



Jade Huang / IST Task 3 - Biomedical Mechatronics

# Folio

Patient: Michelle



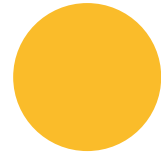
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## Statement of intent



I intend to make a biomedical device that helps Michelle make changes to her sedentary lifestyle. Michelle's mild, 'silent' heart attack indicates that she needs to make changes urgently to her sedentary behaviour and stress she experiences in the workplace which are major factors contributing to her high risk for cardiovascular disease.

My biomedical device will be a watch that displays a "Get Active!" message for Michelle every 2 hours. Michelle has to take some time to walk 500 steps every time this message appears on her the OLED display screen attached. She can walk around her workplace or go outside to walk. An accelerometer will detect when she starts moving and when it does the watch's 10 segment LED gauge bar will turn on and fill one bar each time she completes 500 steps. The OLED display screen will also change to show "number of steps done/5000 steps" when she starts moving. The watch can be turned on or off using a button.

From using my device, Michelle will decrease her risk of cardiovascular disease as it is scientifically proven that taking time to walk instead of sitting each day decreases it. The gauge bar and step counter will make Michelle be more aware of her responsibility to be active and motivate her to fill all 10 bars and 7000 steps. The recommended amount of steps adults should take daily is 10 000 steps. Since Michelle is not a very active person and is very busy, she will walk half the amount each day. This serves as a starting point to push her to exercise more so in the future she will have the motivation to move more herself and improve her health.

# Evaluation of existing ideas

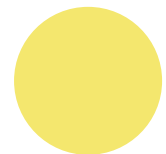
## Fitbit

Fitbit watches provide users with data about their daily physical activity.

Being able to view data about their step count, heart rate and calories burned helps them track their progress towards their exercise goals and keep them aware of their health. The data is easily accessible anywhere and the device can be used by anyone because it is an adjustable, slim wristwatch.

The increased awareness wearers have for their physical activity makes them feel responsible and motivated for improving it. Accumulating a large number of steps also gives them a feeling of satisfaction and pride.

However, Fitbits can be inaccurate with their measurements and can cause people to focus too much on numbers as a marker for their health which can be stressful and misleading.



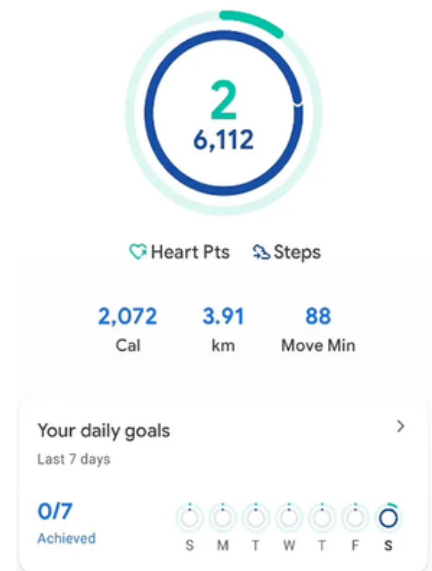
# Evaluation of existing ideas

## Google Fit

Google Fit is an app which enables users to track their physical activity.

Google Fit sets goals for the user and also has “heart points” which accumulate when users exercise. The goal setting forces users to exercise since they will feel guilty if they leave their goals at 0/7 achieved. The heart points are another source of motivation.

Google Fit doesn't track activities that don't involve movement of the user's GPS. This makes it not as useful for people who like to exercise that is in one place like running on treadmills, yoga and weight lifting.



## Sit-stand desk

A sit-stand desk is an adjustable desks that enables the user to raise its height when they want to take a break from sitting.

Desks like these give users freedom to stand up and sit during the day which decreases the risk of heart disease as they are breaking up their sitting time.

Sit-stand desks often cost \$200 to \$2000 depending on their features and quality. This could be too much to spend for some people. Standing up for a long time can also cause pain and soreness, so people unaware of this can be causing harm to themselves. People used to sitting may not have the motivation to stand up when necessary which defeats the whole function of the sit-stand desk.



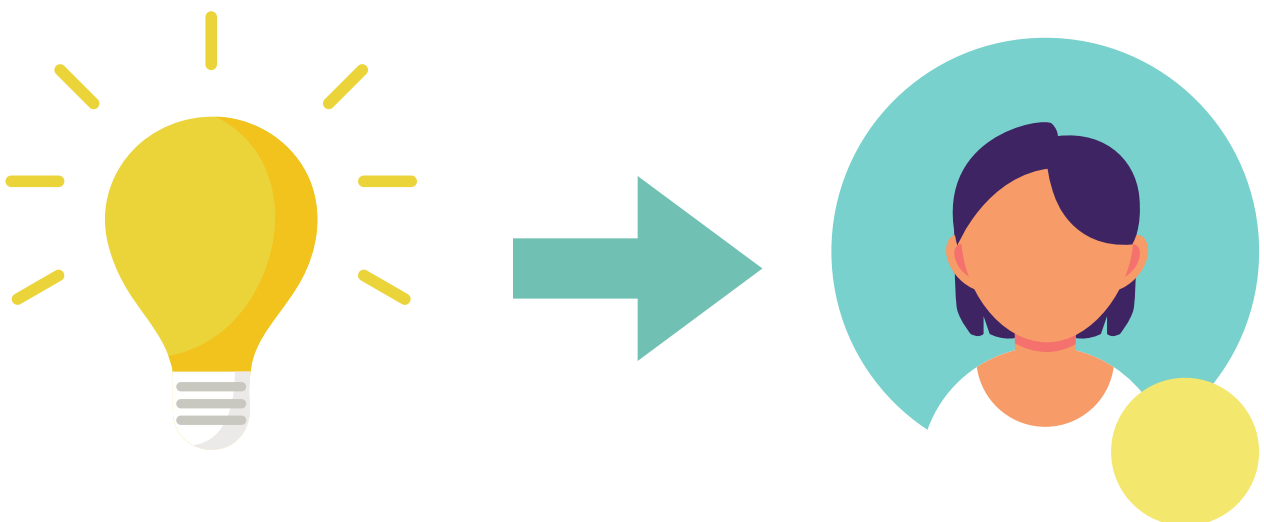
# Application of ideas to Michelle's needs

Fitbits' convenient watch shape will be the shape of my device because it's easy to wear when exercising. Michelle can also easily check her physical activity and be aware of how much she is doing.

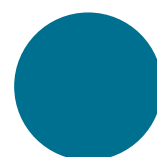
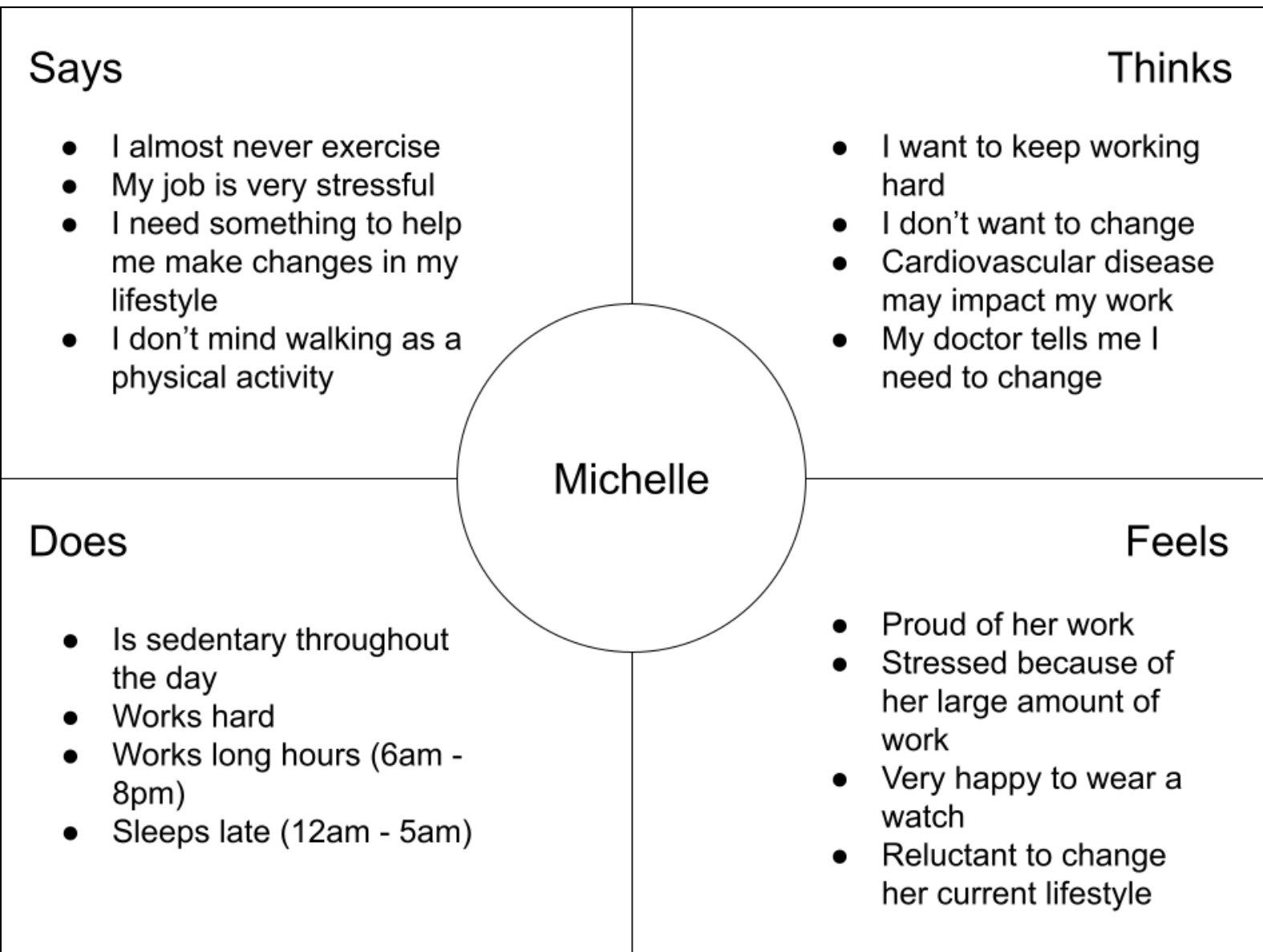
Google Fit and Fitbits both have a step count, which I will include on the watch using a step counter with the OLED screen since it will provide a workaholic like Michelle a reason to increase her physical activity.

Google Fit's forced goal setting is also another source of motivation for Michelle, so I will add a 10 segment LED gauge bar which fills up one gauge each time Michelle walks 500 steps.

Sit-stand desks can give Michelle an easy way to decrease her risk of heart disease. However, Michelle probably will not want to stand up as she sits down for most of the day. She has also stated that her workplace is stressful so changing the desk she is using may not benefit her and may make it worse since she has to force herself to stand up throughout the day. Instead, the watch will take her out of her stressful environment and outside, where it will be more comfortable and make her distanced from her work responsibilities.

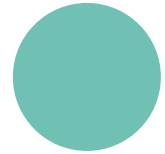


# Empathy map for Michelle



# Communications log

## With Michelle



From: Jade Huang <[jade.huang2@education.nsw.gov.au](mailto:jade.huang2@education.nsw.gov.au)>  
Sent: Wednesday, 11 October 2023 14:41  
To: Michelle <[Benjamin.Jones21@det.nsw.edu.au](mailto:Benjamin.Jones21@det.nsw.edu.au)>  
Subject: Michelle (IST biomedical mechatronics task)

Hi Michelle,

I have a few questions related to your biomedical solution.

1. What do you think of wearing a watch?
2. How often do you exercise?
3. What are your favourite physical activities?
4. When do you start and finish work?
5. When do you wake up and when do you go to sleep?

Thanks,

Jade

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On Thu, 12 Oct 2023 at 17:18, Michelle <[Benjamin.Jones21@det.nsw.edu.au](mailto:Benjamin.Jones21@det.nsw.edu.au)> wrote:

Hi Jade

Hope these answer your questions:

1. What do you think of wearing a watch? – very happy to
2. How often do you exercise? – at the moment never, don't tell my doctor
3. What are your favourite physical activities? I don't mind walking
4. When do you start and finish work? – I start about 6am and finish about 8pm
5. When do you wake up and when do you go to sleep? I sleep from midnight to 5am

Michelle



# Communications log

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On Thu, 12 Oct 2023 at 17:28, Jade Huang <[jade.huang2@education.nsw.gov.au](mailto:jade.huang2@education.nsw.gov.au)> wrote:

Hi Michelle,

Thanks for answering my previous questions. I hope you have time to answer a few more:

1. During work, are you active during breaks?
2. What causes your work to be stressful?
3. What helps you relax? For example: yoga, drinking tea, reading.
4. What is your work environment like? Is it comfortable?

Thanks,

Jade



## With referring specialist Ben Jones

From: Jade Huang <[jade.huang2@education.nsw.gov.au](mailto:jade.huang2@education.nsw.gov.au)>

Sent: Wednesday, 11 October 2023 3:00 PM

To: Ben Jones <[Benjamin.Jones21@det.nsw.edu.au](mailto:Benjamin.Jones21@det.nsw.edu.au)>

Subject: For Michelle's specialist (IST biomedical mechatronics task)

Hi Michelle's specialist,

I have a few questions for Michelle's biomedical solution.

1. What lifestyle changes does Michelle need to make?
2. What activities increase the risk of heart disease for her?
3. Why did Michelle have a mild heart attack two months ago?

Thank you,

Jade

# Communications log

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On Thu, 12 Oct 2023 at 17:12, Ben Jones <[Benjamin.Jones21@det.nsw.edu.au](mailto:Benjamin.Jones21@det.nsw.edu.au)> wrote:

Hi Jade

Michelle had a mild mayo cardiac infarction caused by a range of factors relating to her stress, diet and level of physical activity. She needs to engage in physical activity gradually and reduce her exposure to stress. Being sedentary while stressed (evident in an increased heart rate) is what she needs to avoid.

Ben Jones

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On Thu, 12 Oct 2023 at 17:33, Jade Huang <[jade.huang2@education.nsw.gov.au](mailto:jade.huang2@education.nsw.gov.au)> wrote:  
Thank you for the information.



# Impact of communication

## With Michelle

Michelle has said she is very happy to wear a watch which influenced my decision of making the device a watch since I can confirm she will be comfortable wearing one.

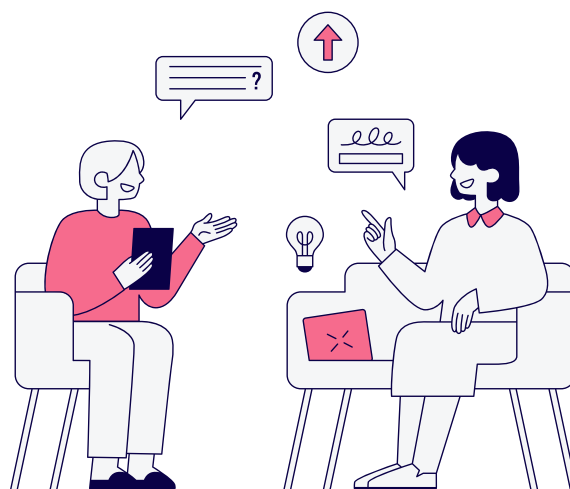
Michelle's lack of exercise indicates to me she is not an active type of person and forcing her to take 10 000 steps every day at once would probably too hard for her and she would be reluctant to do it. Instead, I will give her the goal of 5 000 steps per day which is half as difficult and therefore a more achievable task for her.

Michelle has stated that she "doesn't mind walking" so I have chosen walking as the form of daily exercise my watch prompts her to do.

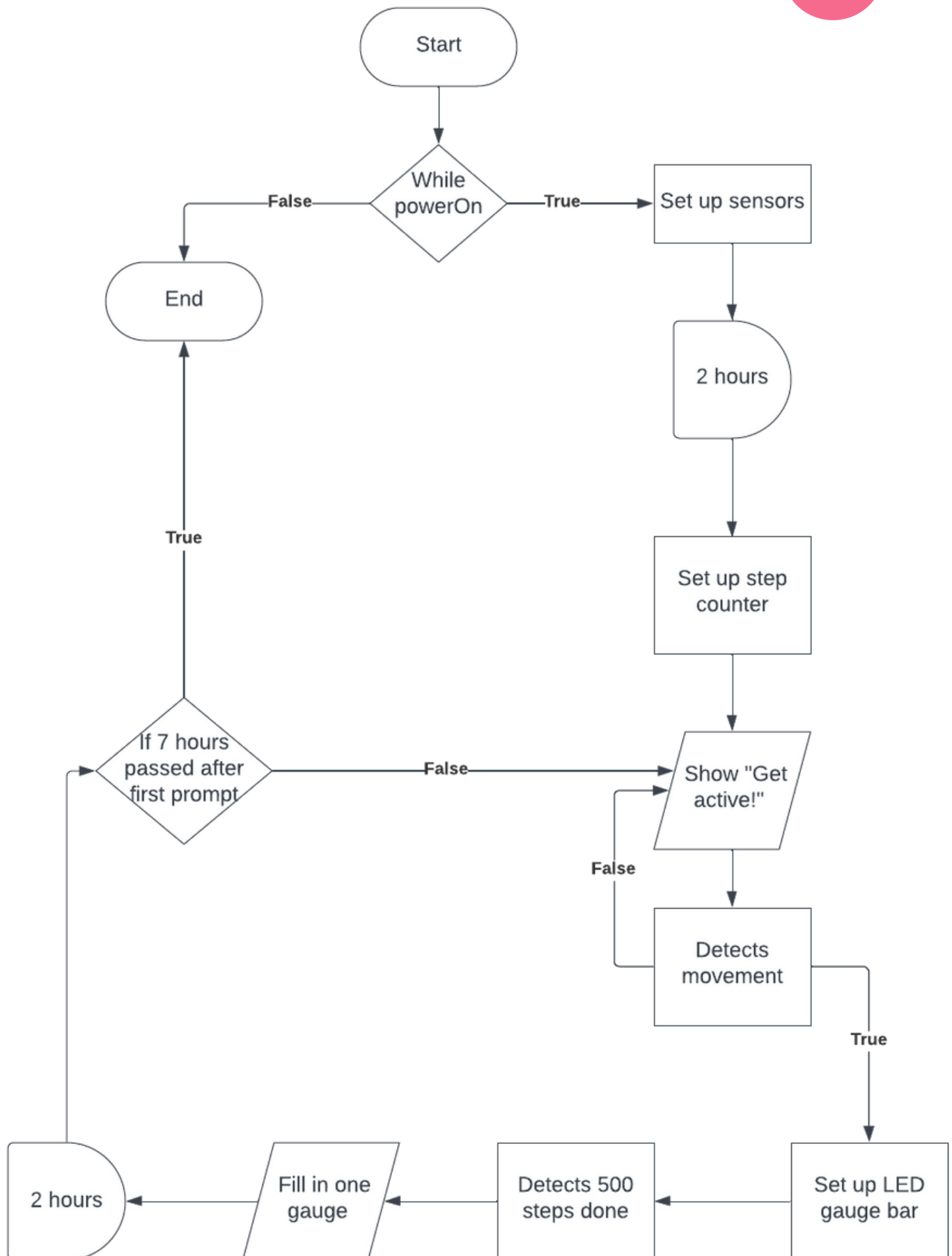
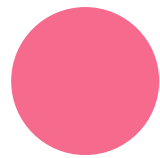
Michelle has said she works from 6am to 8pm which is 14 hours in total. I decided breaking this 14 hour block of time up into 7 two hour blocks with breaks in between divides her day neatly.

## With referring specialist Ben Jones

Mr Jones has explained that her level of stress and physical activity is what caused her heart attack. He states Michelle needs to "engage in physical activity gradually and reduce her exposure to stress". Being sedentary while stressed



# Logic flow chart



# Pseudocode

a = acceleration

s = steps

START

WHILE powerOn

SET UP OLED, accelerometer

DELAY 2 hours

SET UP step counter

IF a > 0 THEN

SET UP gauge bar

ELSE

DISPLAY "Get Active!"

END IF

LOOP WHEN s = 500

DISPLAY 1 filled gauge

DELAY 2 hours

IF 7 hours passed after first prompt

THEN powerOff

END IF

END LOOP

ENDWHILE

END

