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Things need to hand in

- ✓ Python code with result.txt (speed of ISS)
- ✓ documentation file
- ✓ 3mins presentation video
- ✓ Trello, Miro

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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

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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

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Ideate

Brainstorm possible solutions (guaranteed)

GSD is 100% feasible and can be successfully calculated.
We can try to use accelerometer 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.

Discuss possible innovative 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.

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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

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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)
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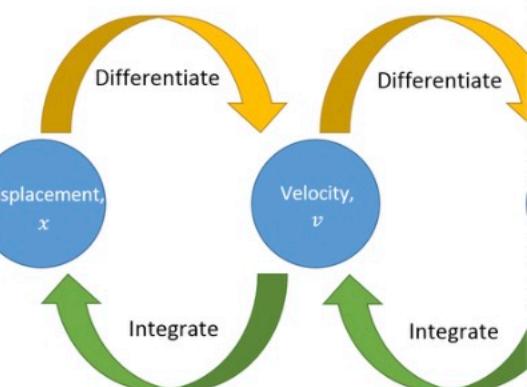
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Empathize ...

- 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 concept
- 
image.png
1
- Come up with required materials, technologies us software, hardware require
- CMD/Terminal
- Python
- HTML

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Prototype

Hands on work on building a prototype of proof of concept

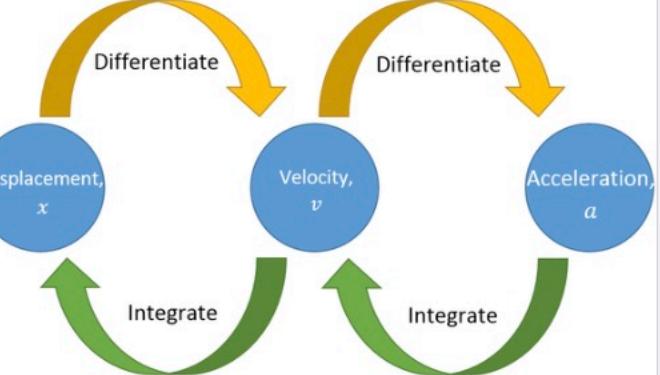


image.png

1

Come up with required materials, technologies used, software, hardware required

CMD/Terminal

Python

HTML

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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 $v = \sqrt{GM/r} = \sqrt{(6.67 \cdot 10^{-11} \cdot 5.97 \cdot 10^{24}) / (6.7 \cdot 10^6)}$

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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)
    for i in range(1, len(acceleration_values)):
        for j in range(i, len(acceleration_values)):
            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_interval
    return velocity

def calculate_average_linear_speed(velocity_values, time_interval):
    displacement = sum(velocity_values) * time_interval
    average_speed = displacement / time_interval
    return average_speed

def 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
```

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Implement

Document final solution

7.70715 km s⁻¹

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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 $v = \sqrt{GM/r}$
 $= \sqrt{(6.67 \cdot 10^{-11} \cdot 5.97 \cdot 10^{24}) / (370 \cdot 10^3)}$ $= 7906 \text{ ms}^{-1} = 7.91 \text{ km s}^{-1}$

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

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Problem

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The hardest part in the code:
Integrate the acceleration into velocity

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integrate_acceleration_trapezoidal(acceleration_values, time_interval):
    velocity = [0.0] * len(acceleration_values[0])
    for i in range(1, len(acceleration_values)):
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            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_interval
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    x = x + K * (measurement - x)
    P = (1 - K) * P + Q

    return x
```

image.png

1

Implement

Document final solution

7.70715 km s⁻¹

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Useful website

<https://projects.raspberrypi.org/projects/astropi-iss-speed/7>

Notice

Don't have an account? Sign up!

lms.60pins.com

<https://poe.com/chat/2rqe9f10fl4aoq>

skyfield - Google Search

Google

Python SkyView Example
`astroquery.skyview.SkyV`

Python SkyView - 42 examples for These are the top rated real world

`python.hotexamples.com`

trapezoidal rule - Google Search

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Simpson's rule - Google

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文章浏览阅读7k次，点赞21次，收藏62次。通过本文的学习，读者即可通过自... blog.csdn.net

Resources

Let us start thinking To help your team start planning their programs, as a team and try to answer the questions below. This should help your team decide how they are going to work together and set some expectations.

1) How are you going to make decisions as a team? Will you all have a say, or will you let someone to take charge?

2) How can you utilize everyone's strengths? What is everyone good at, and how can you help each other?

3) What does everyone want to learn? Don't just do what you're good at — try something new!

4) How much time do you have? Decide when and where you will meet, and how often.

5) How will you work together? Will you work online or mostly in person?

5 1

Identify your measurements Once the team have answered the five questions and created a rough timeline for their work, they may want to now down the measurements, and decide they will need to calculate the velocity of the ISS.

2) Work out the key program tasks they will need to do.

3) Once the team has a good idea of what they want to achieve with their program, the next step might be to work out the tasks that the program will need to do. The team could do this visually, using a pen and paper, or a whiteboard, or online using a free tool like Trello and Miro.

4) Team could list all of the key tasks that their program will need to perform. They don't need to worry about the or the actual functions and commands at this stage — they should just note down the specific things that need to be achieved.

Things to consider:

1) Split into smaller subtasks (e.g. write location data to file, open results file, write temperature data to file, etc.)

2) Consider everything in a logical order

3) Consider "what-if" scenarios

4) Draw a flow chart

5) Assign tasks to members of the team

6) Track your work

identify yourself

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

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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

How do you find acceleration with an accelerometer?
The total acceleration is best described by a vector consisting of the x, y, and z components that you have from the accelerometer. The magnitude of the acceleration is the 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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Resources

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quora.com https://www.quora.com/How-do-I-calculate-total-acceleration
How to calculate total acceleration from the x,y, and z g-force values ...

image.png

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Python

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Green's Theorem: $\iint_D \left(\frac{\partial M}{\partial x} - \frac{\partial L}{\partial y} \right) dx dy = \oint_C L dx + M dy$

Kelvin-Stokes Theorem: $\iint_S (\vec{\nabla} \times \vec{F}) \cdot \hat{n} dS = \oint_C \vec{F} \cdot d\vec{r}$

Divergence Theorem: $\iiint_V (\vec{\nabla} \cdot \vec{F}) dV = \iint_S (\vec{F} \cdot \hat{n}) dS$

Generalized Stokes Theorem: $\int_C d\omega = \int_{\partial C} \omega$

Green's Theorem(no need)

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