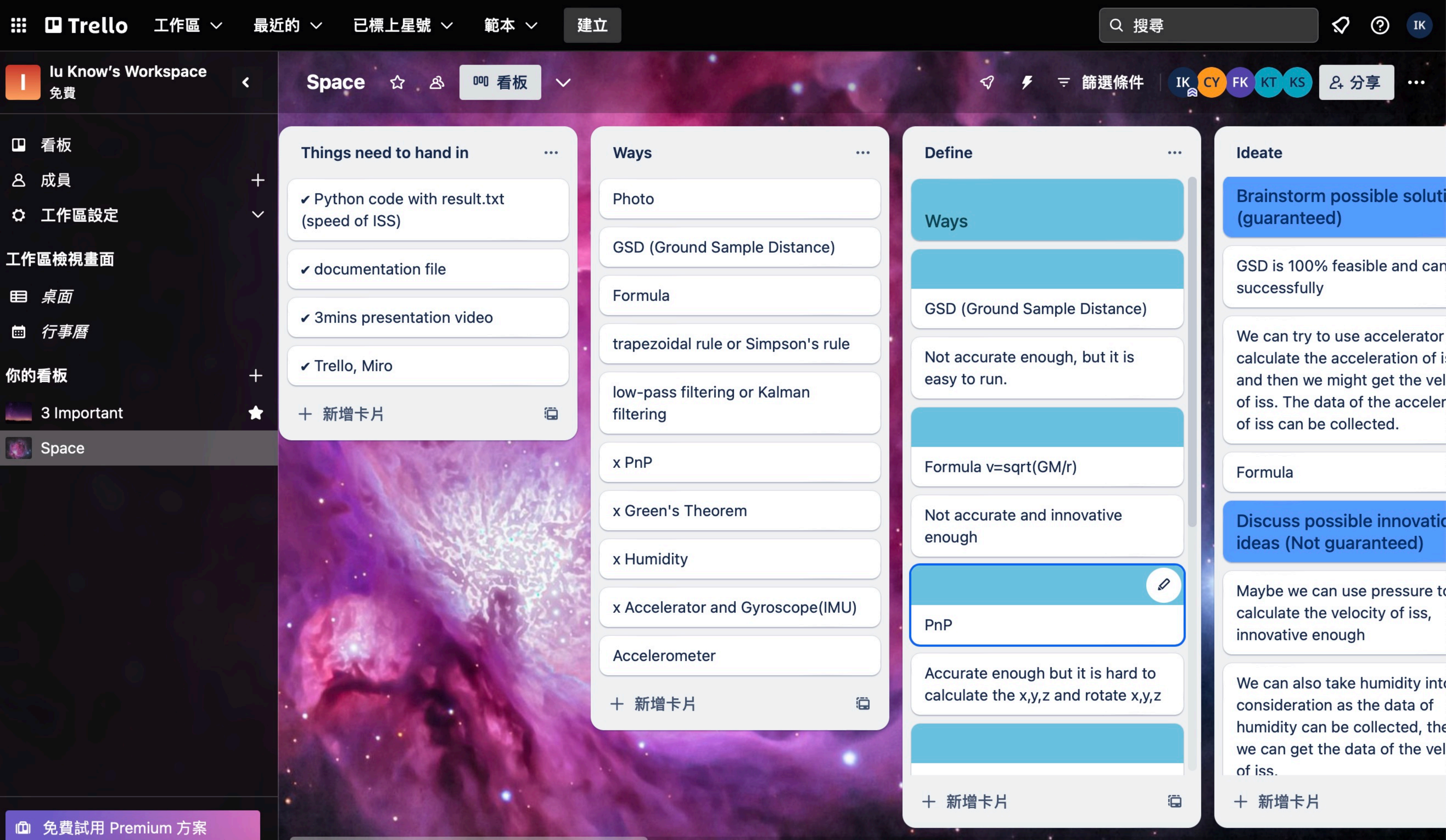
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Things need to hand in
✔ Python code with result.txt (speed of ISS)
✔ documentation file
✔ 3mins presentation video
✔ Trello, Miro
新增卡片
Ways
Photo
GSD (Ground Sample Distance)
Formula
trapezoidal rule or Simpson's rule
low-pass filtering or Kalman filtering
x PnP
x Green's Theorem
x Humidity
x Accelerator and Gyroscope(IMU)
Accelerometer
新增卡片
Define
Ways
GSD (Ground Sample Distance)
Not accurate enough, but it is easy to run.
Formula v=sqrt(GM/r)
Not accurate and innovative enough
PnP
Accurate enough but it is hard to calculate the x,y,z and rotate x,y,z
新增卡片
Ideate
Brainstorm possible soluti (guaranteed)
GSD is 100% feasible and can successfully
We can try to use accelerator calculate the acceleration of i and then we might get the vel of iss. The data of the acceler of iss can be collected.
Formula
Discuss possible innovatio ideas (Not guaranteed)
Maybe we can use pressure to calculate the velocity of iss, innovative enough
We can also take humidity into consideration as the data of humidity can be collected, the we can get the data of the vel of iss.
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Define

- PnP
- Accurate enough but it is hard to calculate the x,y,z and rotate x,y,z
- Green's Theorem
- Can do it, but not necessary, it is also hard to calculate
- Humidity
- Innovative enough, but have no idea how to calculate it so far
- Accelerator and Gyroscope
- Innovative enough, maybe we can do it

＋ 新增卡片

Ideate

- Brainstorm possible solution (guaranteed)
- GSD is 100% feasible and can run successfully
- We can try to use accelerator to calculate the acceleration of iss, and then we might get the velocity of iss. The data of the acceleration of iss can be collected.
- Formula
- Discuss possible innovation ideas (Not guaranteed)
- Maybe we can use pressure to calculate the velocity of iss, innovative enough
- We can also take humidity into consideration as the data of humidity can be collected, then we can get the data of the velocity of iss.

＋ 新增卡片

Empathize

- Ultimate goal: We have to calculate it correctly and innovatively
- What's the plan
- First we use GSD to calculate the solution then use accelerator to get the solution and finally add them together and divide by two

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Prototype

- Hands on work on building prototype of proof of conc

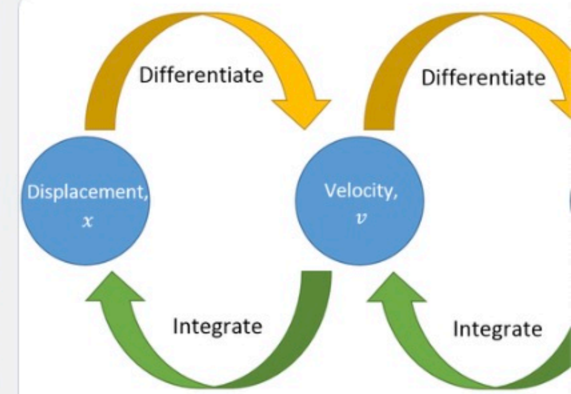

image.png
1

- Come up with required materials, technologies us software, hardware require
- CMD/Terminal
- Python
- HTML

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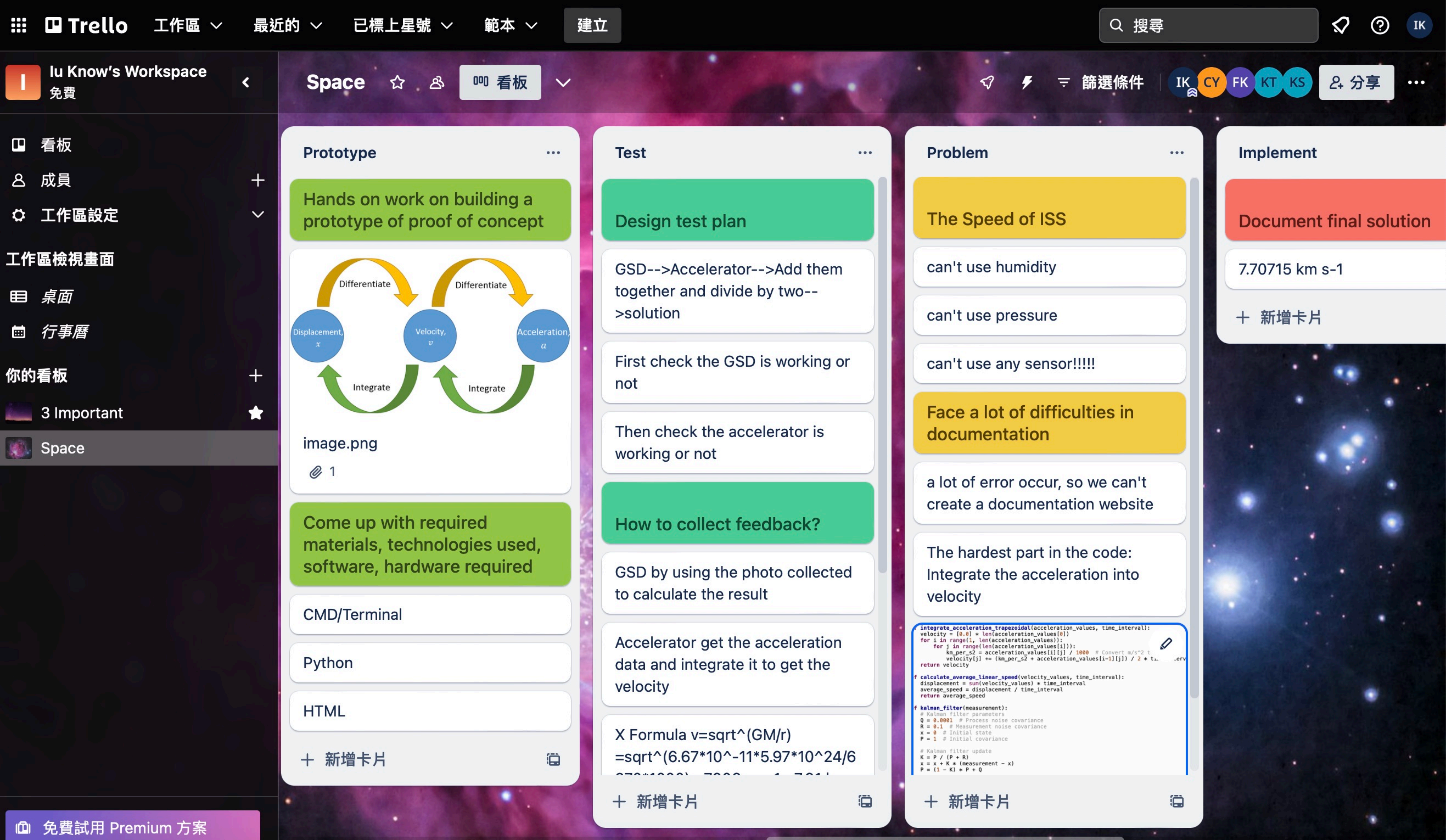

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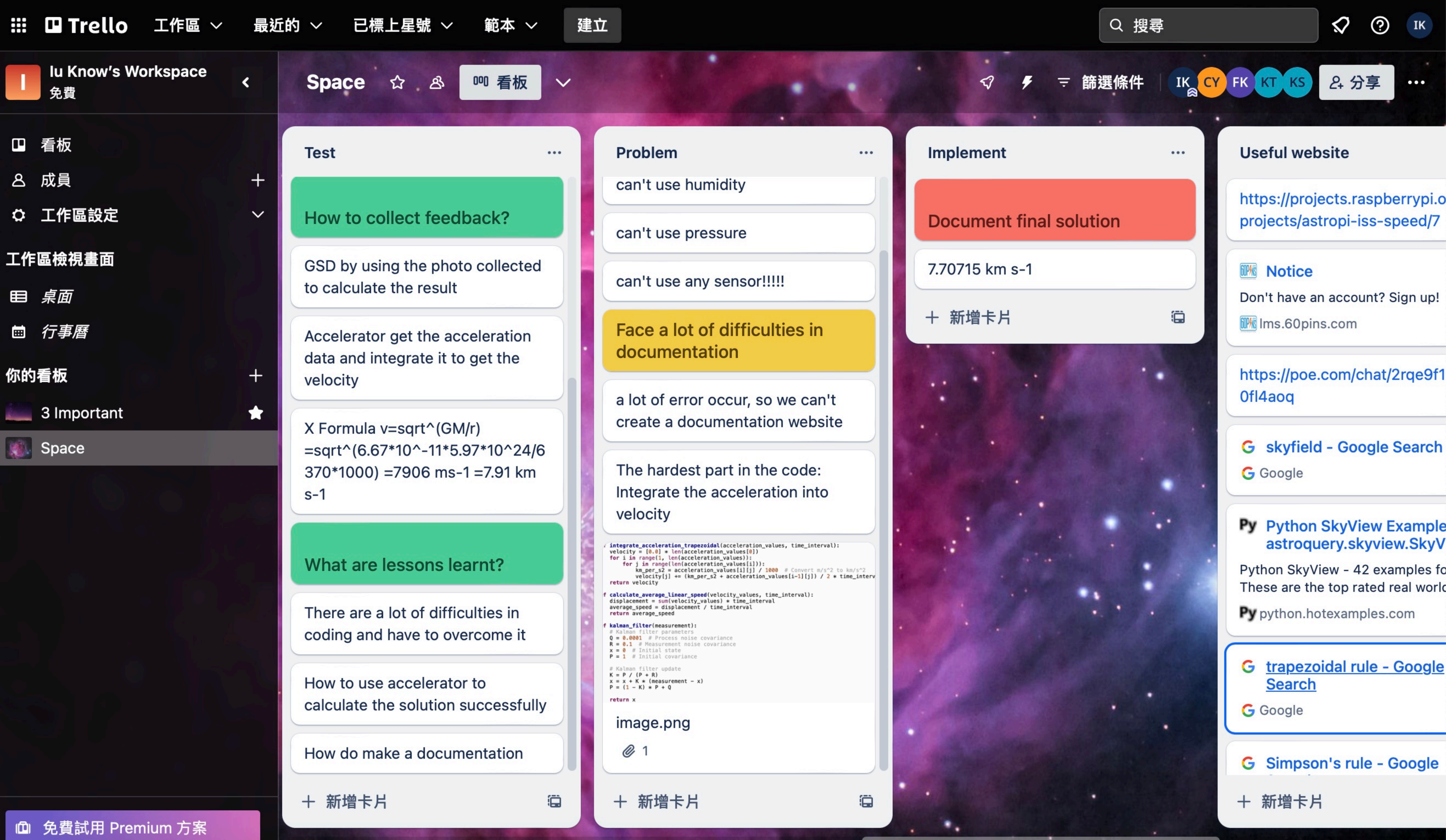
Prototype
Hands on work on building a prototype of proof of concept
Differentiate
Differentiate
Displacement, x
Velocity, v
Acceleration, a
Integrate
Integrate
image.png
1
Come up with required materials, technologies used, software, hardware required
CMD/Terminal
Python
HTML
新增卡片
Test
Design test plan
GSD-->Accelerator-->Add them together and divide by two-->solution
First check the GSD is working or not
Then check the accelerator is working or not
How to collect feedback?
GSD by using the photo collected to calculate the result
Accelerator get the acceleration data and integrate it to get the velocity
X Formula v=sqrt^(GM/r)
=sqrt^(6.67*10^-11*5.97*10^24/6
新增卡片
Problem
The Speed of ISS
can't use humidity
can't use pressure
can't use any sensor!!!!!
Face a lot of difficulties in documentation
a lot of error occur, so we can't create a documentation website
The hardest part in the code: Integrate the acceleration into velocity
integrate_acceleration_trapezoidal(acceleration_values, time_interval):
velocity = [0.0] * len(acceleration_values[0])
for i in range(1, len(acceleration_values)):
for j in range(len(acceleration_values[i])):
km_per_s2 = acceleration_values[i][j] / 1000 # Convert m/s^2
velocity[j] += (km_per_s2 + acceleration_values[i-1][j]) / 2 *
return velocity
calculate_average_linear_speed(velocity_values, time_interval):
displacement = sum(velocity_values) * time_interval
average_speed = displacement / time_interval
return average_speed
kalman_filter(measurement):
# Kalman filter parameters
Q = 0.0001 # Process noise covariance
R = 0.1 # Measurement noise covariance
x = 0 # Initial state
P = 1 # Initial covariance
# Kalman filter update
K = P / (P + R)
x = x + K * (measurement - x)
P = (1 - K) * P + Q
新增卡片
Implement
Document final solution
7.70715 km s-1
新增卡片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Test
How to collect feedback?
GSD by using the photo collected to calculate the result
Accelerator get the acceleration data and integrate it to get the velocity
X Formula v=sqrt^(GM/r) =sqrt^(6.67*10^-11*5.97*10^24/6 370*1000) =7906 ms-1 =7.91 km s-1
What are lessons learnt?
There are a lot of difficulties in coding and have to overcome it
How to use accelerator to calculate the solution successfully
How do make a documentation
新增卡片
Problem
can't use humidity
can't use pressure
can't use any sensor!!!!!
Face a lot of difficulties in documentation
a lot of error occur, so we can't create a documentation website
The hardest part in the code: Integrate the acceleration into velocity
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for i in range(1, len(acceleration_values)):
for j in range(len(acceleration_values[i])):
km_per_s2 = acceleration_values[i][j] / 1000 # Convert m/s^2 to km/s^2
velocity[j] += (km_per_s2 + acceleration_values[i-1][j]) / 2 * time_interv
return velocity
calculate_average_linear_speed(velocity_values, time_interval):
displacement = sum(velocity_values) * time_interval
average_speed = displacement / time_interval
return average_speed
kalman_filter(measurement):
# Kalman filter parameters
Q = 0.0001 # Process noise covariance
R = 0.1 # Measurement noise covariance
x = 0 # Initial state
P = 1 # Initial covariance
# Kalman filter update
K = P / (P + R)
x = x + K * (measurement - x)
P = (1 - K) * P + Q
return x
image.png
1
新增卡片
Implement
Document final solution
7.70715 km s-1
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Useful website
https://projects.raspberrypi.o projects/astropi-iss-speed/7
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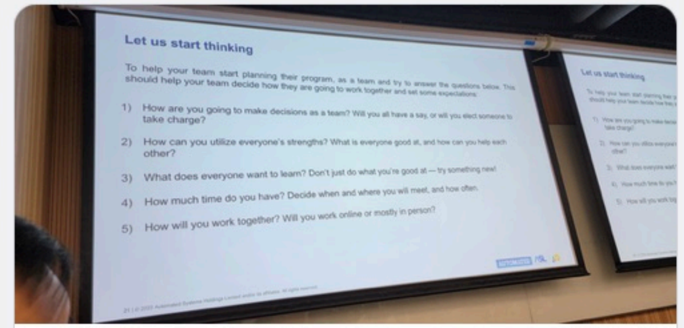

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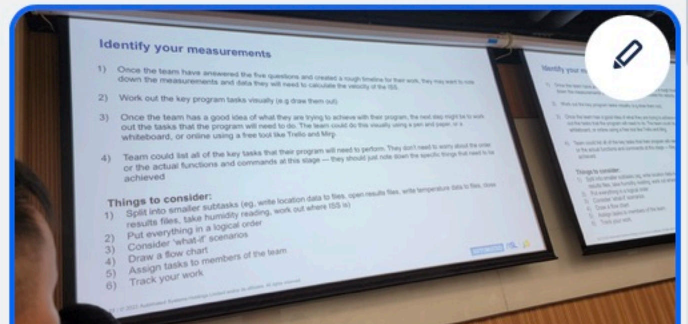

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PnP
https://blog.csdn.net/weixin_43949950/article/details/126348550

Nasa

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Low Earth orbit

A **low Earth orbit** (**LEO**) is an orbit around Earth with a period of 128 minutes or less and an eccentricity less than 0.25. Most of the artificial objects in outer space are in LEO, with an altitude never more than about one-third of the radius of Earth.

Decrease Error
1

ow do you find acceleration with an accelerometer?
he total acceleration is best described by a vector consisting of the x, y, and z omponents that you have from the accelerometer. The magnitude of the acceleration i he square root of the sum of the squares of each component, i.e. sqrt(x^2+y^2+z^2).
quora.com

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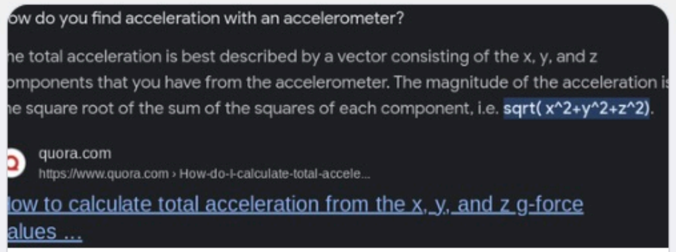

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Python
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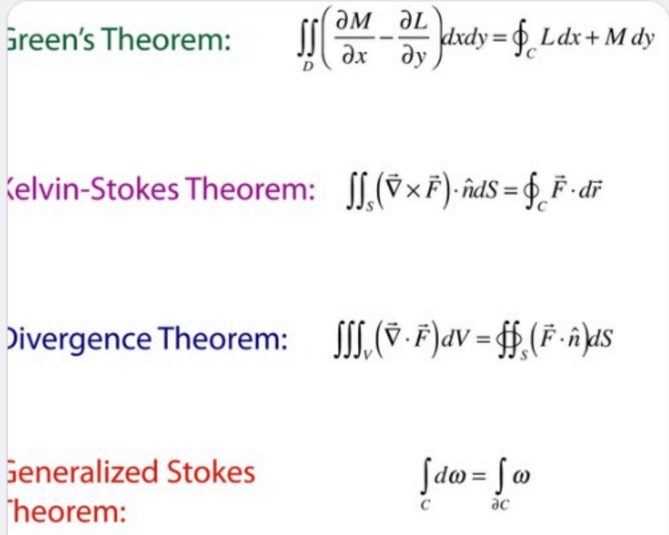

Green's Theorem(no need)
1

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