartbeat and potentially automating replies to messages?

To answer this question, it is best to look at Question 3 of the evaluation interview. The average score here was a 5.75. with a range of answers extremely across the board. In conducting the interview, varied responses were noted, such as subjects wishing to view the messages before being sent out, subjects wanting to review their heartbeat data, some subjects being completely on board, and some subjects being completely against the idea. With our small sample size, a score that close to neutral is far from definitive. A more definitive question at least is the question of novelty of the heartrate sensor, with the cool factor being evaluated in Question 2 of the evaluation interview, as well as having a part in the experience as a whole. The satisfaction score for Question 2 was a much more definitive 7.25, with anything above a 5 being considered positive. However, many subjects made suggested improvements such as ease of use of the sensor, moving it to a different part of the body, or being able to more easily understand the data. Overall, it is hard to establish whether people are ready to have computers automate their responses based on their heartbeat. In summary, inconclusive.

Our research hypothesis was:

1) The user will experience changes in heartrate that are noticeable enough while chatting that could be used to automate replies with emojis to various messages.

This is a question that was measured purely through observational notes. As the subjects were completing their testing of the application, the testers would insert various jokes through texts or emojis in the chat, such as sending the eggplant and peach emojis (commonly known to represent male genitals and posteriors) in order to induce an emotional response, and therefore a heartrate change. This was successful in all 12 subjects we tested, with an increase in heartrate observed in all 12 subjects after the appropriate emotional stimulus was applied. In summary, yes.

8. CONCLUSION

In conclusion, much was learned from this study, with valuable information being gained that will benefit both future research as well as potential future products in the field of human-computer interfaces.

In our attempt to determine the ease of use of our login and chat interfaces, we were successful and learned that it is overall fairly easy to use, but some areas of improvement were learned about. In our attempt to learn how to best implement emojis, we learned that users much prefer a GUI based approach over one based on the command line. In our attempt to learn if users would be willing to accept a system that automatically sends replies based on their heartrate, we were inconclusive as the answers from our testers were both varied and close to neutral. It appears that more research is needed in this particular area of study. Finally, in our attempt to learn whether our hypothesis about heartrates changing enough to be used to automate replies, we were correct and successfully measured heartrate increases in all subjects.

Overall, this study can be considered a success, although future research must still be conducted to both replicate our results, as well as clarify unanswered questions based on our data.