# Moodle – Smart mirror for mental health check-in

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## ABSTRACT

This pictorial aims to explore the development and potential benefits of the mental health mirror - an innovative solution that promotes employee well-being and productivity in the workplace. With its sleek and discreet design, this tool blends seamlessly with any workspace decor while providing discreet support for employees' mental health. Apart from serving its primary purpose as a reflective surface, the mental health mirror also provides employees with an opportunity to take pictures of themselves with prompts or captions, thereby encouraging them to take breaks, manage their stress levels, and prioritize their mental health.

Incorporating this mirror into the workplace is a proactive step employers can take towards prioritizing their employees' well-being. The mental health mirror provides personalized prompts and resources to employees based on their chosen emotions, making it an accessible tool that caters to individual needs. This pictorial aims to highlight the potential benefits of the mental health mirror and encourage workplaces to invest in employee mental health and well-being.

## GitHub Repository

https://github.com/loukiaioannou17/Moodle_smartMirror.git

## INTRODUCTION

Moodle was designed as a response to the brief "Living well with data". We decided to focus on the workplace because of the lack of technology that could help improve mental health in the workplace.

With the goal of developing something for the workplace and mental health, we thought of a smart mirror (figure 1). A mirror can be easily integrated into any environment. In the workplace, we thought about integrating the mirror into the water-cooling area where conversations are usually held. This way, employees are more likely to notice and interact with the mirror. Our goal is to create a design that does not force users to act, but rather naturally encourages them to change their habits toward wellness in order to collect data about people in the workplace in a meaningful and responsible way.

Moodle offers incentives that can help change employees' moods and act as a place to relax, reflect, and rest. Moodle also offers suggestions for breaks and appointments with the counsellor when an employee needs them.

The main function of Moodle is for the user to select their own emotions based on a predefined list of emotions. This encourages the user to take notice of their feelings. Moodle then shows them prompts of how to improve their mood, either through urging them to take an action, reading a motivational quote, or simply taking a moment to breathe or stretch. At the end of the user's interaction with our Moodle, their mood has improved, and they feel better.
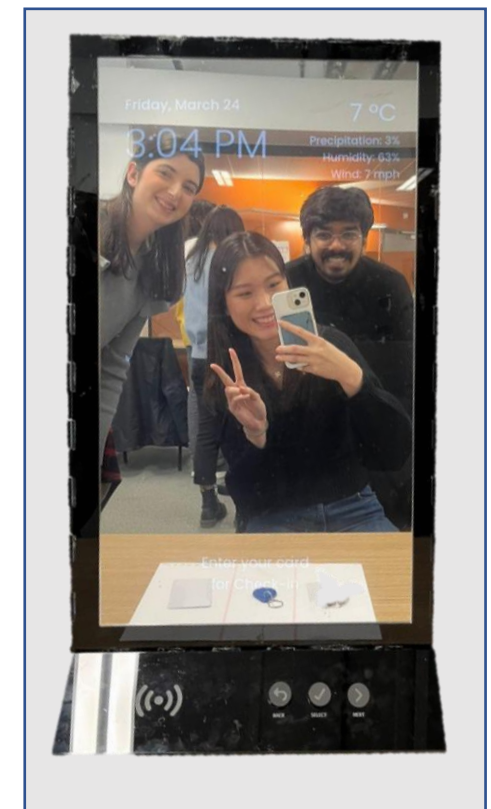


Figure 1: Smart Mirror – Final Design

The prototype was built using a Raspberry Pi and an exoskeleton shell made from laser-cut acrylic sheets. It also uses an RFID chip to scan and count employees and tactile buttons to control the prototype. For the demonstration, a 2-way mirror film was used to demonstrate the effect of a mirror.

## BACKGROUND RESEARCH

We looked at several devices that use smart mirror technology in cosmetics, as well as devices that help with meditation and improve mental health. This helped us with inspiration, the design process, and the development of Moodle (figure 2).

The first device we investigated was Themis Smart Mirror [5], which uses data from its camera, temperature sensor IR, and an ultraviolet light for skin analysis. It checks the user's general health at the beginning and end of the day, checks the skin, and provides guidance for facial yoga and relaxed breathing exercises. The next device was the Zmirror all-in-one Smart Mirror [10], which uses a selfie to track skin health and provides treatment for the skin based on data obtained from a dermatologist. It also has a built-in speaker and supports Alexa. The next two devices are the Muse 2 [2] meditation headband and the Hapbee Emotional control wearable [1]. Both are used to monitor body movements and help relax the mind through auditory and magnetic fields.

In addition, we have learned through a study by WHO [18] that an average of $1 trillion USD is lost each year due to lost productivity from depression and anxiety. This study also shows that 15% of working-age adults live with a mental disorder.

These findings highlight the importance of mental health awareness in the workplace and how our product will not only save a lot of money, but also improve employee morale.



Figure 2: Similar designs

## IDEATION PROCESS

We decided to focus on a design for a workspace and how it can efficiently manage employees' mental health. As we want the design to blend seamlessly into the surroundings, we got the idea to use a mirror as the medium. Furthermore, in a psychological sense, mirrors symbolize the threshold between the conscious and unconscious minds [9], identity exploration, and self-acceptance [11], which match the purpose of reflecting and elevating mental health.

The personas we created represent two common characteristics in a workplace; one as a young, ambitious person who gets stressed easily and another as a senior high-level employee who wants to achieve work-life balance. For the first persona (figure 3), Daniel Santos is a junior Filipino designer working in the UK. Daniel gets stressed easily from his ambitious

personality. So in the scenario, he does daily mental health check-in and follows the suggestions to cope with his stress and how he should plan the work (figure 4).
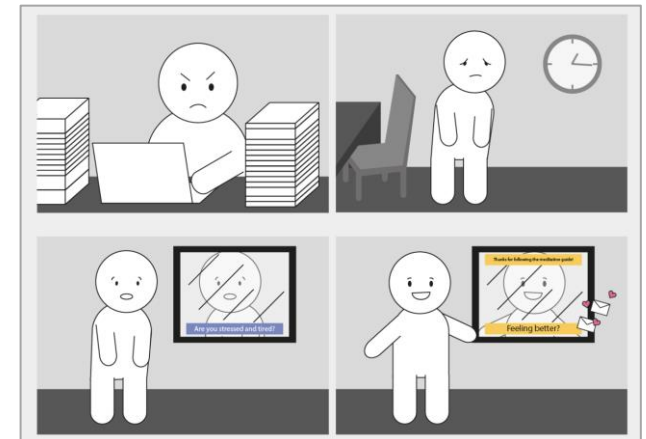


Figure 3: Persona 1



Figure 4: Scenario 1

The second persona (Figure 5) is a senior British director named Lily Smith. Lily used to work a lot, but now she wants to spend more time with her family. The mirror can help her remind herself to take breaks and let her know the available vacation time. She can also stay in closer contact with her team while working through the product's Connect feature (figure 6).

## DEVELOPING FEATURES AND USER FLOW

We developed the full functionality of the product (Figure 8) with four main functions based on the "5 steps of mental well-being" [6], as shown in Figure 7. However, due to limited time and resources, we focused on the mental check-up system (Figure 10).
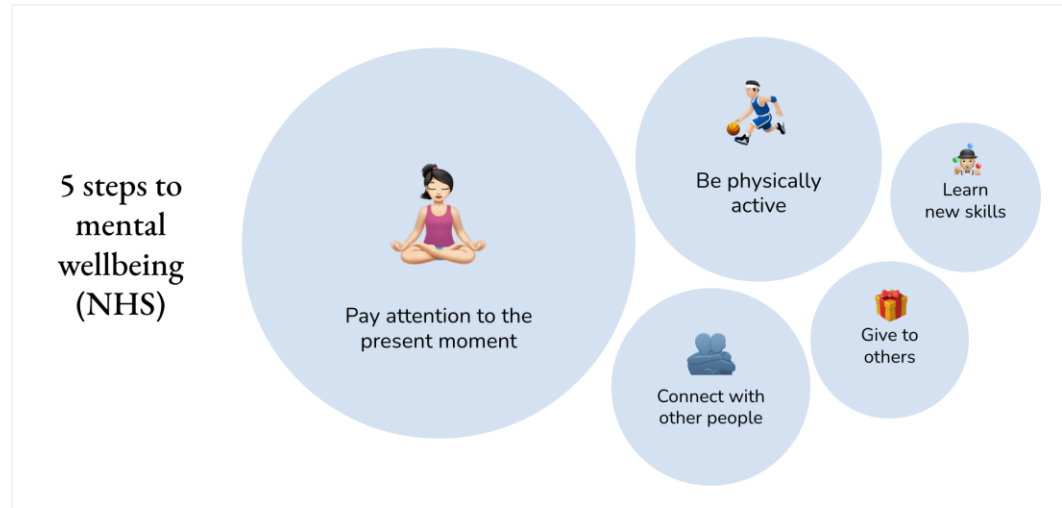


Figure 5: Persona 2



Figure 6: Scenario 2



Figure 7: NHS's 5 steps to mental well-being,



Figure 8: The product features

The user flow (Figure 9) starts with logging in by tapping the user's employee card. A welcome page is then displayed before the main menu appears, into which we could incorporate the reward system in the future.

The mental state check system (Figure 10) begins by asking the user to identify their current emotional state by selecting from five categories: happy, sad, stressed, tired, and bored. For each choice, there are different prompts, suggestions, and mental exercises, such as a breathing exercise (Figs. 13, 14) based on breathing techniques to reduce depression and stress [3], [7] and a short stretching guide (Fig. 15) modelled after a workout to reduce pain and fatigue from office syndromes [4].
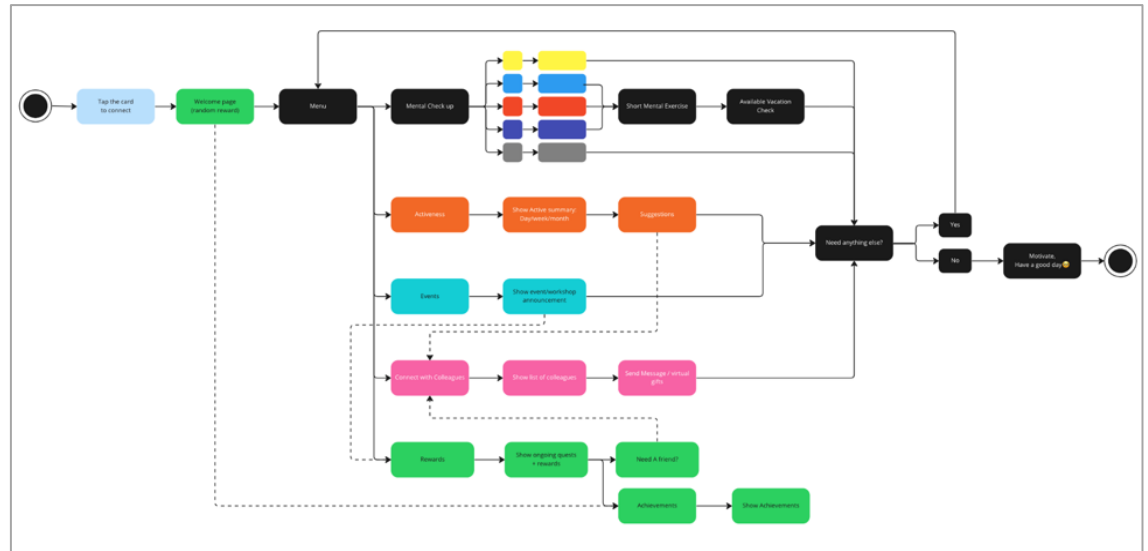


Figure 9: Overall user flow of Moodle
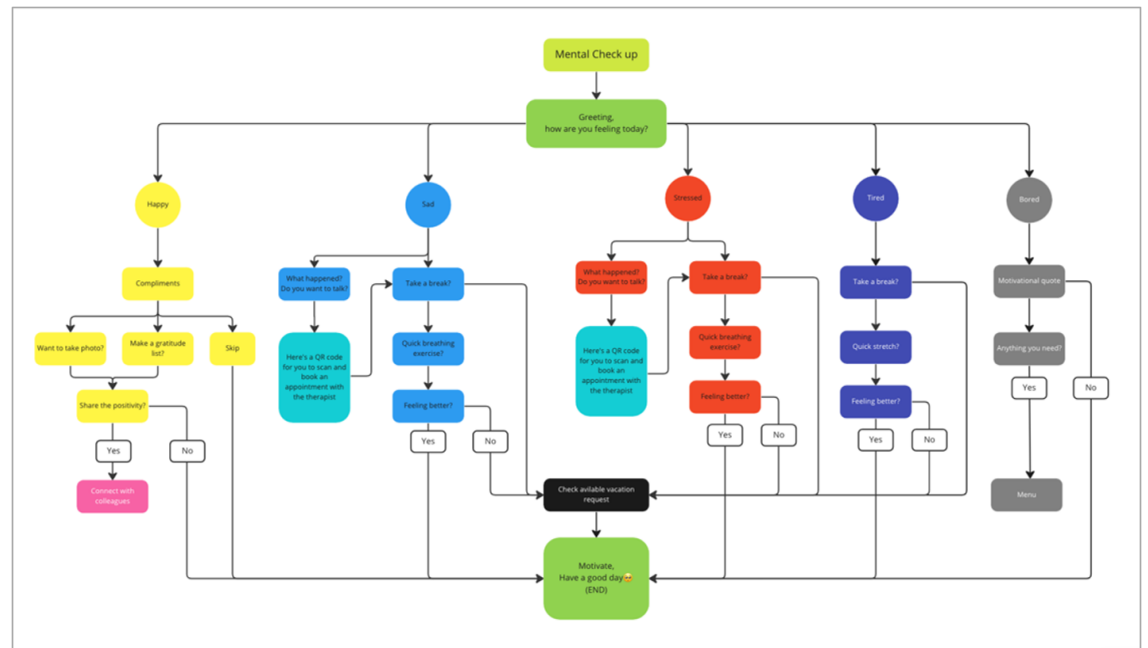


Figure 10: User flow of the mental health check-up system

## PROTOTYPING

Our product, as described earlier, is a smart mirror that allows users to choose how they feel and read the cues provided to improve their mood. The implementation of our mirror was divided into three parts: the website implementation, the backend development and the physical system. The backend development is about programming the physical components that connect to the Raspberry Pi and how they can modify a static website. The physical system consists of the actual mirror, the frame for it, and the dashboard.

Website Design

The focus of the product is on the emotions of the user. Therefore, it was important to decide which emotions should be represented. We decided to use 5 basic emotions. As we can see in the figure below, the selected emotions are happy, sad, tired, stressed and bored. These are emotions that workers feel more often in a work environment.

The design of the smart mirror required careful consideration to ensure that the display behind the one-way mirror achieved the right balance between visibility and invisibility. The mirror is intended to serve as a mental health check-in station. Therefore, it was important that the display not obscure the user's reflection, but still be noticeable enough for the user to interact with it.

To achieve this, we decided to use a black background and white text on the display. This ensured that only the intended light would pass through the one-way mirror, and that the user's reflection would be disturbed as little as possible. We also strategically placed all interface elements on the sides and corners of the mirror, leaving the center free for the user's reflection.

By balancing the visibility and invisibility of the display, we were able to create a mirror that effectively serves its purpose. It provides users with a discreet and unobtrusive way to monitor their emotions, while allowing them to focus on their reflection and overall well-being.

On each page we also included the date/time and current temperature. The reason for this decision was to encourage employees to use the mirror. Especially in the workplace, people are constantly looking at the time on their phones, so the time on the screen will catch the user's attention and perhaps encourage them to use the smart mirror. For the same reason, we have also displayed the temperature on each screen.

The selection page is the most important page of the website and also the page that shows the different emotions. Therefore, we had 2 different concepts for the design of the selection page, as shown in the following images. We chose the left design of figure 11 because we had to use physical buttons. It would be clearer if the emotions were arranged in a circle and the user pressed a button that selected each emotion around the circle than if they were arranged in a grid, as in the right design of Figure 16.

For each emotion, we developed about 6 pages. We have 3 different types of prompt pages (Figure 12) as shown in the figures. We have a prompt page that contains only motivational quotes for the emotion in question. Another page plays a video that prompts the user to take action. We created 2 breathing exercise videos and a stretching video (Figure 13,14,15). Finally, we designed pages that prompt the user to take an action, such as writing down a random idea they had today or taking a coffee break to relieve stress.

Another page we tried to create was QR code prompts. When the user selects the emotion sadness or indicates that they are feeling stressed, one of the prompts pages displays a QR code that, when the user scans the code with their cell phone, takes them to Newcastle University's mental health page. Because the product was a mirror and reflective, the QR code scanner built into the cell phone camera, was unable to capture the QR code , so we ended up not including it. We tried shrinking the URL and making the image larger as suggested, but since the film is reflective, the camera could not capture the QR code.
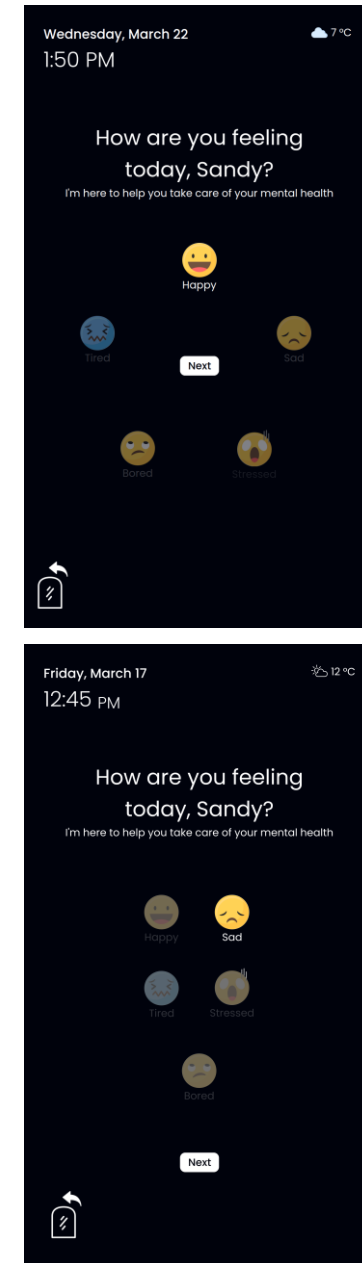


Figure 11: Design for main page

**USER'S JOURNEY**

The diagram in Figure 12 shows the sequence of actions, touch points, and emotions on the employee side with the two personas, as well as the steps the company could take to improve employee well-being over the long-term using the data.

We can see that Daniel is stressed and burned out. Daniel interacts with our mirror, recognizes how he feels, and through our prompts, finds a way to manage his stress so that he slowly starts to feel more relaxed.

Lily is a workaholic, meaning she is very motivated to work, but later interacts with our mirror and is reminded how important breaks are and that she has a lot of vacation days left. Then she practices what she read on the mirror and goes to Disneyland with her husband and twin daughters.
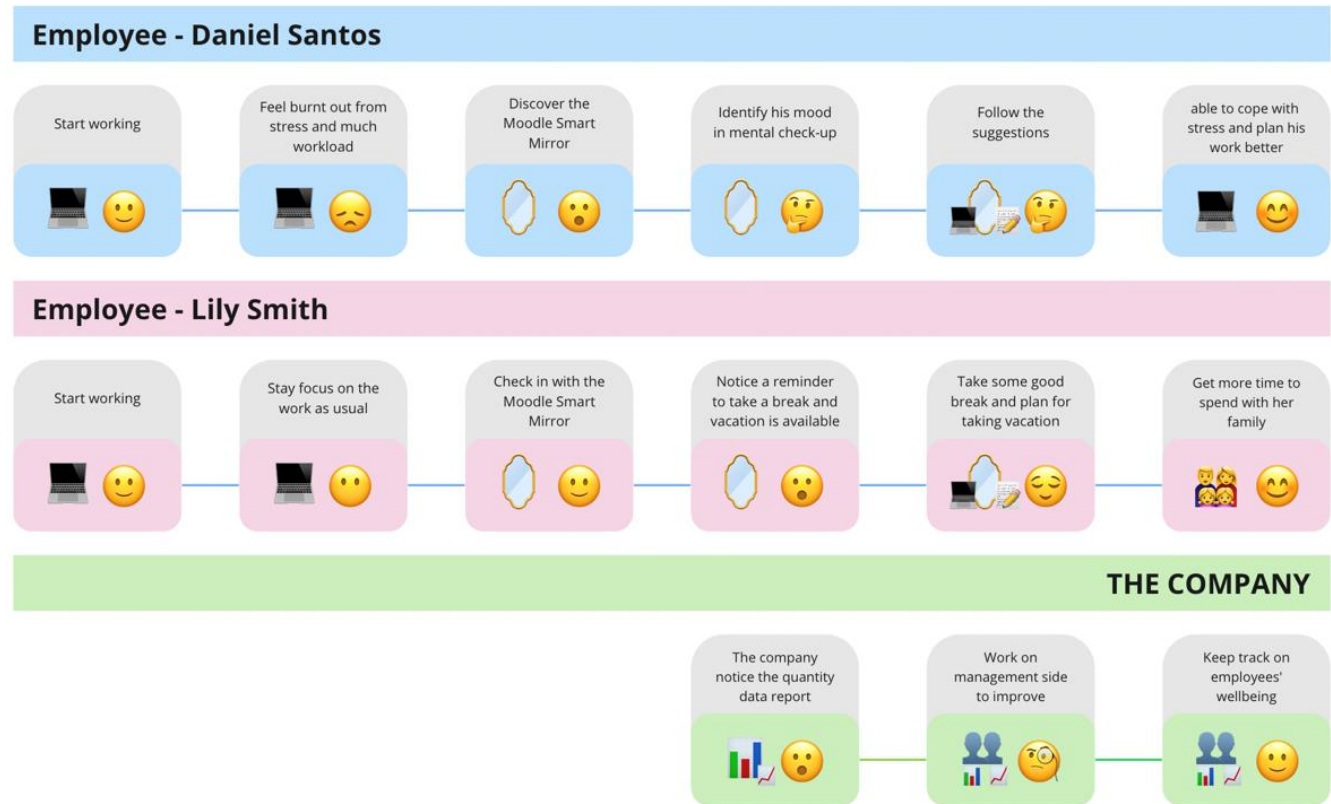


Figure 12: User journey

Screenshots of website design

The following images are screenshots from our website design. Figures 13-15 show the video exercises. We designed 2 different breathing exercises (Figure 13-14) and a stretching exercise (Figure 15).

The figures on the right are screenshots from the prompt pages. Figure 16 shows the design of the video page, which displays the video from Figure 13 and is shown to the user when they select either the sad or tired emotion. Figure 17 shows a list of activities that the user can do when they feel stressed to take a break,

such as having a snack or going for a walk, and again displayed to the user when they feel either stressed or bored. Figure 18 is a design of an information page that informs the user how many vacation days they have and prompts them to take more.

Finally, Figure 19 shows a motivational quote to improve the user's morale when they feel stressed.



Figure 13:
4-7-8 breathing guide
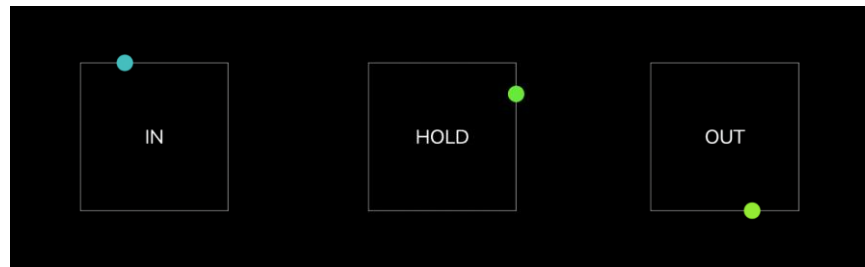


Figure 14:
Box breathing guide



Figure 15:
Quick stretching guide
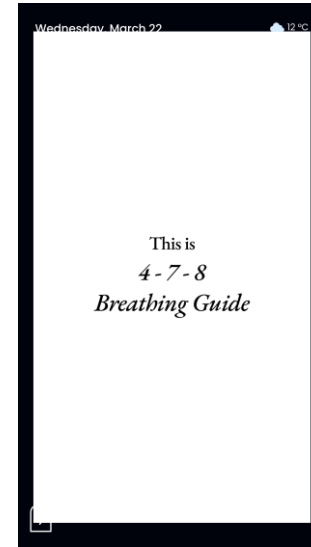


Figure 16: Screenshot of
video page
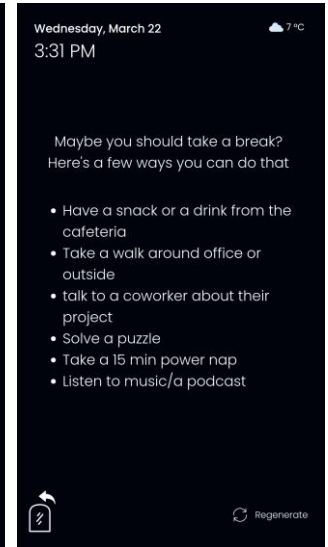


Figure 17: Screenshot of
prompting user page
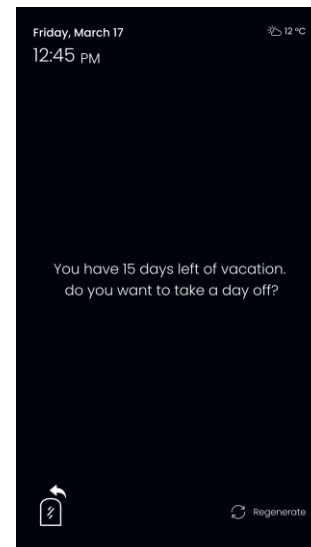


Figure 18: Screenshot of
informative page
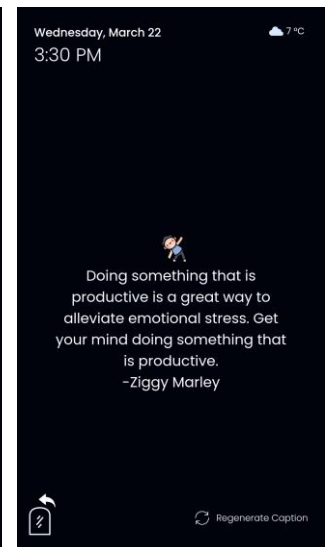


Figure 19: Screenshot of
quote

**DATA SHARING**

Our design is about monitoring the mental health of an employee. But mental health is something personal to each person. If a person wants to share how they feel, they can, but not with our mirror, because we want to respect their privacy.

For the product to work, the employee has to scan their card, but that is only to collect quantitative data, such as how many users feel sad. If many people express negative feelings, the mirror will notify the manager to take action. Our design is that the user scans their card, and then only the counter for the emotion the user is feeling is incremented, it does not store which user is feeling what (figure 20).

We were concerned that collecting this data would discourage many employees from using our system for fear that others would know if they were depressed, for example, which would violate their privacy.

Improve employee wellbeing management

Prompts & Suggestions

Updates

**Employees**

**Company**

Daily emotion check-in

Anonymous quantity data of emotion tracking

Figure 20: Data sharing between employees and the company

## Physical Frame and Dashboard

When we started thinking about the physical aspect of our mirror, we developed three different versions, as shown in the following figures.



Figure 21: Initial design concepts for the frame's mirror



Figure 22: Final design sketch for the physical mirror and dashboard

Figure 21 shows the concept with 2 designs that we ultimately did not implement. The left image in figure x shows a wearable scanner, a motion sensor, and a joystick that we decided not to use.

The wearable scanner was rejected for privacy reasons, as we would get a lot of personal data by scanning a wearable sensor. Collecting personal data from users would require user consent and a lot of ethical approvals

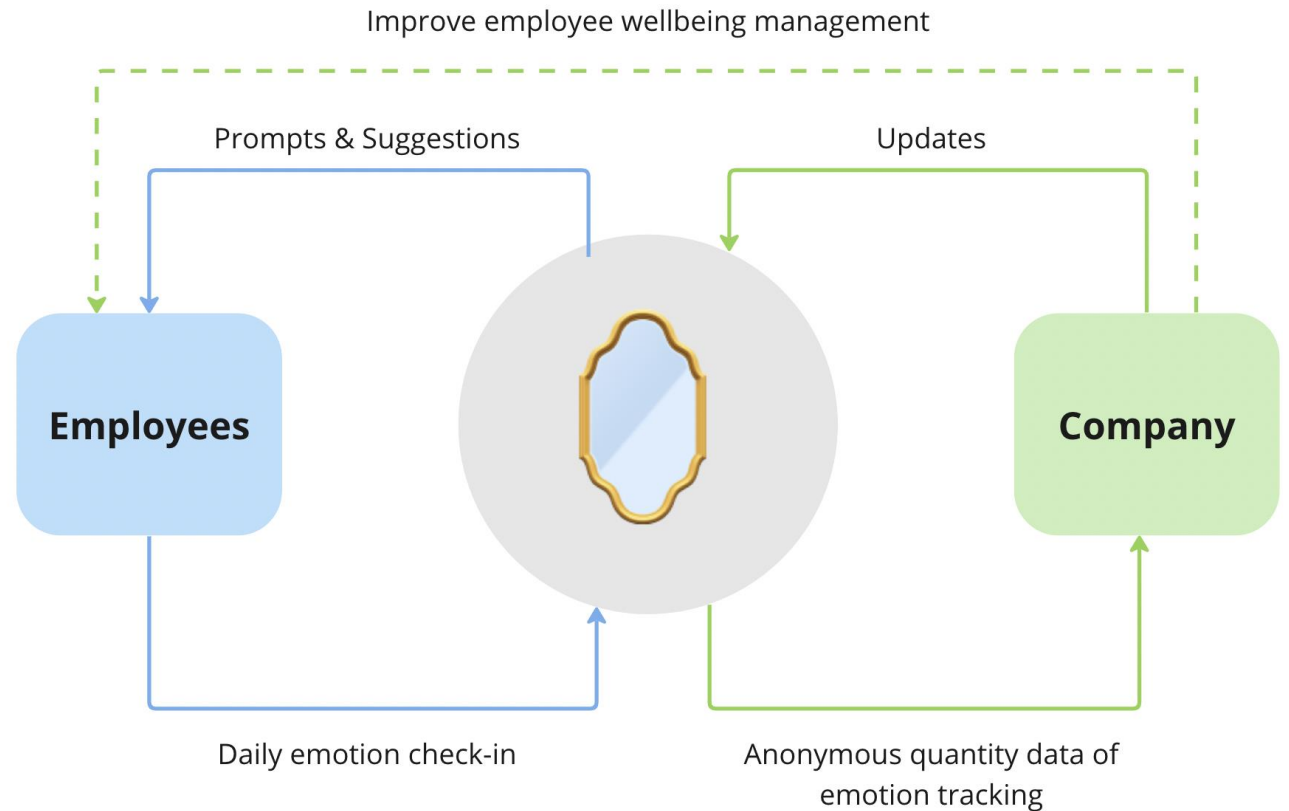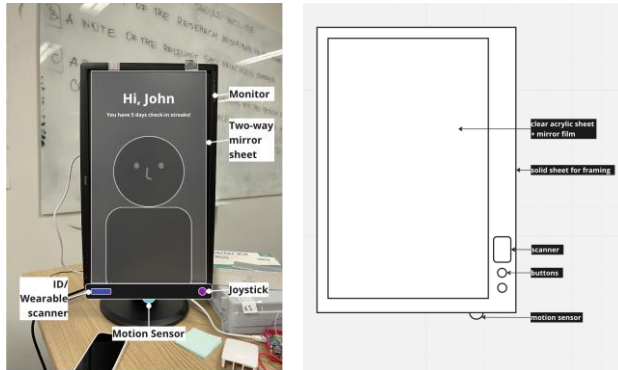that would take time to obtain. We also rejected the motion sensor because we thought it would be better for interaction if the mirror was always on so everyone could see the time and weather. We also thought of adding an RFID card scanner that would scan the user's smart card, after which the mirror would display the emotion selection page. Finally, we removed the joystick and replaced it with 3 buttons, since the joystick is mainly used for cases where you need a mouse or movements on the x and y axis. Our implementation needed only one way to have a back button, a forward button, and a select button, so we decided that it would be more self-explanatory to the user to use only buttons. As for the right image of Figure 24, we did not push it through because we initially removed the motion sensor for the reason explained above, and we thought it would be better to have the dashboard at the bottom of the screen instead of next to it because it gives the user a more compact look.
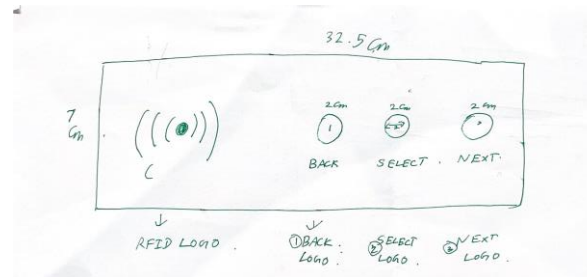


Figure 23: Sketch for designing the button dashboard

The final design of our product is simple (Figure 22, 23). We used a single computer monitor connected to a Raspberry Pi. On top of the monitor, we placed an acrylic surface and glued a 2-way mirror film. Then we wanted the mirror to blend in with its surroundings, so we made a black acrylic frame for it, and we also used a matte black acrylic frame to design the dashboard so that the buttons would blend in better with the mirror frame.



Figure 24: Final Design of the mirror with the monitor inside

## Backend development

The dashboard contains 3 buttons corresponding to 3 functions for the mirror and an RFID scanner. With the scanner, users scan their smartcard and depending on which card was scanned, a counter is incremented to track how many people interacted with the mirror and then the main page displays the user's name.

The 3 buttons on the dashboard are a back button, a select button, and a next button. The back button is only for the user to go to the previous page of the website. The select button is used like the enter key on the keyboard. Once the user selects their emotion, they can press the select button to see the prompts that correspond to that emotion. In addition, the Select key is also used on each prompt page. When the user presses the select button on a prompt page, the goodbye page is displayed, asking the user if they want to continue interacting with the screen. If the user presses Yes, the user returns to the selection page. If not, the mirror returns and waits for the next user to scan their card. The "Continue" button allows the user to select their emotion and "wander" through the circle of emotions.

**FUTURE WORK**

To improve the ability of the smart mirror to monitor mental well-being in the workplace, there are several potential features and future work that could be explored. A key area for development is personalization, where the mirror could be tailored to each employee's specific needs, preferences, and schedule. This could include tracking mental health data and providing personalized prompts based on past responses, as well as integrating with wearables such as fitness trackers or smartwatches to collect more data on employees' physical and emotional health.

Another potential area for development is mood tracking, where employees can monitor their mental health over time and gain insights into how it is evolving. This information could be used to identify trends and patterns in workforce mental health, allowing managers to respond proactively.

In addition to wearables, the smart mirror could also be connected to other smart devices in the workplace, such as smart home assistants or thermostats, so it can adjust its prompts or responses based on the environment or other factors that may impact an employee's mental health.

The mirror could also serve as a platform for employees to anonymously connect and support each other, fostering a culture of wellness and community. Natural language processing (nlp) technologies could be used to facilitate conversation and intuitive interaction with employees, making it easier for them to express themselves and in turn receive more personalized responses.

Overall, there are many interesting opportunities to improve the functionality of the smart mirror and its impact on employee mental health in the workplace. However, ethical and privacy concerns related to the use of personal data should be carefully considered, as well as ensuring that the technology is accessible and inclusive to all employees.
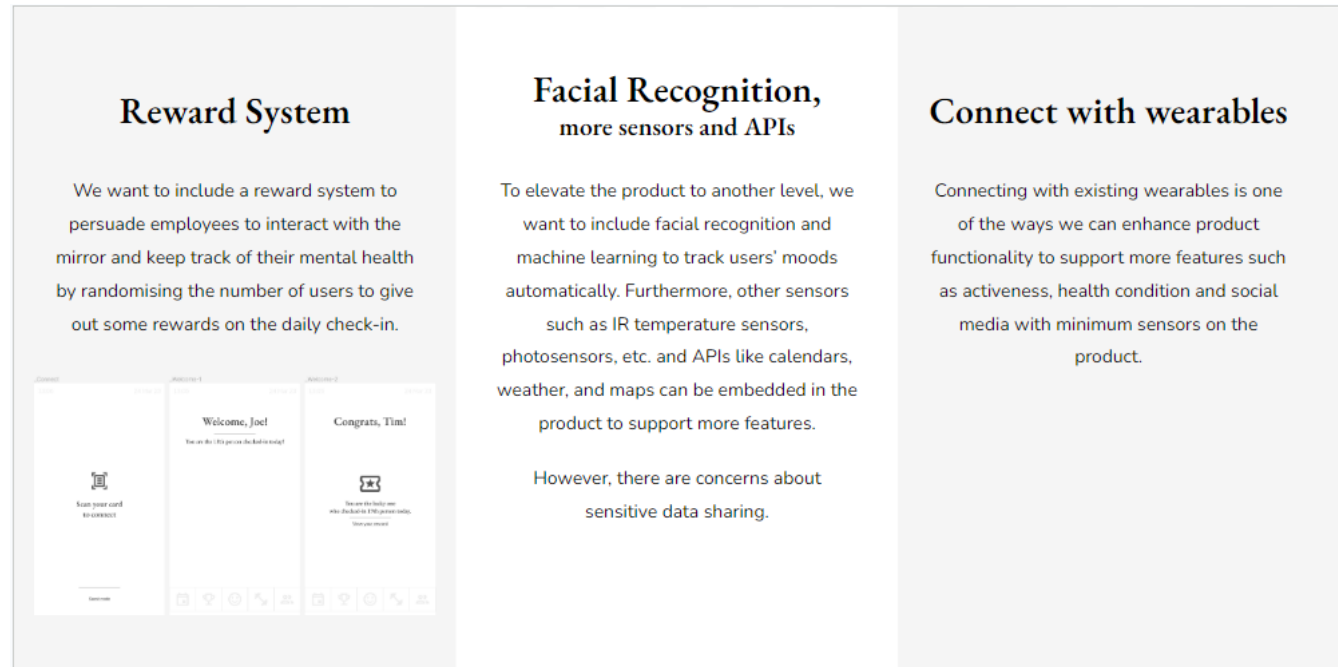


Figure 25: Future work

**CONCLUSION**

The Mental Health Mirror is an innovative solution that helps employees monitor and manage their mental health in the workplace. Its sleek and discreet design blends seamlessly into the interior design, making it a natural addition to any workplace. The user interface has been carefully designed to stand out without being distracting, keeping the mirror a useful tool that employees can rely on.

By tapping the sign with their employee card and selecting an emotion, employees can access personalized cues and resources to help them deal with the selected emotion. The mirror primarily serves as a reflection surface, but it also provides a convenient way for employees to take a photo of themselves with prompts or captions when they select the "happy" emotion.

Overall, the mental health mirror is a valuable tool for promoting employee wellness and productivity. It reminds employees to take breaks, manage their stress levels, and provides helpful suggestions on how to improve their mental health. By integrating this mirror into the workplace, employers can take proactive steps to ensure their employees' mental health and well-being are at the forefront.



Figure 26: Setup of the project for demonstration/presentation day

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## INDIVIDUAL CONTRIBUTIONS AND REFLECTIONS

The project, as previously described, was a smart mirror where users could select an emotion they were feeling and then read some advice on how to improve their mood. My role in this project started as the programmer of the group and I was only supposed to do the back-end development of the project. However in order to finish a project there has to be an overlap of effort to smooth the connection of the different parts so my role expanded.

First, I had to figure out how to connect the physical components to the Raspberry Pi, which was extremely frustrating because as I found out later, some pins expect certain components, so I ended up using pins 2 through 4 to connect all three buttons. During the initial stages, the idea was to also connect a motion sensor, so I had to figure that out as well.

Once I had everything successfully connected to the Raspberry Pi it was time to program it. Since I was the only member with a computer science background, it was my job to figure out how to successfully program it, which was a challenge for me because even though I have the background, I had zero knowledge about programming IoT. With the experience I gained in the practicals, I figured out how to program the buttons using JavaScript. The problem then was that the implementation of the mirror was going to be done with HTML/CSS, since the display would be a static website. So I had to figure out how to use the buttons that I had previously connected to the Raspberry Pi to change the look of a static website. This was difficult because I have never done anything like this before. I tried many different approaches, but the most obvious one was to use the Raspberry Pi as a server using Apache and then run a PHP script that asynchronously executed a Python script. The Python script was a "while true" loop that queried when a key was pressed. This approach failed, but with the help of Professor Dan, we figured out that the best approach for this task would be to use websockets, which eventually worked and was included in the final version. The way websockets work is that they wait asynchronously for something. In this case, the socket was waiting for either a button pressed, a movement, or a card scan. Once something happens at the socket, a message is sent to the main JavaScript files where a function is called depending on the event. For example, when the back button is pressed, the back function is called where the displayed page changes and either shows the selected page or if the user is on the selection page, goes back to the main page. After successfully programming the buttons and figuring out how a button can change the site, my tasks should be done. At this point, the member in charge of front-end development finished designing UI and handed me the HTML/CSS code to include the buttons. However, after taking a closer look at the code, I noticed that many things were out of place. For example, they put the time on the pages, but there was no code for it, so I had to program the clock display to show real time and date. Also, the other member's design showed the weather, but that was something they did not mention, and since I was doing the Raspberry Pi programming back-end development, and front-end development of the website at the time, I did not have time to connect an API to our website to retrieve the real-time weather, humidity, and barometric pressure to show real data on our website.

In addition, the design was done on the member's laptop but not checked on the actual screen with the actual dimensions, so many components appeared in the wrong place, so I asked the member to correct that, although they tried, but again they didn't check it on the actual monitor. I went through all the pages and made sure the design was in the right place and that the buttons, which were the same throughout the site, were always in exactly the right place. I also had to design and code the prompt pages where the videos would be displayed, and then embed those videos. Since the other member had not design all of the prompt pages, I designed the prompt pages for the emotions tired, stressed, and bored and created more prompt pages for happy and sad since we only had 3 for each emotion at this point, which was very limiting and we wanted more for the prototype.

After we finished the whole website, the RFID card scanner was delivered, so it was time to find a solution for that as well. The card scanner was something completely new to me because, as I mentioned earlier, I had no experience with Rasberry Pi and the buttons on a card scanner. I figured out how to successfully connect the card to wires and which pin to connect which wire to. After that, it was time to program the card scanner. I used the library of mfrc522 and softspi to program the scanner using JavaScript. The code I developed simply reads the IDs of an RFID card and then checks to see if those IDs match any of the IDs I hard-coded. If they do, either the name Sandy or Mark is displayed. Normally this would be done using a database with multiple IDs stored, but due to time constraints I was unable to program something like this. Also, at this point in the project implementation, I had already integrated the motion sensor into my code, even though my group members decided we no longer needed it. So even though the motion sensor wasn't included in our final design, there are still some remnants of the code in the design because this decision was made at the last minute, I didn't have enough time to remove it completely, and I wasn't quite sure if we didn't need it anymore.

After completing the front-end and back-end development of the website and making sure everything worked, my tasks were actually done. However, I had to figure out how many buttons we wanted to use and what functions each button should have. At first I thought about a joystick, but since the only real "movement" the user would make on the site would be with 2 arrow keys, I decided to go with that. Following the other member's design, we needed a return button and a button to regenerate a prompt page that just happened to display a different prompt page.

I programmed an enter button that would allow the user to select the emotion they were feeling, and a back button. After careful consideration, I decided that it would be best not to use many buttons to keep the design as simple and minimalistic as possible. In the end, we used 3 buttons. After completing the design and backend of the site, I helped provide information about prototyping to write the presentation, but only for the prototyping section of the presentation, and I did the same for the visuals.

I also wrote for the entire prototyping section, a part of the introduction, the data sharing and the background research .

Reflections

During this experience of implementing a smart mirror, I learned many important values, such as the value of teamwork and communication.

Although we faced many difficulties, we managed to develop a smart mirror from scratch. Since I was one of the only team members with a computer science background, it was important to figure out exactly how to program the Raspberry Pi, which was challenging for me since I had no previous experience with IoT, but I'm glad I came through in the end and learned a lot of new knowledge. I now know how to program different physical components connected to the Rasberyy Pi and how to connect them, which isn't hard once you figure out how the basics work. Also, during this process, I had to learn for the first time how to convert software into something physical, which I've never done before. It was a very interesting and new experience for me to think about how a website and actual buttons can interact with each other, because it's one thing to program a static website on a screen that a user would operate with just their mouse pad and keyboard, and it's another to program a website and then think about all the interaction between the user and the website and how many buttons there will be, what each button does, which button to use, etc.

Also, through the development of our project, I've learned the importance of group work, because even though it's easier to work alone, it's much more useful to work in a group. Working in a group is very useful because more work is done, you can share ideas, help each other learn and move forward. For example, I learned a lot from my group members about how to make physical components and how to put them together.

Overall, this project was fascinating for me because I was able to apply my programming skills in a new environment, namely on the Raspberry Pi. During this project, I had to figure out many new things and find a way to combine them with the knowledge I already had.