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WATER INTAKE APPLET BASED ON HUMAN EXCREMENT

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Abstrak

Agar berfungsi dengan baik, tubuh manusia membutuhkan hidrasi yang cukup karena 70% tubuh manusia dibangun oleh air dengan banyaknya reaksi kimia yang terlibat agar dapat bekerja secara optimal sepanjang hari. Kekurangan air atau hidrasi dapat menyebabkan masalah pada system pencernaan dan ginjal manusia, yang dapat terlihat pada warna urine dan faeses. Makalah ini bertujuan untuk memaparkan ide untuk membuat aplikasi keseharian konsumsi air berbasis pengawasan warna kotoran manusia. Ini mungkin solusi untuk mengintensifkan kemampuan orang menjadi sadar diri saat minum ebih sedikit air dengan mensurvei zat yang dikeluarkan. Metode yang digunakan adalah mengukur satu indikator yaitu antara urine dan feses yang mendeteksi seberapa banyak air yang harus diminum pengguna, yang dapat terlihat pada warna urin dan feces mereka. Namun sebenarnya, kedua indikator kotoran tersebut dibutuhkan untuk mendeteksi seberapa banyak pengguna minum dalam sehari-hari. Jika salah satu dari indikator ini menunjukkan hasil yang buruk, dapat menyebabkan keracunan air atau hidrasi. Aplikasi berhasil dibuat dengan menggunakan Python untuk memberikan masukan terkait asupan air pengguna berdasarkan kondisi zat yang dikeluarkan, dan menunjukkan indicator yang jelas untuk dehidrasi. Dengan demikian, dapat disimpulkan bahwa aplikasi water intake ini dapat mendeteksi fenomena dehidrasi dengan menjadikan kotoran manusia sebagai indikator.

Kata kunci: Asupan Air, Dehidrasi, Warna, Kotoran Manusia

Abstract

To function properly, the human body requires adequate hydration as 70% of the human body was being built up by water. It acts as a solvent for lots of biochemical reactions to keep our physiological function work optimally throughout the day. Dehydration could cause a disturbance in both the gastrointestinal and kidney systems of human beings, and it could be noticed in the color of both urine and feces. The objective of this paper is to present an idea on how to make a water intake app based on the color indicator of human excrement surveillance. It might be a solution to intensify people's ability to become self-conscious when drinking less water by surveying the excreted substance. The deployed method is to measure one indicator which is between urine and feces detector on how much water should the user drink by observing the color of both their urine and feces. However, both excrement indicators are needed to detect users' drinking amount. If one of these indicators shows a bad result, it could lead to water intoxication or hydration. The application has been successfully created using Python to give feedback for the user's water intake based on the condition of their excreted substance. The Water Intake application has successfully shown a clear indicator for dehydration. It could be inferred that this water intake software could detect the dehydration phenomenon with human excrement as the main indicator.

Keywords: Water Intake, Dehydration, Color, Human Excrement

INTRODUCTION

Water is an inorganic, colorless chemical substance, composed of hydrogen and oxygen elements, which is the most plentiful and necessary compound for all living beings (Aversa, Petrescu, Apicella, & Petrescu, 2016). All living beings require water in their lives. Without water, most living beings are only able to survive for several days. Water requirements came from food intake and beverages among healthy individuals. Sufficient water intake is essential for the homeostasis of fluid and electrolyte tests in our body (Jéquier & Constant, 2010). Thus, dehydration could pose serious health consequences as seen in

the six-day war of 1967 that caused significant heat-stroke casualties of Egyptian soldiers (Grandjean, 2014). Healthy humans regulate daily water intake across their lifespan despite the changes within their biological development as well as exposure to a stressor on hydration status (Popkin, D'Anci, & Rosenberg, 2010). Things that are considered as daily water intake includes drinking water, water in food, and water in any beverages. Many factors contributed to differences in total body water which contributed to age, gender, activities, and daily routines, all accounted for each person's body composition (Stookey, 2019). Total body water is distributed into different parts of intracellular and extracellular fluid components within the body, containing around 50% to 70% of total body water (Sawka, Cheuvront, & Carter, 2005).

Disturbance in water intake will also affect the human excretion of the body, regardless it's in solid or fluid form. This could also affect the level of hydration which is also increased with the flow of urine and also solid excretion (Rose, Parker, Jefferson, Cartmell, & Rose, 2015). A study from Arnaud, 2003 based on elderly people concluded that hydration lowers the chance of getting constipated. Another review study by (Perrier et al., 2020), found that the lack of water intake may increase the chance of kidney stones occurring when urine forms crystals due to the lack of substances within the kidney to bladder area. All of these symptoms have a high chance of occurring due to dehydration, and low fluid intake or liquid deprivation in which water intake was only around 2,500 to 500 milliliters per day (Liska et al., 2019).
In the realm of computer science, the software that caters for both urine and feces detections are mainly limited to the large-scale system for biomarker detection, and specialized machine-learning-based system for specific disease diagnostics (Fujimoto et al., 1998; Shu, Liu, Xie, & Ren, 2017). In this regard, there are a lot of improvements and gaps to be a field in this studies, as there is a need for a more general diagnostics measure for human excrement. However, in the life sciences domain, extensive research has been conducted to establish diagnostics for the water dehydration marker in human excrement (Bičanić, Hladnik, Džaja, & Petanjek, 2019; Cheuvront, Muñoz, & Kenefick, 2016; Ghasemi, Khorvash, Ghorbani, & Elmamouz, 2014). Moreover, large-scale diagnostics with a machine learning approach have been established, albeit only for experts (Ford & McElvania, 2020; Fujimoto et al., 1998; Shu et al., 2017). It should be noted that impaired executive function and cognitive performance for dehydrated people could occur due to water imbalance level (Guo et al., 2020; Malisova, Bountziouka, Panagiotakos, Zampelas, & Kapsokefalou, 2013; Riebl & Davy, 2013; Stachenfeld, Leone, Mitchell, Freese, & Harkness, 2018). More advanced engineering efforts have been devised for detecting dehydration in toilet systems and water treatments as well (Park et al., 2020; Rose et al., 2015). So, the combination of both domains of computer and life sciences approaches should devise for an easy-to-use diagnostics measure for water intake diagnostics with human excrement as the marker.

An appropriate water intake of around 2.7 liters to 3.7 liters should do well in assisting our bodies to do daily activities during the day (Kenefick & Sawka, 2007). There are clinical indicators for determining water dehydration in humans, but more efforts towards automatization are necessary (Carmichael, 2011). There is several-water intake reminder software in the market, but without clear urine and feces indicators available (Everyone, 2020; Funn Media, 2020). The paper aims to present an idea of making a water intake app based on human excrement surveillance whether in liquid (pee form) or solid (stool form) with a color indicator. The novelty of our applet is the combination of both pee and stool color indicators with a user-friendly interface. The app could improve people's ability to become more self-aware of their own body needs whether they lack water intake within the body or an adequate amount of water has finally been reached. This is done by observing the color of the urine or the hardness of the fecal substance.

RESEARCH METHODS

The applet was created with the Python programming language version 3.6, along with the kivy and kivymd frameworks development (Ivan, Nurdiansyah, & Parikesit, 2019). The interactive user interface deployment and visual matching form were exposed in the pseudo-code below (Bhat, Wijaya, & Parikesit, 2019), and the block sequences were deployed in sequences along with the detailed explanations (Block 1 – 16) :

```
main.py
Import kivy
Import kivymd
```

Block 1: The kivy python framework was deployed to enable the multi-touch user interface

```
create interface:
MenuScreen:
PeeLog:
plResult1:
plResult2:
plResult3:
plResult4:
```

```
PooLog:
pooResult1:
pooResult2:
pooResult3:
pooResult4:
History:
Setting:
```

Block 2: This pseudocode depicts the creation of the menu of the urine colors and feces forms. It also shows the user setting of the applet

```
<MenuScreen>:
name: 'menu'
create label:
text: 'Welcome'
create button:
text: 'Pee Log'
on _click:
direct to 'peeLog'
create button:
text: 'Poo Log'
on _click:
direct to 'pooLog'
create button:
text: 'Settings'
on_click:
direct to 'setting'
```

Block 3: This pseudocode explains the contents within the menu screen which consists of "Welcome" text, and four buttons which are between pee log, poo log, and settings.

```
<PeeLog>:
name: 'peeLog'
create label:
text: 'Select the color of your urine!'
create button:
color: x
on_click:
direct to 'PeeResult1'
create button:
color: y
on_click:
direct to 'PeeResult1'
create button:
color: z
on_click:
direct to 'PeeResult1'
create button:
color: a
on_click:
direct to 'PeeResult2'
create button:
color: b
on_click:
direct to 'PeeResult3'
create button:
color: c
on_click:
direct to 'PeeResult4'
create button:
text: 'Back'
on_click:
direct to 'menu'
```

Block 4: When the Pee Log option is chosen on the menu page, users need to pick the color of their urine.

```
<plResult1>:
name: 'PeeResult1'
create label:
text: 'You are hydrated.'
create label:
text: 'Keep up the good work!'
create button:
text: 'Back'
on_click:
direct to 'menu'
create button:
text: 'Submit'
on_click:
direct to 'menu'
append current_time + ' - Pee = Hydrated \n'
to history.log
```

Block 5: This pseudocode shows the output of pee result 1. It will show a message that tells users are very well hydrated. The text result will then be put automatically into the history log.

```
<plResult2>:
name: 'PeeResult2'
create label:
text: 'Healthy.'
create label:
text: 'But drink water soon~'
create button:
text: 'Back'
on_click:
direct to 'menu'
create button:
text: 'Submit'
on_click:
direct to 'menu'
append current_time + ' - Pee = Acceptable \n'
to history.log
```

Block 6: This pseudocode shows the output of pee result 2. It will show a message that tells users are hydrated enough but should drink more water. The text result will then be put automatically into the history log.

```
<plResult3>:
name: 'PeeResult3'
create label:
text: 'You seem to be dehydrated.'
create label:
text: 'Please drink more water!'
create button:
text: 'Back'
on_click:
direct to 'menu'
create button:
text: 'Submit'
on_click:
direct to 'menu'
append current_time + ' - Pee = Dehydrated \n'
to history.log

<plResult4>:
name: 'PeeResult4'
create label:
```

```
text: 'Oh no! You are severely dehydrated.'
create label:
text: 'Please drink water and consult a doctor'
create button:
text: 'Back'
on_click:
direct to 'menu'
create button:
text: 'Submit'
on_click:
direct to 'menu'
append current_time + ' - Pee = Severely
dehydrated \n' to history.log
```

Block 7: This pseudocode shows the other two possible outputs, pee result 3 and 4. Pee result 3 will show a message that tells users that they are dehydrated, while pee result 4 will tell them that they are severely hydrated. The text result will then be put automatically into the history log.

```
<PooLog>:
name: 'pooLog'
create label:
text: 'Select the consistency of the poo'
create image:
source: img.jpg
create button:
text: 'Type 1'
on_click:
direct to 'PooResult4'
create button:
text: 'Type 2'
on_click:
direct to 'PooResult3'
create button:
text: 'Type 3'
on_click:
direct to 'PooResult1'
create button:
text: 'Type 4'
on_click:
direct to 'PooResult1'
create button:
text: 'Type 5'
on_click:
direct to 'PooResult2'
create button:
text: 'Type 6'
on_click:
direct to 'PooResult3'
create button:
text: 'Type 7'
on_click:
direct to 'PooResult4'
create button:
text: 'Back'
on_click:
direct to 'menu'
```

Block 8: When the Poo Log option is chosen in the menu page, users need to pick the consistency of their feces.

```
<pooResult1>:
name: 'PooResult1'
create label:
text: 'Your stool is normal'
create label:
text: 'Keep up the good work!'
create button:
text: 'Back'
on_click:
direct to 'menu'
create button:
text: 'Submit'
on_click:
direct to 'menu'
append current_time + ' - Stool = Normal \n'
to history.log
```

Block 9: This pseudocode depicts the first result for Poo Log, which will tell users that their feces is normal. The result will be sent to the history log.

```
<pooResult2>:
name: 'PooResult2'
create label:
text: 'You lack fiber'
create label:
text: 'Try to eat some more fiber'
create button:
text: 'Back'
on_click:
direct to 'menu'
create button:
text: 'Submit'
on_click:
direct to 'menu'
append current_time + ' - Stool = Lack of Fiber
\n' to history.log
```

Block 10: this pseudocode depicts the second possible result for Poo Log, which will tell users that their diet seems to lack fiber. The result will be sent to the history log.

```
<pooResult3>:
name: 'PooResult3'
create label:
text: 'Your stool is normal'
create label:
text: 'But if it persists, please consult a
doctor'
create button:
text: 'Back'
on_click:
direct to 'menu'
create button:
text: 'Submit'
on_click:
direct to 'menu'
append current_time + ' - Stool = Mild
Abnormalities \n' to history.log
```

Block 11: This pseudocode shows the third possible result for Poo Log, which will tell users that the consistency of their feces is still normal, but they might need to consult their doctor if they keep getting the same result. The result will be sent to the history log.

```
<pooResult4>:
name: 'PooResult4'
create label:
text: 'Your stool is abnormal'
create label:
text: 'Please seek medical attention'
```

```
create button:
text: 'Back'
on_click:
direct to 'menu'
create button:
text: 'Submit'
on_click:
direct to 'menu'
append current_time + ' - Stool = Severe
Abnormalities \n' to history.log
```

Block 12: This pseudocode shows the fourth possible result for Poo Log, which will tell users that their feces seems abnormal and will need to seek medical attention. The result will be sent to the history log.

```
<Setting>
name: 'setting'
create button:
text: 'Set start'
on_click:
show timer picker
create button:
text: 'Set End'
on_click:
show timer picker
create label:
text: 'Notification will automatically be
turned off during sleep hours'
create button:
text: 'Submit'
on_click:
export to notification.py
create button:
text: 'Back'
on_click:
direct to 'menu'

add widget to interface

build
```

Block 13: This pseudocode explains how the setting page is created. Here, users can set their sleep time. During these hours, the app will not send any notification.

Pseudocode for notification.py

```
import time
from system import notifier
```

Block 14: Time is imported to the notification.py.

```
while True:
current.time = import current.time(%h:%m:%s)
if main.settings.setend > current.time >
main.settings.setstart:
push notification
pause for 7200
else:
loop
```

Block 15: This pseudocode explains how the app will send notifications two hours after the last time a new input is detected for Pee Log. Notification will not be sent during sleep time (between set start and set end).

```
notification:
text: 'It's time to log! Don't forget to drink
water'
Block 16: The notification will remind the
users to log in and drink water.
```

Procedure

The 'create interface' function on the pseudo-code above was done to create every display page that has to be created and linked together (Nguyen, 2014). This means that there would be around 13 screens that the user might be able to visit. The parameters of each item always consist of the 'name' and other configuration for each page. 'name' function was used to name the item to be referenced on other pages. 'create label' was used to create a label, with the text displayed on the 'text' parameter. 'create button' would create a button for the user to press on. 'create button' function had a parameter called 'on-click' which defines what the program should do if the user clicks the button 'direct to' function would direct the user to the page it was directed to (Archie, 2019). The 'create image' function was used to import images to be shown in the pages, with the 'source' parameter to define where and what item to be displayed. 'show timer picker' function was used to display the timer picker the android operating system had on stock. 'export to' function indicates that the fields those were field by the user are sent to other files to be processed. 'append to' function was used to add some item to a file. The while loop shows that first, it would import the device time (Meiliana, Septian, Alianto, & Daniel, 2018). It would then be processed by comparing the device time with the time set by the user. If the device time was between the start and the end time set by the user, the program would push a notification to the user and pause for two hours, and start it over again. If not, the program would start it all over again.

RESULTS AND DISCUSSION

A mobile hydration application was developed to help people track their water intake based on the condition of their urine and stool. The application was created with kivy, a python package. When the application is opened, the user will see a menu page with three buttons: Pee Input, Poo Input, and Settings. Figure 1 depicted the easy-to-use user menu that is ready to log the excrement visuals, as well as its sets.

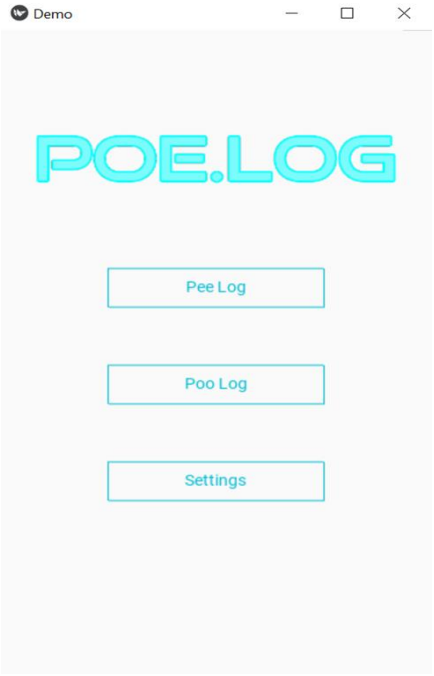


Figure 1. The menu page. It is using bright colors so will facilitate a visually impaired person. Moreover, the menu has been depicted simply.

The first button, Pee Input, would lead to a page where users can input the color of their urine. On the Pee input page, there are six buttons with different colors (Figure 2). From left to right, the first three buttons represent the ideal or healthy color; the fourth button represents the urine color of someone with mild dehydration; the fifth button represents the urine color of someone who is dehydrated; the sixth button represents the urine color of a severely dehydrated person. Based on the input, the user would be directed to a new page where they can see the implication of the color of their urine and a submit button that would save the user input when clicked. If the user selects one of the first three buttons, they would see a page with a message saying "You are hydrated" and "Keep up the good work" (Figure 3a). When the user chooses the fourth button, a message saying "Healthy! But drink water soon" would be seen (Figure 3b). The fifth button would lead to a page with a text saying "You seem to be dehydrated. Please drink more water!" (Figure 3c). The last button would show a page with the message: "Oh no! You are severely dehydrated. Please drink water and consult a doctor" (Figure 3d). In this part, it is important to remember that the users should have exposed their good and healthy depiction of their urine visually, especially the upper bright part in figure 2. If they eventually stumble upon the darker visuals below, certain health disorders could be imminent (Liao & Churchill, 2001)

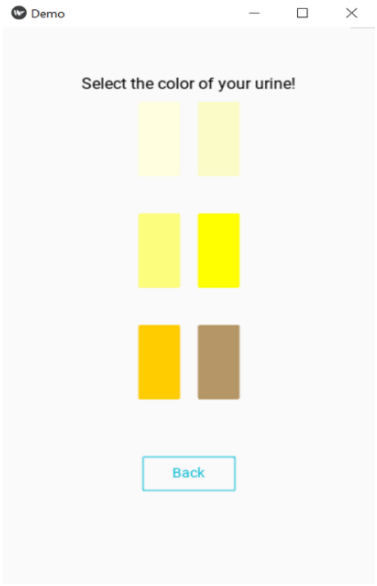
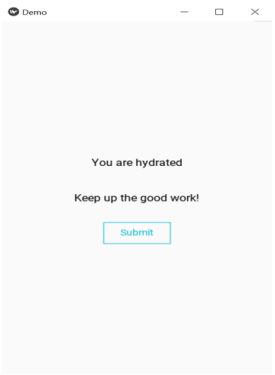
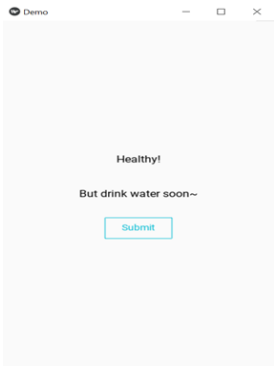


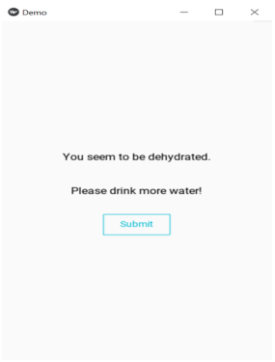
Figure 2. The Pee Log page. It is depicted with different colors of the urine.



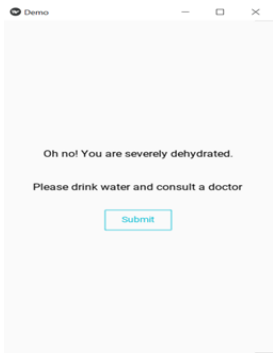
a. The depicted form signifies if the user is healthy and hydrated



b. The depicted form signifies if the user is healthy but a bit dehydrated



c. The depicted form signifies if the user is dehydrated and should drink more water soon



d. The depicted form signifies if the user is severely dehydrated and should consult the doctor

Figure 3 a-d. The possible results for Pee Log.

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The second button of the menu page, Poo Input, would show the page where the user can input the condition of their stool. Poo Input works the same way as Pee Input. Seven buttons are representing different shapes and textures of stool (Figure 4). These options are based on the Bristol stool chart. Type 1, with separate and hard lumps, indicates severe constipation; type 2, lumpy and sausage-like, indicate mild constipation; types 3 and 4 indicate a normal stool; type 5, soft blobs with clear-cut edges, indicates lack of fiber; type 6 with mushy consistency indicates mild diarrhea; type 7, liquid consistency and no solid pieces indicate severe diarrhea. The buttons representing types 3 and 4 would lead to a page that says "Your stool is normal" and "keep up the good work" (Figure 5a). Button for type 5 would show a page with a text saying "You lack fiber" and "Try to eat some more fiber" (Figure 5b). Button for type 2 and 6 will lead to a page with the text: "Your stool is normal. However, if the problem persists please consult a doctor" (Figure 5c). Button for types 1 and 7 will lead to a page with a message saying "Your stool is abnormal. Please seek medical attention" (Figure 5d). Herewith, as seen in figure 4, the most favorable stool form will be numbers 3 and 4. The other forms are considered malformed due to dehydration (Chumpitazi et al., 2010).

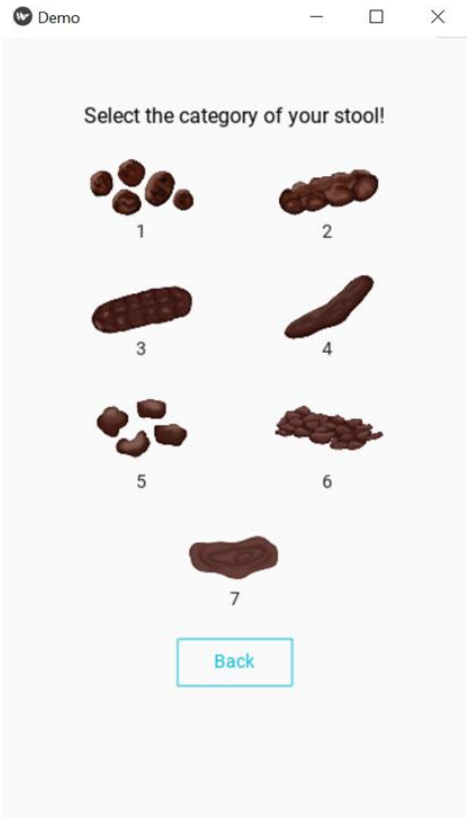
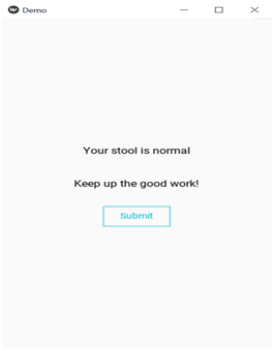
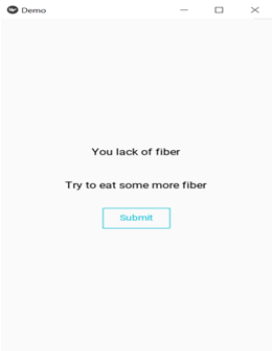


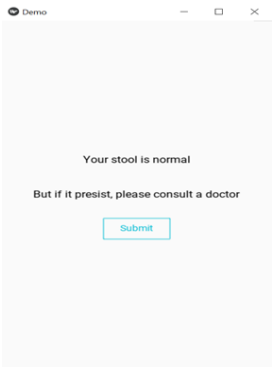
Figure 4. The Poo Log. It is depicted with different shapes of feces.



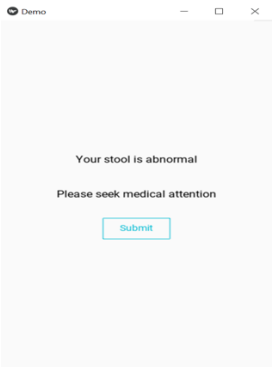
a. The depicted form signifies if the user is having normal stool



b. The depicted form signifies if the user's lack of fiber



a. The depicted form signifies if the user is having normal stool but caution should be there



b. The depicted form signifies if the user is having abnormal stool and doctor consultation is necessary

Figure 5 a-d. The possible results for Poo Log.

This application would send a reminder for users to drink water every time there's no submission from Pee Input detected in two and a half hours. The application would also send a notification when no new entry for the Poo Input is found within a week. In settings, users can alter some options (Figure 6). Users can turn off the notification from the Pee Input and/or the Poo Input. As seen in Figure 7, user can also enter their sleep time; within these hours no notification will be sent.

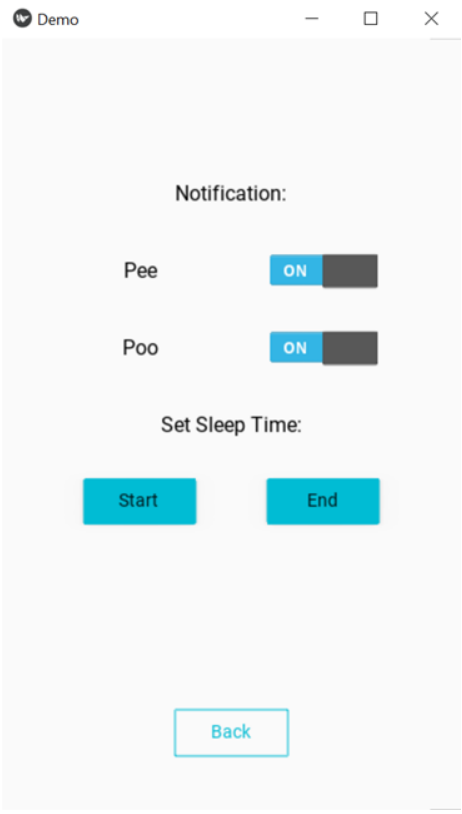


Figure 6. Settings. It is depicted in an easy-to-navigate manner to facilitate user configurations

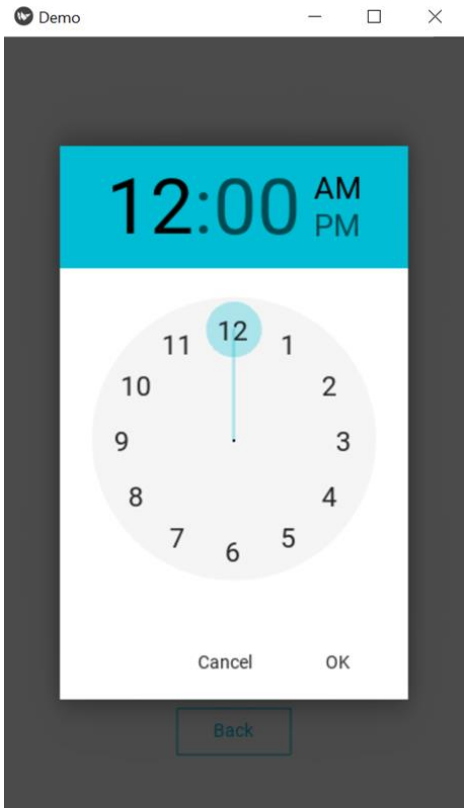


Figure 7. Set sleep time. The conventional system clock was deployed in this regard.

As seen in the user interface depictions, this project can elicit good assistance to ensure sufficient water intake for users. The effect of the application on users' habits has been elicited accordingly, and it is shown that the users enjoy its easiness and user-friendliness. Moreover, it could be concluded that the efficacy of this applet could be considered acceptable to our user.

Our research has elicited a combination of computer and life sciences for developing water intake applets for the users' health annotations. The streamlined user interface has enabled users to optimize this applet for their needs. However, one feature that is currently absent is the unavailability of an expert system, especially the medical one (Kobrinskii, 2020). It is important to provide medical expert judgment to users, so doctors can obtain useful medical annotations before meeting the patient (Broom, 2005). Moreover, visually impaired people will have difficulty in recognizing their feces and urine. In this regard, a more advanced proposal to leverage the gadget's camera to recognize the color and pattern of human excrement with artificial intelligence-based tools could be devised (Fogel & Kvedar, 2018). Although this kind of instrument has been successfully elicited in cancer diagnostics, further application in this area could be doable (Bernard & Parikesit, 2020). In the end, the future of the water intake applet for human excrement will be entering the further application of machine learning and big data.

CONCLUSIONS AND SUGGESTIONS

Conclusion

This water intake based on human excrement app provides a digital response to the user about their excrement condition after receiving the user's input. It will be expected that the risk of possibly lacking water in the human's body resulting in dehydration can be prevented. By tracking the result in the app, the users could obtain fine-grained information on their water intake level based on the color of the feces and urine. Moreover, it could be inferred that the graphical user interface-based deployment of the applet has enabled users in curating their own excrement data. The main pitfall of inability to use big data and machine learning should be addressed in the next version of the water intake applet. It is expected that the further improvement of this applet will be the deployment of large-scale user experience data, in order to cater for the machine learning approach of a more complex water-intake related disorder.

Suggestion

The significance of using this water intake applet has been elicited to limited respondents. However, the annotation for the rare condition or symptoms in the stool and urine category such as blood presence should be catered in order to facilitate user to seek immediate medical attention. Therefore, the effect on users who use this application and its correlation to their deeply-impacted hydration status has not yet been determined.

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