DEVELOPMENT OF VISUAL IDIOMS TO UNDERSTAND THE NECESSITY OF THE SPACE EXPLORATION

CSE3020(DATA VISUALIZATION – J COMPONENT)

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VIT Vellore Institute of Technology (Deemed to be University under section 3 of UGC Act, 1956)

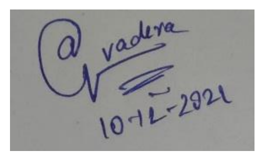
DECEMBER 9, 2021

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

DECLARATION:

I hereby declare that the report entitles “DEVELOPMENT OF VISUAL IDIOMS TO UNDERSTAND THE NECESSITY OF THE SPACE EXPLORATION” submitted by me, for the CSE3020 DATA VISUALISATION (EPJ) to VIT is a record of bonafide work carried out by me under the supervision of Dr. S. VENGADESWARAN.

I further declare that the work reported in this report has not been submitted and will not be submitted, either in part or in full, for any other courses in this institute or any other institute or university.



PLACE: VELLORE

DATE: 10-12-2021

SIGNATURE OF THE CANDIDATE

INDEX

1. ABSTRACT:

In the project we are going to export the topic of need of space exploration. As the topic is very vast we will mainly be focusing on three questions what dangers do we face in terms of asteroid impacts, how many past missions we had done and the possibility of any habitable planets. These three question will be answered using various visualization designs which best suited the topics and subtopics but the goal will be same to provide the viewer with some intuition about the need of space exploration by providing them with enough information so to keep their minds busy but not too much that the viewer is repelled by any visual clutter or over complexity. In the end the viewer should be able to understand the need of space exploration, will have the confidence that we as humans can overcome any hurdles and that there is hope for us.

2. INTRODUCTION:

2.1. OBJECTIVE

The objectives of the project are clear; to provide the viewer with the basic information about 3 basic things related to space exploration: dangers we face, past missions, possible habitable planets.

Now in these sections we need to provide various graphs and visual designs so that the viewers can be engaged in that for sufficient amount of time. That will require the graphs to be as visually appealing as possible and the visual clutter must be avoided.

The readability of the graphs must be high and by adding interactivity more information can be conveyed without using much extra space.

By keeping the design of the dashboard intuitive and simple we will encourage viewers to explore freely and take it at their pace. By accomplishing these the viewer will be satisfied with the knowledge that they gained and will have a new outlook towards space exploration.

2.2. PROBLEM STATEMENT

Space exploration is an essential task for the betterment of humanity and it can solve many of the problems faced by us as a species such as resource shortages, no backup in case of an extension level event, lack of motivation to solve new problems that comes with space exploration, etc.

These problems have always been there and at the time of space race the quest to make space accessible was pursued at full throttle. But in the last few decades everything slowed down, space exploration is now not seen as a necessity but as a burden that’s why in developed countries such as USA the budget for NASA is too low.

We should not forget that it was the space exploration that brought us GPS, solar cells, all the satellites and communication technology, etc.

The main problem is lack of motivation and through this project we are hoping to show people the need and feasibility of space exploration. We will be showing the past advancements of the humans in the field to show that it can be done then we will show the dangers we face in the form of asteroid impacts and lastly we will show the possible planets that are suitable for humans to Settle on if any situation occurs where we have to.

3. FUNCTIONAL REQUIREMENTS

System Features

DESCRIPTION:

We have 3 main datasets with their corresponding data visualizations:

1. Where we have been and our past missions:

   This particular data visualization helps us view our progress in space exploration and with some insights we can also estimate our future progress in the upcoming years

2. Danger to earth due to asteroids near us:

   A brief overview of the asteroids on a large scale that have collided with earth, their impact, deaths caused, size of asteroids etc. to estimate the impact of new asteroids and the damage they can cause based on past analysis.

3. Possible habitable planets and alien life:

   To predict whether exoplanets can support human life. This is accomplished by our past missions (NASA's Kepler mission: which helps us find habitable planets).

➢ Dashboard:

The home page for our project contains:

- The 3 data visualization links
- Feedback
- Suggestions

Functional Requirements:

- **Functionality (system feature)**

a) Dashboard
b) 3 sections to view few different types of graph
Those graphs may contain "where we have been", "Threats to Earth", "Possible habitable planets", etc.
c) Adding interactivity to the graph that might include but is not limited to zoom in zoom out, hover tooltip type information delivery, detailed explanation of the graph with the press of a button.
b) Carefully selected and tailored visual idioms to best represent the data fairly.

- **Accuracy and Fairness**

The data that has to be represented has been selected from the trusted sources and the visual idiom has to be selected so that it has a fair representation of the data and is not misleading in any way.

- **Variety in visualization**

Enough variety in the representation has to be provided so that the data can be understood with ease and the dashboard is appealing to look at.
This variety has to be ensured without creating any visual clutter and providing enough colors and interesting points of focus so that the viewer doesn't lose focus or interest.

- **View:**

Different views of data visualization provided to help users and researchers analyses according to their convenience. Views that might be available are:

- To compare or to find threshold values/ limits
  - Bar chart
    - Stacked bar char
    - Grouped bar chart

    - Pie chart
- Graphs to see overall growth
    - Line graph
    - Scatterplot
- Box plots
- Customize

- **Details-on-demand:**

    - Accurate and up-to-date records to be provided to the user for best analysis
    - Recommendations for a particular type of view should be given for chosen configurations (filter and search, etc.).
    - Graphs should be precise and easily understandable by users.

- **Filter and search:**

For accurate and relevant results users can filter their search results to match with the user's demandes.

- Time
    - Date
    - Month
    - Year
- Place
    - Country
    - State
    - City
- Time and Place
- View

4. DATA ABSTRACTION/DETAILS ABOUT THE DATASET:

1. Asteroid Prediction.

Dataset chosen for Analysis is: NEO Earth Close Approaches

Description:

A visualization of known and tracked Near Earth Asteroids, or NEAs that will make a close approach to Earth within the next 12 months, or have made a close approach within the last 12 months.

As they orbit the Sun, NEOs can occasionally approach close to Earth. Note that a “close” passage astronomically can be very far away in human terms: millions or even tens of millions of kilometers. CNEOS software detects predicted Earth close approaches for all known NEOs, in both the past and the future, and tabulates the close approach data organized by time.

Uncertainties:

This describes the limits placed on the Near Earth Objects close-approach tables and discusses the uncertainties in those data.

Format:

- Future (within a year): Nominal Distance <= 0.05au: No H limit

A data frame with 114 entries observations on 8 (attributes) variables.

- Past (within a year): Nominal Distance <= 0.05au: No H limit

A data frame with 1487 observations on 8 (attributes) variables.

Source : https://cneos.jpl.nasa.gov/ca/

We will be using a csv file for our purpose

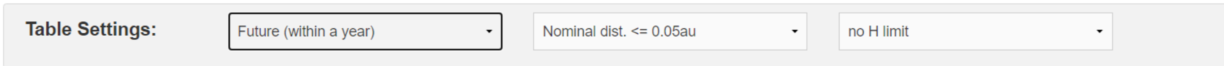
Our dataset will be stored in a csv format as follows:

Dataset Arguments:

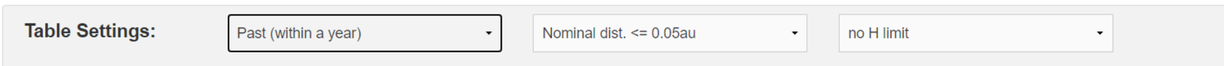
Table Settings:

We are including 2 datasets with table settings as:

Future (within a year): Nominal Distance <= 0.05au: No H limit



Past (within a year): Nominal Distance <= 0.05au: No H limit



Dataset is divided in two parts:

- Near Future (Within a year):

Summarizes the details of Close Earth Approaches from till date to next year

- Immediate Past (Within a year):

Summarizes the details of Close Earth Approaches from last year to till date

All the Attributes:

The Attributes in both the datasets is same the only difference is the content and the row items.

Variable(Attribute)	Description
Object	**Primary designation of the asteroid or comet(eg (2000 SG344)) and its orbit ID**
Close-Approach (CA) Date	**Time of Close-Approach(formatted calendar date/time, TDB) and Time uncertainty**
CA Distance Nominal (LD | au)	**Nominal Approach Distance - Earth Center to NEO center in (au)(astronomical unit) and LD(Lunar Distance)**
CA Distance Minimum (LD | au)	**Minimum (3-sigma) Approach Distance - Earth Center to NEO center in (au)(astronomical unit) and LD(Lunar Distance)**

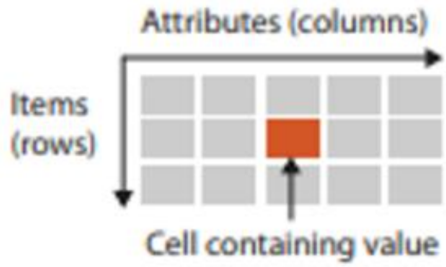
V relative (km/s)	**Object Velocity Relative to the Earth at close Approach(km/s)**
V infinity (km/s)	**Object Velocity Relative to a Massless Earth at close Approach(km/s)**
H (mag)	**Asteroid Absolute Magnitude H(mag)** **Smaller H -> Larger Asteroid diameter** **Undefined for comets**
Diameter	**Diameter of the body(km)** **Null if not known**

Data Types of the attributes

Variable(Attribute)	Datatype
Object	**Character**
Close-Approach (CA) Date	**Character**
CA Distance Nominal (LD | au)	**Character(Numeric but Stored as Character)**
CA Distance Minimum (LD | au)	**Character(Numeric but Stored as Character)**
V relative (km/s)	**Numeric(Decimal)**
V infinity (km/s)	**Numeric(Decimal)**
H (mag)	**Numeric(Decimal)**
Diameter	**Character(Numeric but Stored as Character)**

Data Abstraction:

- **Dataset:** Tables (Items, Attributes)
  1. Future (within a year): Nominal Distance <= 0.05au: No H limit
     A data frame with 114 entries observations on 8 (attributes) variables.
  2. Past (within a year): Nominal Distance <= 0.05au: No H limit
     A data frame with 1487 observations on 8 (attributes) variables.



Dataset Type: Qualitative or Quantitative

(Referring to the description given above)

1. Object – Qualitative
2. Close-Approach (CA) Date – Quantitative(Discrete)
3. CA Distance Nominal (LD | au)– Quantitative(Continuous)
4. CA Distance Minimum (LD | au)– Quantitative(Continuous)
5. V relative (km/s)- Quantitative(Continuous)
6. V infinity (km/s)– Quantitative(Continuous)
7. H (mag)– Quantitative(Continuous)
8. Diameter – Quantitative(Continuous)

Levels of Measurement:

- Object – Nominal (Names given to respective NEO's)
- Close-Approach (CA) Date – Interval (Difference between any 2 dates is meaningful as in what we call time lapse however there is no natural starting point)
- CA Distance Nominal (LD | au)– Ratio (Absolute Zero (Reached Earth)-0)
- CA Distance Minimum (LD | au)– Ratio (Absolute Zero (Reached Earth)-0)
- V relative (km/s)- Ratio (Absolute Zero (If the velocities of the object and Earth Is same)-0)
- V infinity (km/s)– Ratio (Absolute Zero (If the velocities of the object and Earth Is same)-0)
- H (mag)– Interval (The objects can be large beyond to our imagination as we have only been able to explore a handful of NEO's however there is no natural starting point)
- Diameter – Ratio (Absolute Zero (The objects can be as small as a stone and there exists a natural starting point as diameter can't be negative)-0)

2. Past Missions.

The dataset contains 8 attributes (columns)

1. Index
2. Company name: the name of the company that launched the rocket
3. Location: the address from which the rocket was launched
4. Datum: the date and time of the rocket launch
5. Details: the name and type of rocket launched
6. Status rocket: is the rocket still active or not
7. Rocket
8. Status mission: weather the missions was a success or a partial failure or prelaunch failure or failure

Dataset Type: Qualitative or Quantitative

- Index – Quantitative (Discrete)
- Company Name – Qualitative
- Location – Qualitative
- Datum – Quantitative (Discrete)
- Detail – Qualitative
- Status Rocket – Qualitative (StatusActive or StatusRetired)
- Rocket – Quantitative (Continuous)
- Status Mission – Qualitative (Success or Failure)

Levels of Measurement:

- Index– Ratio (Absolute Zero (Starting Position)-1)
- Company Name – Nominal
- Location – Nominal
- Datum – Interval (Difference between any 2 dates is meaningful as in what we call time lapse however there is no natural starting point)
- Detail – Nominal

- Status Rocket – Nominal

- Rocket – Ratio (Absolute Zero (Cost can't be negative)-0)

Status Mission – Nominal

```
> summary(x)
       X             Unnamed..0     Company.Name         Location             Datum               Detail            Status.Rocket         Rocket           Status.Mission
 Min.   :   0    Min.   :   0    Length:4324        Length:4324        Length:4324        Length:4324        Length:4324        Length:4324        Length:4324
 1st Qu.:1081    1st Qu.:1081    Class :character   Class :character   Class :character   Class :character   Class :character   Class :character   Class :character
 Median :2162    Median :2162    Mode  :character   Mode  :character   Mode  :character   Mode  :character   Mode  :character   Mode  :character   Mode  :character
 Mean   :2162    Mean   :2162
 3rd Qu.:3242    3rd Qu.:3242
 Max.   :4323    Max.   :4323
```

3. POSIBILTY OF LIFE IN SPACE

Data Abstraction:

- **Dataset:** Tables (Items, Attributes)
  A data frame with 4538 entries observations on 17 (attributes) variables.

- **Dataset Type: Qualitative or Quantitative**

  (Referring to the description given above)

  - Planet Name – Qualitative
  - Discovery Method – Qualitative
  - Discovery Year – Quantitative (Discrete)
  - Orbital Periods – Quantitative (Continuous)
  - Planet Radius – Quantitative(Continuous)
  - Planet Mass – Quantitative (Continuous)
  - Equilibrium Temperature – Quantitative (Continuous)
  - Stellar Effective Temperature – Quantitative (Continuous)
  - Stellar Radius – Quantitative (Continuous)
  - Stellar Mass – Quantitative (Continuous)
  - Stellar Surface Gravity – Quantitative (Continuous)

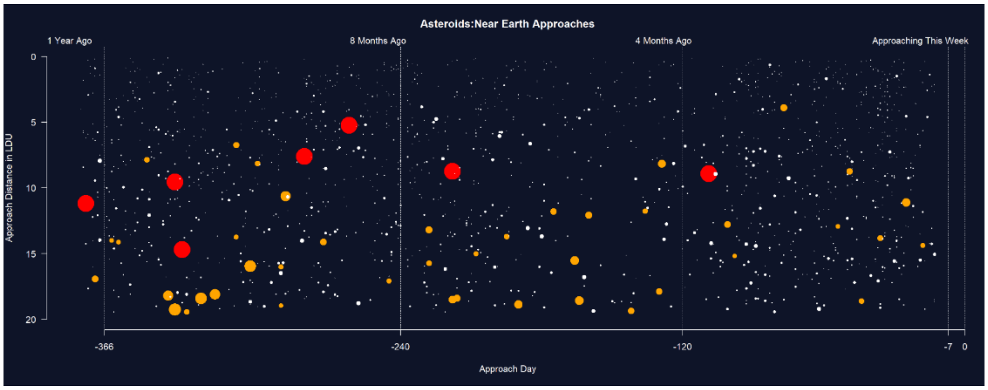
- **Levels of Measurement:**
  - Planet Name – Nominal
  - Host Name – Nominal

- Discovery Year – Interval (Difference between any 2 dates is meaningful as in what we call time lapse however there is no natural starting point)
- Orbital Periods – Ratio (Absolute Zero (Can't be negative it could be defined as time taken to revolve)-0)
- Planet Radius – Ratio (Absolute Zero (Can't be negative)-0)
- Planet Mass – Ratio (Absolute Zero (Can't be negative)-0)
- Equilibrium Temperature – Interval (Difference between any 2 temperatures is meaningful however there is no natural starting point aexo-body can even exist at temperatures that are even below what humans have recorded)
- Stellar Effective Temperature – Interval (Difference between any 2 temperatures is meaningful however there is no natural starting point aexo-body can even exist at temperatures that are even below what humans have recorded)
- Stellar Radius – Ratio (Absolute Zero (Can't be negative)-0)
- Stellar Mass – Ratio (Absolute Zero (Can't be negative)-0)
- Stellar Surface Gravity – Ratio (Absolute Zero (Can't be negative)-0)

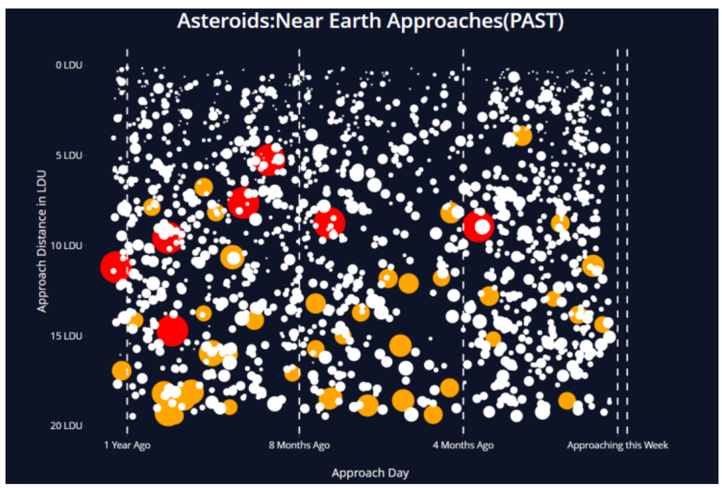
5. TASK ABSTRACTION

1. Relationship between app_day (Approach Day) and CA_Dis_Nom (Nominal Distance of closest approach to earth)

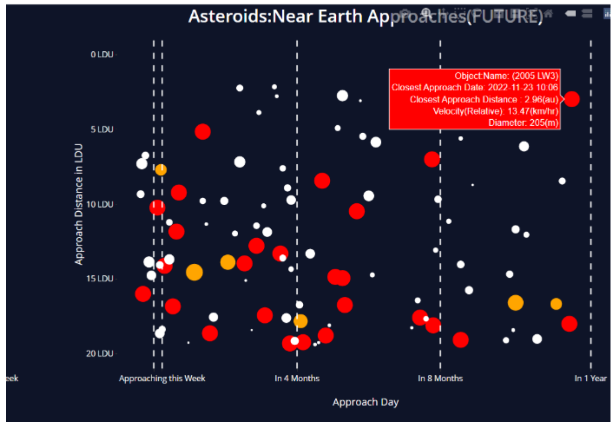
- The main goal of our analysis is to decide which asteroid might prove to be a danger to earth in near future or analysis of asteroids impacts to earth in past and learn from them also to accurately identify the time and date of impact.
- **Actions:**
  1. Analysing
     a. Consuming data
        i. Discovering and Presenting data



2. Search
    a. Target Unknown Location Known(Browse)
    We can get the location of the NEO by getting its time of approach and then we can browse in our visualization to find the perfect item.



3. Query
Analysis is to decide which asteroid might prove to be a danger to earth in near future or analysis of asteroids impacts to earth in past and learn from them also to accurately identify the time and date of impact.

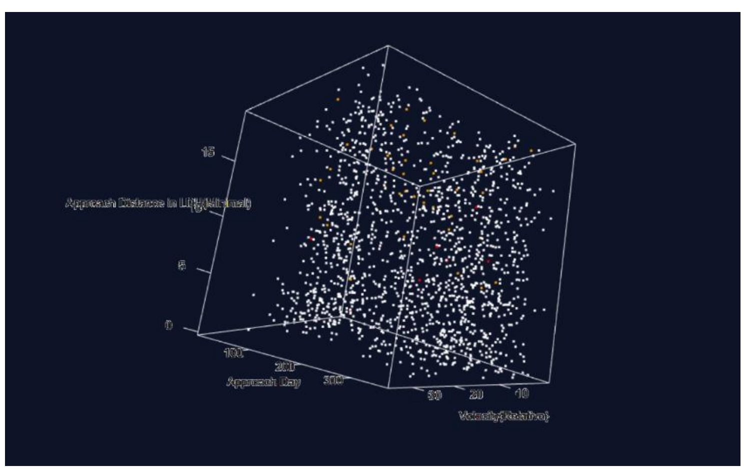


a. Identify

We will be providing interactivity for the above graph so that the user can identify a particular NEO and all the information related to it.

- **Targets:**
    1. Attributes
        a. Many
            - ✓ Dependency of NEO impact based on approach day and distance from earth
    2. All Data
        a. Features

        We will also be providing a 3d scatterplot for interactive intuition of NEO's impact on Earth

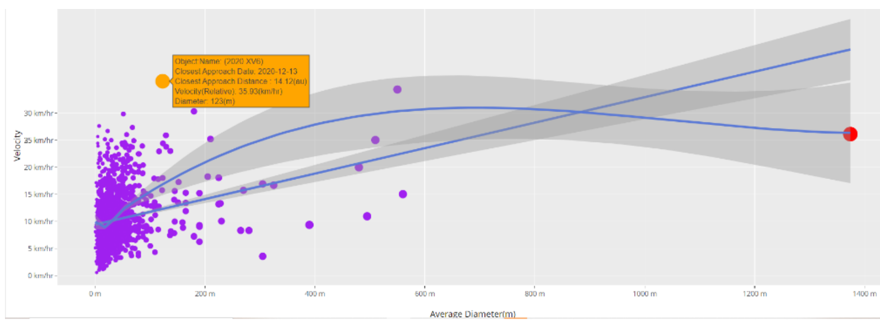


2. Visualizing the near Earth object database as velocity by diameter

- We can visualize the data with regard to diameter and velocity by plotting the objects. The immediate outliers in the data become apparent in the resulting graph. Two objects, in particular, represent the most extreme ends of the graph,
  They include [(2020 XV6)] and [(2016 AJ193)].

- **Actions:**

1. Analysing
    a. Consuming data
        i. Discovering and Presenting data



2. Query

   Finding the relationship between Average Diameter and Velocity of a NEO

    a. Identify
       Identifying the dangers to earth on the basis of the largest and the fastest moving NEO.
    b. Summary
       ✓ (2020 XV6) has the highest velocity in the dataset, at 35.93 km/s. (2016 AJ193) has the largest size at a mean of 1374m in diameter.

- **Targets:**
    - Attributes
        c. Many
           ✓ Showing the dependency of size of a NEO with its velocity
    - All Data

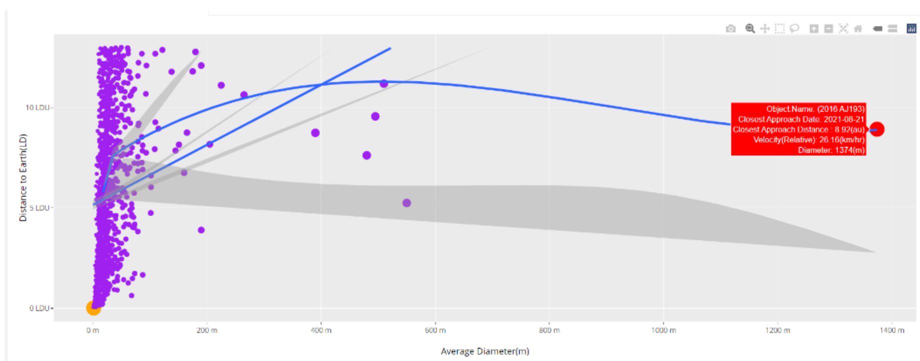
- Features
  - Shows the boxplot and smooth regression and regression line in out scatterplot

3. Visualizing the near Earth object database as distance by diameter

- We can visualize one of the most critical points with respect to Earth, by displaying the distance of each object by its corresponding size.
- The asteroid (2021 UA1) is the closest approaching object in the dataset. The asteroid will pass by Earth at an estimated distance of 0.02 lunar distance.

Actions:

1. Analysing
   a. Consuming data
      ii. Discovering and Presenting data



2. Search
   a. Target known Location Known(Lookup)
   The asteroid (2021 UA1), highlighted in red, represents the closest approaching object to Earth included in the dataset.

3. Query

   Finding the closest approaching NEO towards earth

   a. Identify

Identifying the dangers to earth on the basis of the largest and the closest approaching NEO.

b. Summary

- ✓ The asteroid (2021 UA1) is the closest approaching object in the dataset. The asteroid will pass by Earth at an estimated distance of 0.02 lunar distance.

- ♦ **Targets:**
  - Attributes

c. Many

- ✓ Showing the dependency of size of a NEO with its velocity

- All Data
  - o Features
    - ▪ Shows the boxplot and smooth regression and regression line in out scatterplot

4. Visualizing the near Earth object database as distance by velocity

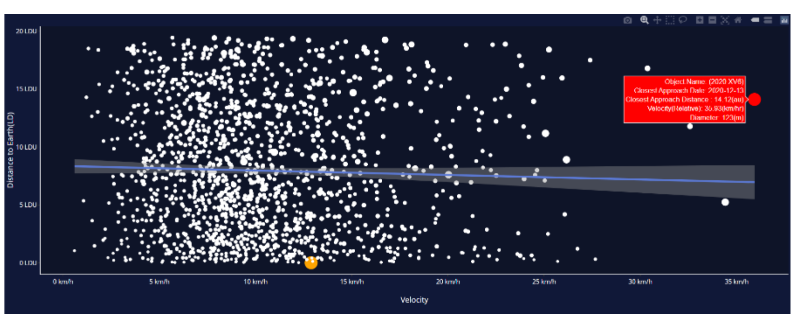
- We can visualize one of the most critical points with respect to Earth, by displaying the distance of each object by its corresponding velocity.
- The velocity of (2016 AJ193) also displays as an outlier, with regard to the dataset.

Actions:

1.. Analysing

d. Consuming data

iii. Discovering and Presenting data



2.. Search

e. Target known Location Known(Lookup)
The asteroid (2016 AJ193), highlighted in red, represents the fastest moving and (2021 UA1) is the closest approaching object within the dataset.

3.. Query

Finding the fastest moving NEO towards earth

f. Identify
Identifying the dangers to earth on the basis of the fastest moving and the closest approaching NEO.

g. Summary
✓ The asteroid (2016 AJ193), highlighted in red, represents the fastest moving and (2021 UA1) is the closest approaching object within the dataset

♦ **Targets:**

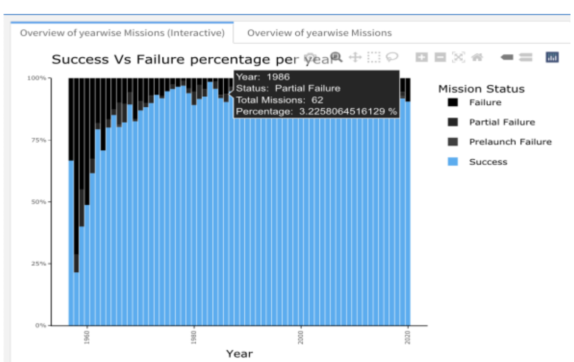
- Attributes

h. Many
✓ Showing the V_Infinity of a NEO

2.. **PAST MISSIONS:**

1) **Year-wise total contribution with success and failure rate**

The main goal of this graph is to show how the success rate of missions has changed over the years in the interactive version one can hover and find out the exact number of missions launched that year.



Now in the non-interactive version of the graph we can see the relative number of missions per year as the line on the bar graph that will help us visualize the amount of missions in comparison to the success and failure rate.

Action

Consume

Present

Search

Looking up the year wise missions and success and failure rates

Query

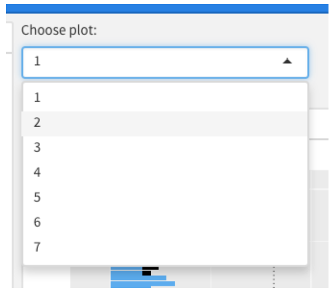
Compare the yearly difference in success rates and number of missions

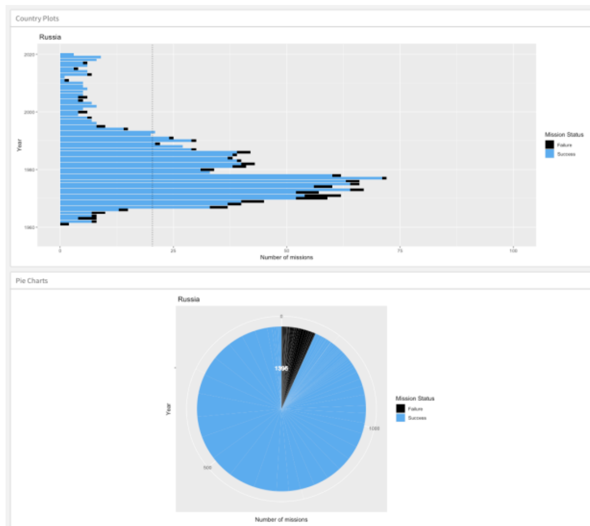
Target

A trend can be seen in the space race era and the covid era.

2) **Year wise contribution by each countries with success and failure rate**

in this group of graph using the dropdown menu one can find the top contributors in the field and their year wise contributions with year wise success and failures. A mean line is also present to show the average contribution of each country.
here with each bar plot a pie chart is also provided to know the overall number of success and failures for that country.





Action

Consume

Present and discover the countries that contributed the most

Search

Looking up the countries with most contributions and the success and failure rates over the year

Query

Compare the success rates and the overall contributions of the countries over the decades

Target

A trend can be seen in the space race era but only in USA and Russia and the trend in covid era can be seen in every country.

3.. POSIBILITY OF LIFE IN SPACE

1. Relationship between Stellar Surface Gravity (log10(cm/s**2)) and habitability

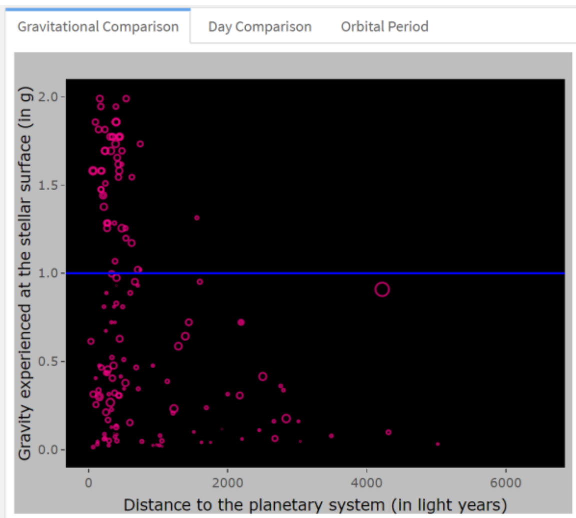
- Life is not possible on planets with relatively large or less gravity as compared to Earth. It is not possible to make a civilization with buildings, etc on a planet with less gravity. Everything would be loosely held to the surface of the planet and humans would be crushed under a high gravity. Hence, the probable safe range would be 0.5g to 2g .

♦ **Actions:**

1. Analysing:

a. Consuming data

i. Discovering and Presenting data



2. Search

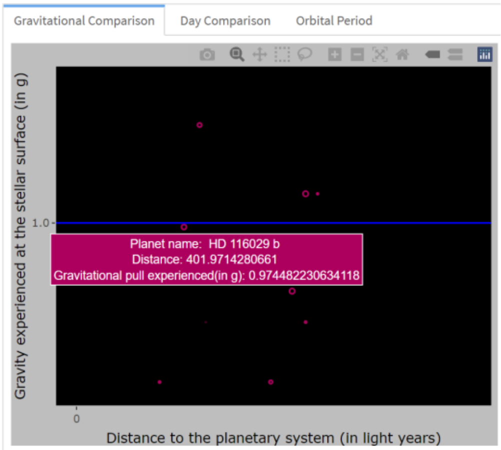
b. Target known Location Known(Lookup)

The most suitable planets for living are the ones closer to the line y=1g or gravity=1g. We can get these by zooming in the area near the line and hovering on the planet gives us information about the planet.

Channel used: earth radius(radius of planets in units of earth radius) scaled down further more.

3. Query

Analysis is to decide which planets aren't habitable for life and hence we have not plotted planets not lying in the range 0.5 g to 2g. The ylim is set such that only planets that may be habitable are focused at.



a. Compare

We will be providing interactivity for the above graph so that the user can identify a particular planet and all the information related to it.

- **Targets:**

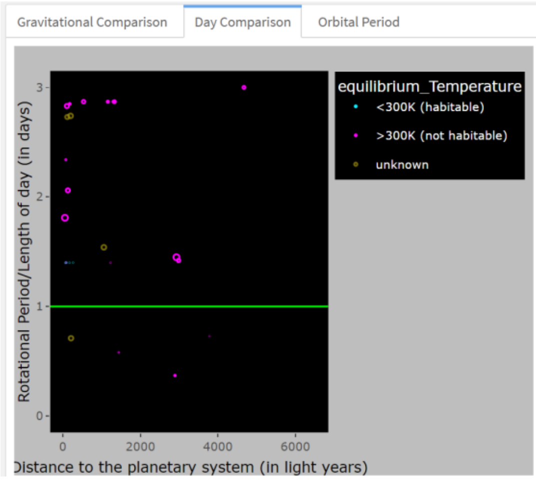
3. Attributes
   a. Many
      - ✓ Dependency of habitability on many factors as discussed before
4. All Data
   a. Features
      A set of suitable planets has to be selected which will further be filtered based on other attributes which affect habitability.

3.. Relationship between Rotational period and Temperature for habitability

- We can visualize the data with regard to diameter and rotational period of the planet by plotting them against the planet's distance from earth in light years so that we also get the information of how far the planets is.

- **Actions:**

5. Analysing
   a. Consuming data
      i. Discovering and Presenting data



6. Query

Finding the habitable planets which have temperature < 300K as earth's equilibrium temperature is 255K. So we have taken temperatures less than 300 K in acceptable range (displayed in blue). Channel used: color,

Size(Jupiter size as it doesn't need to be scaled down like that of Earth's)

a. Compare
   - ✓ (LP 714-47 b), (LTT 9779 b) and (LTT 3780 c) lie in the habitable region

- ♦ **Targets:**
  - Attributes
    b. Many

    Dependency of habitability on many factors as discussed before

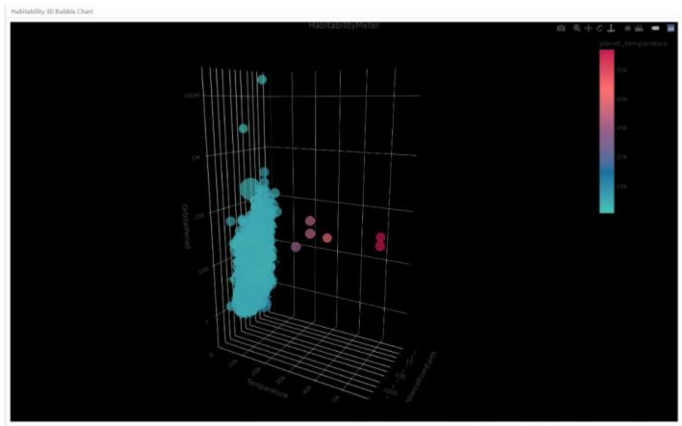
  - All Data
    - Features

Habitability meter

- The following graph is a habitability meter which is presented in the form of a 3D bubble chart which plots the following attributes on the x, y and z scale respectively
  1. Orbital period
  2. Distance from earth
  3. Temperature
  4. Size of the planet is proportional to the size of the bubble in the chart below.

Actions:

4. Analysing
    a. Consuming data
        ii. Discovering and Presenting data



5. Search
    a. Target unknown Location Known(Browse)

6. Query

Finding the most suitable habitable planet

- ○ Compare

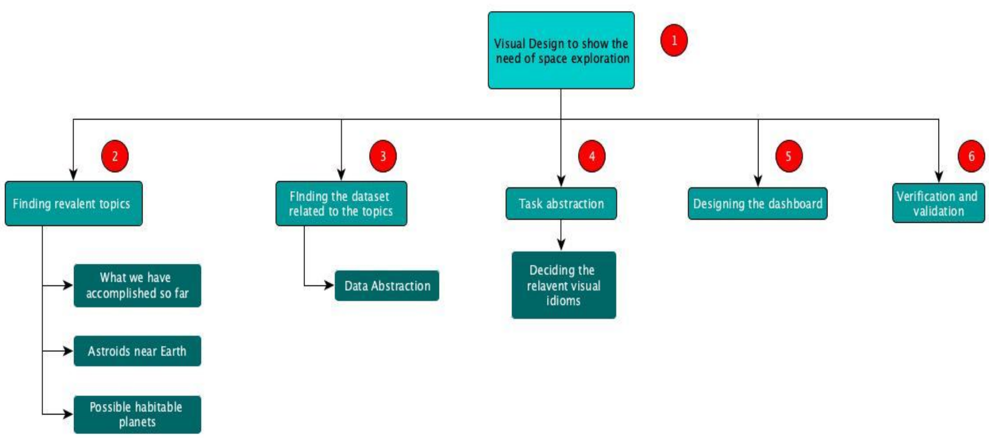
♦ **Targets:**

- Attributes
    a. Many
- All Data
    - ○ Features
        - ▪ Shows the #D scatterplot.
    - ○ Trend
        - ✓ Most of the planets that we see have a temperature range of 0-10k. Very less planets have temperature more than 10k shown in red.

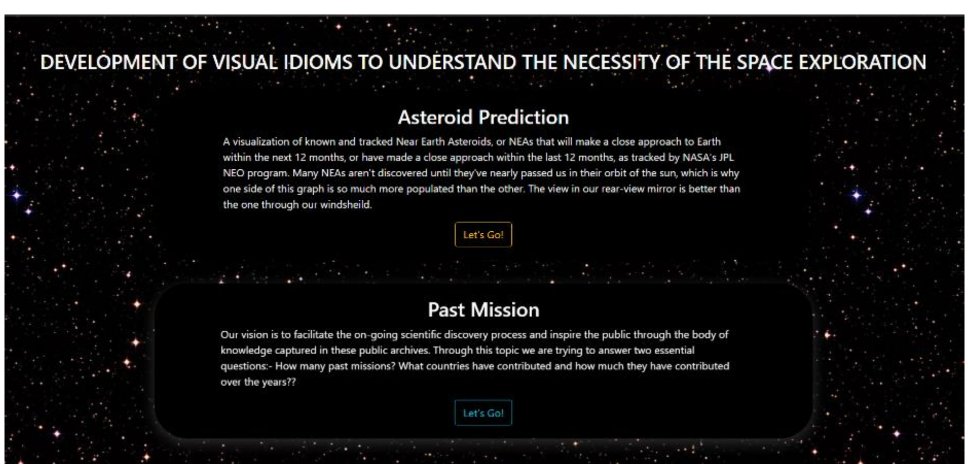
6. WORKFLOW AND WORK BREAKDOWN STRUCTURE(WBS):

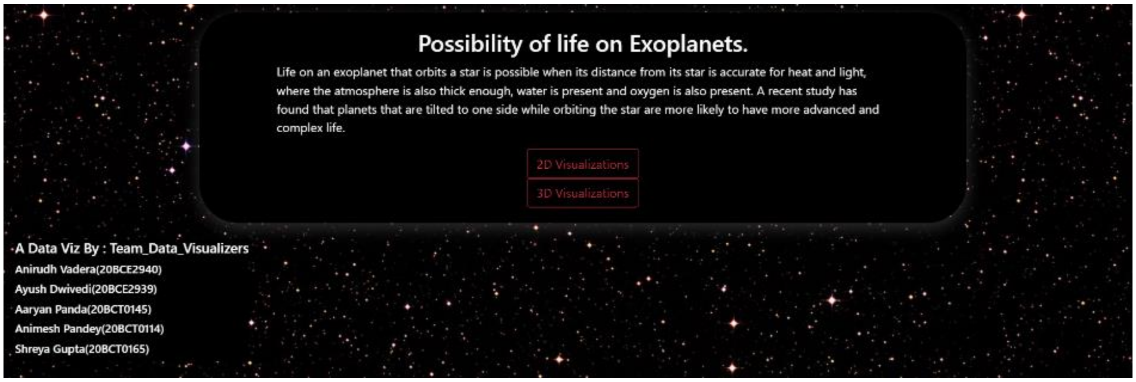
First it has to be decide what relevant topic has to be chosen as the title of the project is vast and abstract. After the topics have been chosen the data set has to be explored to get the most accurate and relevant ones to ensure the fairness towards the goal i.e. to show the necessity of space exploration. After the dataset have Benn chosen then data abstraction has to be done to properly understand the data and make it more accessible for others to understand if needed.

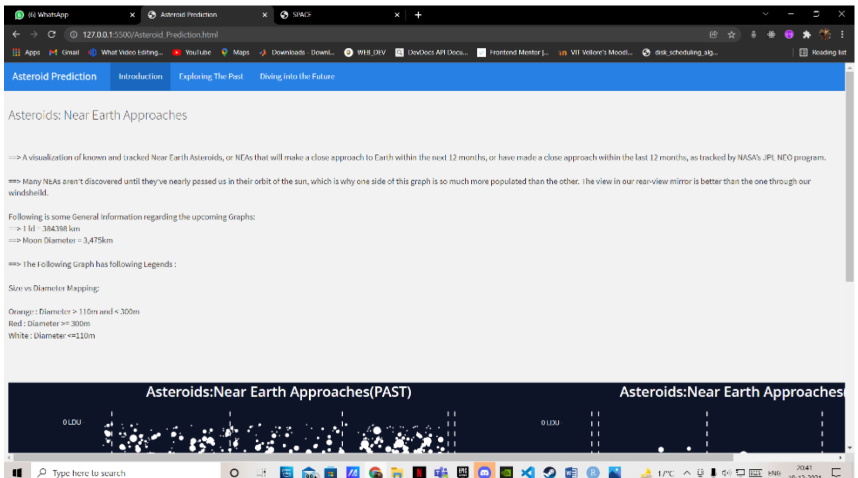
Then comes the task abstraction and selecting the appropriate visual idioms to portray the data in an orderly fashion to create a beautiful and stunning dashboard to fairly represent the data and finally the. Verification and validation has to be done to make sure that the project is correct and acceptable.

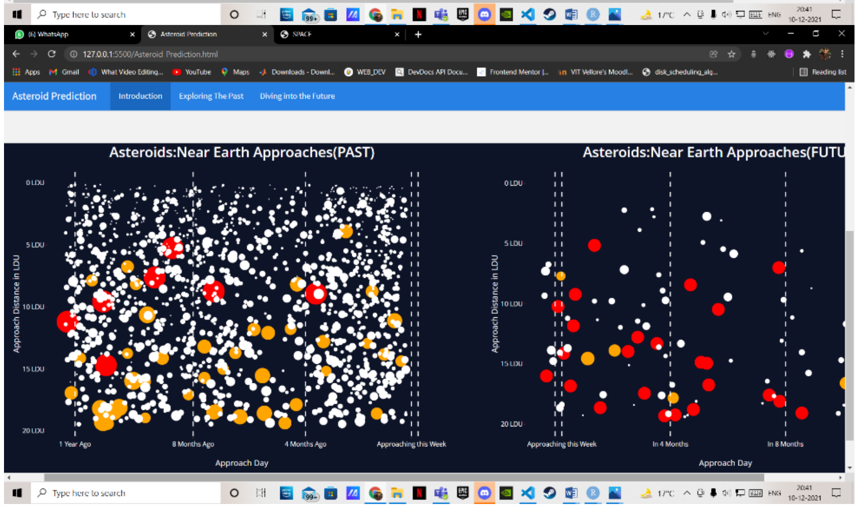


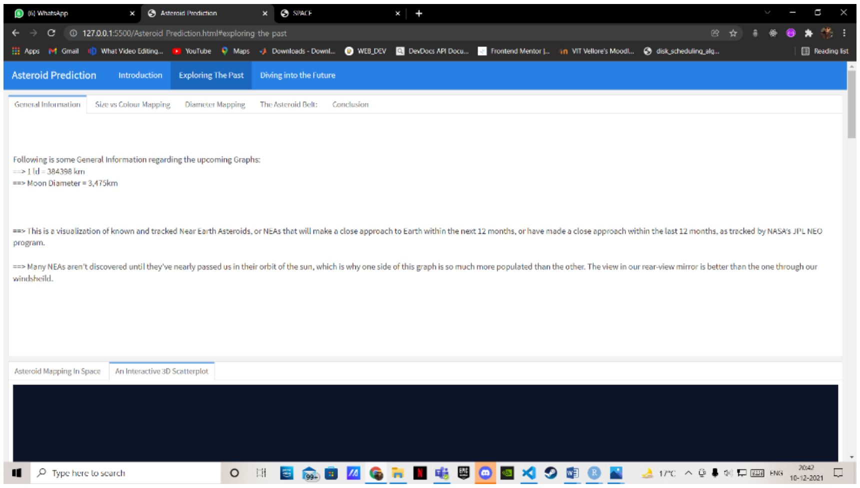
7. DASHBOARD IMPLEMENTATION:




Possibility of life on Exoplanets.
Life on an exoplanet that orbits a star is possible when its distance from its star is accurate for heat and light, where the atmosphere is also thick enough, water is present and oxygen is also present. A recent study has found that planets that are tilted to one side while orbiting the star are more likely to have more advanced and complex life.
2D Visualizations
3D Visualizations
A Data Viz By : Team_Data_Visualizers
Anirudh Vadera(20BCE2940)
Ayush Dwivedi(20BCE2939)
Aaryan Panda(20BCT0145)
Animesh Pandey(20BCT0114)
Shreya Gupta(20BCT0165)


127.0.0.1:5500/Asteroid_Prediction.html
Asteroid Prediction
Introduction
Exploring The Past
Diving into the Future
Asteroids: Near Earth Approaches
==> A visualization of known and tracked Near Earth Asteroids, or NEAs that will make a close approach to Earth within the next 12 months, or have made a close approach within the last 12 months, as tracked by NASA's JPL NEO program.
==> Many NEAs aren't discovered until they've nearly passed us in their orbit of the sun, which is why one side of this graph is so much more populated than the other. The view in our rear-view mirror is better than the one through our windsheild.
Following is some General Information regarding the upcoming Graphs:
==> 1 ld = 384398 km
==> Moon Diameter = 3,475km
==> The Following Graph has following Legends :
Size vs Diameter Mapping:
Orange : Diameter > 110m and < 300m
Red : Diameter >= 300m
White : Diameter <=110m
Asteroids:Near Earth Approaches(PAST)
Asteroids:Near Earth Approaches


127.0.0.1:5500/Asteroid_Prediction.html
Asteroid Prediction
Introduction
Exploring The Past
Diving into the Future
Asteroids:Near Earth Approaches(PAST)
Asteroids:Near Earth Approaches(FUTU
Approach Distance in LDU
0 LDU
5 LDU
10 LDU
15 LDU
20 LDU
1 Year Ago
8 Months Ago
4 Months Ago
Approaching this Week
In 4 Months
In 8 Months
Approach Day


Asteroid Prediction
Introduction
Exploring The Past
Diving into the Future
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==> 1 ld = 384398 km
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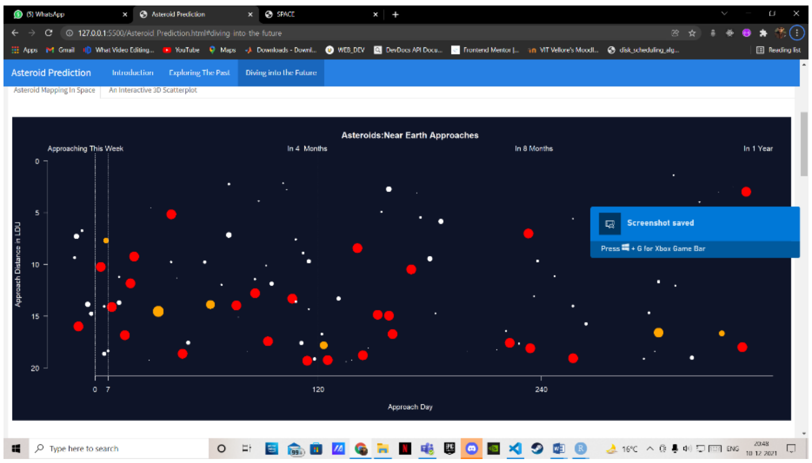
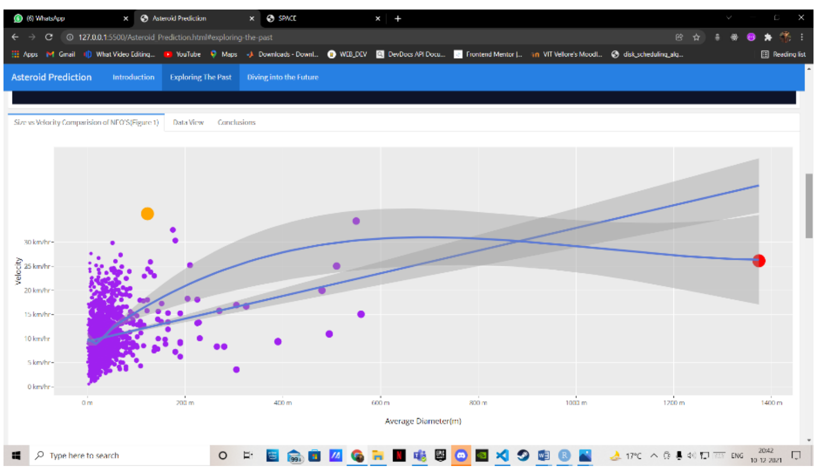
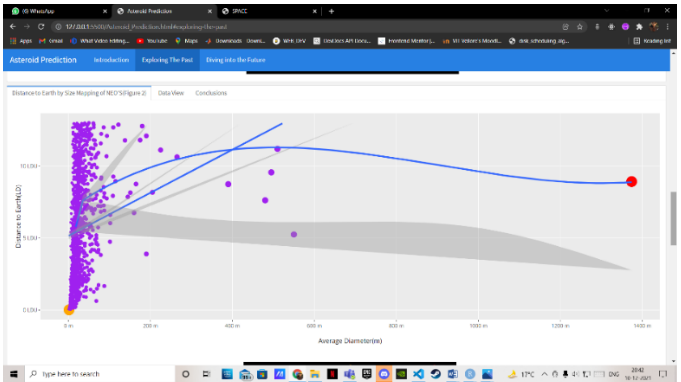
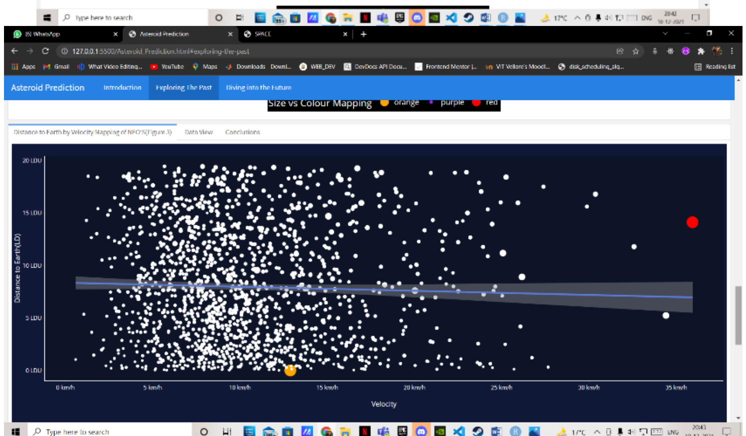
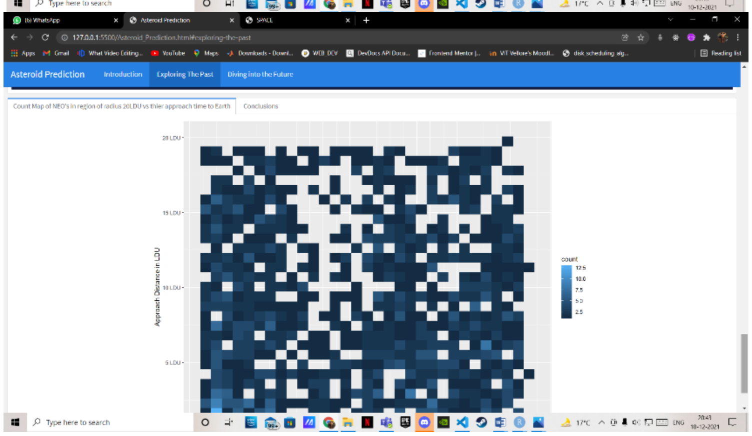
==> This is a visualization of known and tracked Near Earth Asteroids, or NEAs that will make a close approach to Earth within the next 12 months, or have made a close approach within the last 12 months, as tracked by NASA's JPL NEO program.
==> Many NEAs aren't discovered until they've nearly passed us in their orbit of the sun, which is why one side of this graph is so much more populated than the other. The view in our rear-view mirror is better than the one through our windshield.

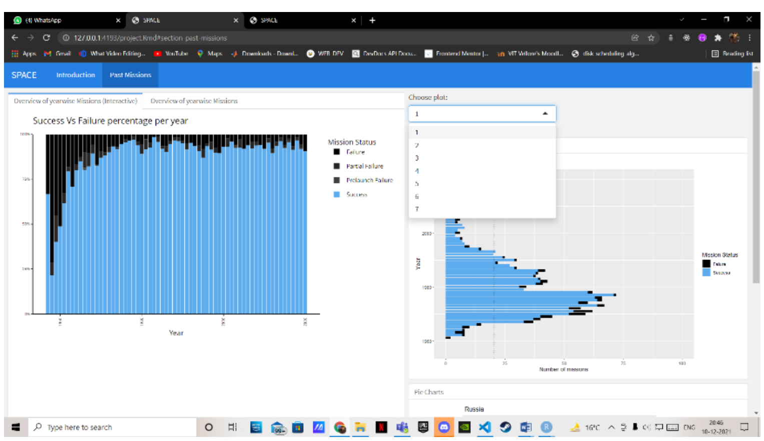

Asteroids:Near Earth Approaches
Approaching This Week
In 4 Months
In 8 Months
In 1 Year
Approach Distance in LDU
Approach Day
Screenshot saved

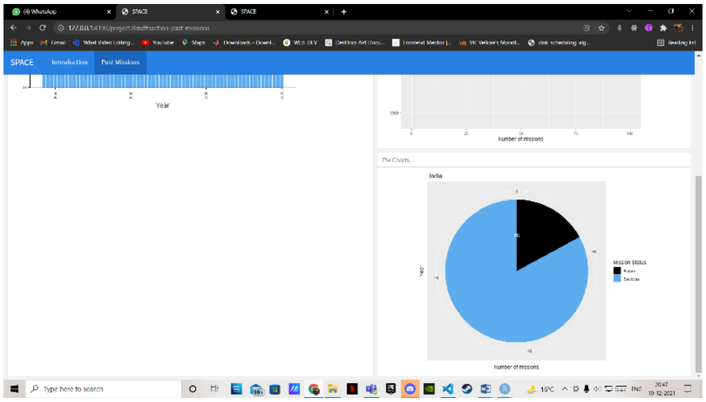

Velocity
Average Diameter(m)

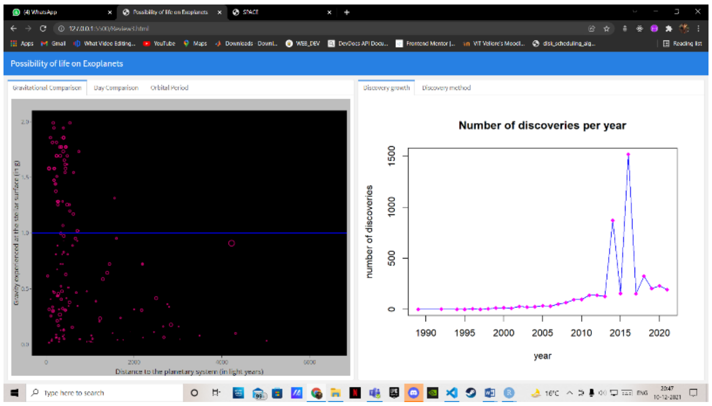

Asteroid Prediction
Introduction
Exploring The Past
Diving into the Future
Average Diameter(m)

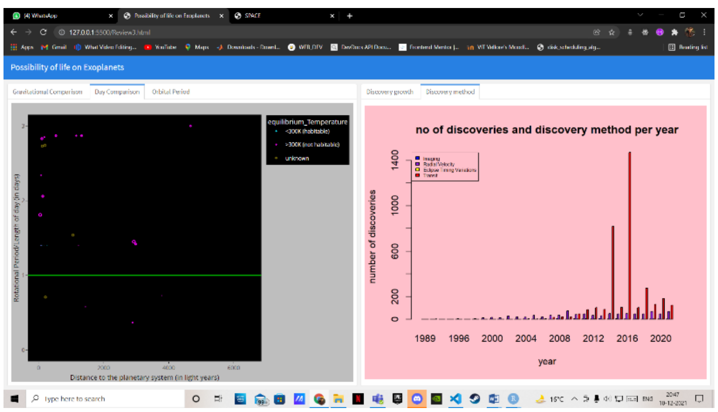

Asteroid Prediction
Introduction
Exploring The Past
Diving into the Future
Size vs Colour Mapping
orange
purple
red
Velocity

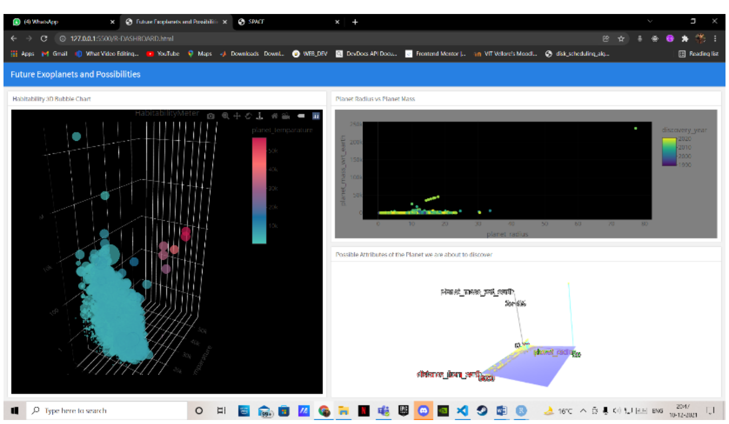

Asteroid Prediction
Introduction
Exploring The Past
Diving into the Future


SPACE
Introduction
Past Missions
Success Vs Failure percentage per year
Mission Status
Year
Choose plot:


SPACE
Introduction
Past Missions
Year
Number of missions
Pie Charts
India
Mission status


Possibility of life on Exoplanets
Gravitational Comparison
Day Comparison
Orbital Period
Discovery growth
Discovery method
Number of discoveries per year
number of discoveries
year


Possibility of life on Exoplanets
no of discoveries and discovery method per year
number of discoveries
year


Future Exoplanets and Possibilities

8. RESULT ANALYSIS:

1. ASTEROID PREDICTION

a. EXPLORING THE PAST

==> Through the analysis of the NASA JPL Near Earth Object database, we've determined that currently, the object with the highest velocity is the (2020 XV6) asteroid.

==> The asteroid (2021 UA1) is the largest closest passing object currently in the active dataset.

==> A second outlier object is (2016 AJ193), holding the largest diameter of all objects in the dataset.
Of important note is the condition code 8 classification for (2021 UA1), indicating the asteroid's orbit is highly uncertain.
==> This may be a result of the recent discovery of its presence, combined with the high velocity of movement.
==> The most fearful thing is the velocity and the diameter of a NEO.

b. DIVING INTO THE FUTURE

==> Through the analysis of the NASA JPL Near Earth Object database, we've determined that currently, the object with the highest velocity is the 455176 (1999 VF22) asteroid.

==> The asteroid (2020 AP1) is the largest closest passing object currently in the active dataset.

==> A second outlier object is 7335 (1989 JA), holding the largest diameter of all objects in the dataset.
Of important note is the condition code 6 classification for (2020 AP1), indicating the asteroid's orbit is highly uncertain.
==> This may be a result of the recent discovery of its presence, combined with the high velocity of movement.
==> The most fearful thing is the velocity and the diameter of a NEO.

2. PAST MISSIONS

As we can see in the beginning as the scientists didn't have that much experience in the field the failure rate was too high but with each year the success rate increased and now it is at a somewhat stable state and that observation is true even in the country wise graphs too and in the copied era due to a global pandemic the funding for the space research and due to lockdown the staff members were cut down and because of these the number of missions went down in the year 2020 and this can be seen in every graph.

3. POSSIBILTY OF LIFE ON EXOPLANETS

We can see how certain planets may give livable circumstances. Even though they are now out of our reach, if we continue to explore and discover planets with habitable circumstances, one day when technology catches up with reach, we will be able to go there as an interplanetary civilization.

9. CONCLUSION:

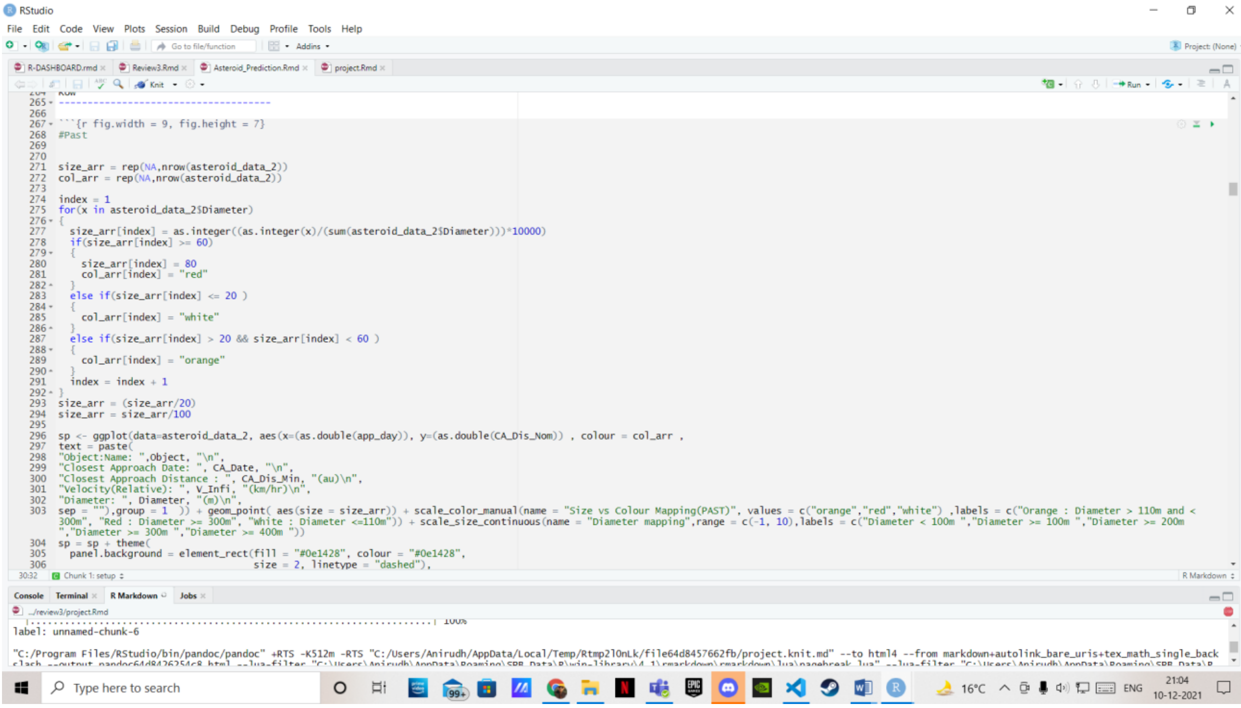
By the means of this dashboard the viewer can know the three different aspects of the need of space exploration.

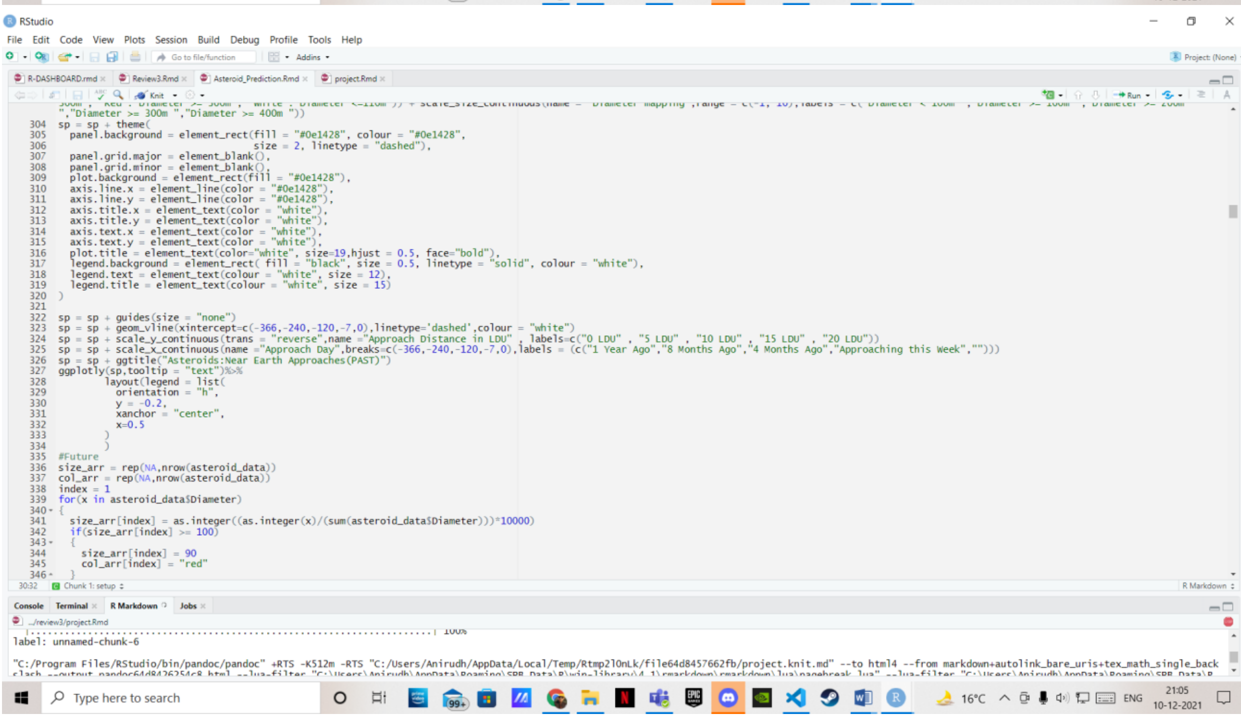
The first one is to show the dangers that earth faces in terms of asteroid impacts. In the visualization provided we can clearly see the number of asteroids that comes close to earth and the size and speed of it. That will provide a clear picture that we are not completely safe from the danger. Now the viewers are presented with pass missions. In this section we can see the number of missions over the years and the success and failure rates. This will encourage the viewers that even though the failures we can still persevere and come up on top as more and more countries begin to contribute to space exploration each year.

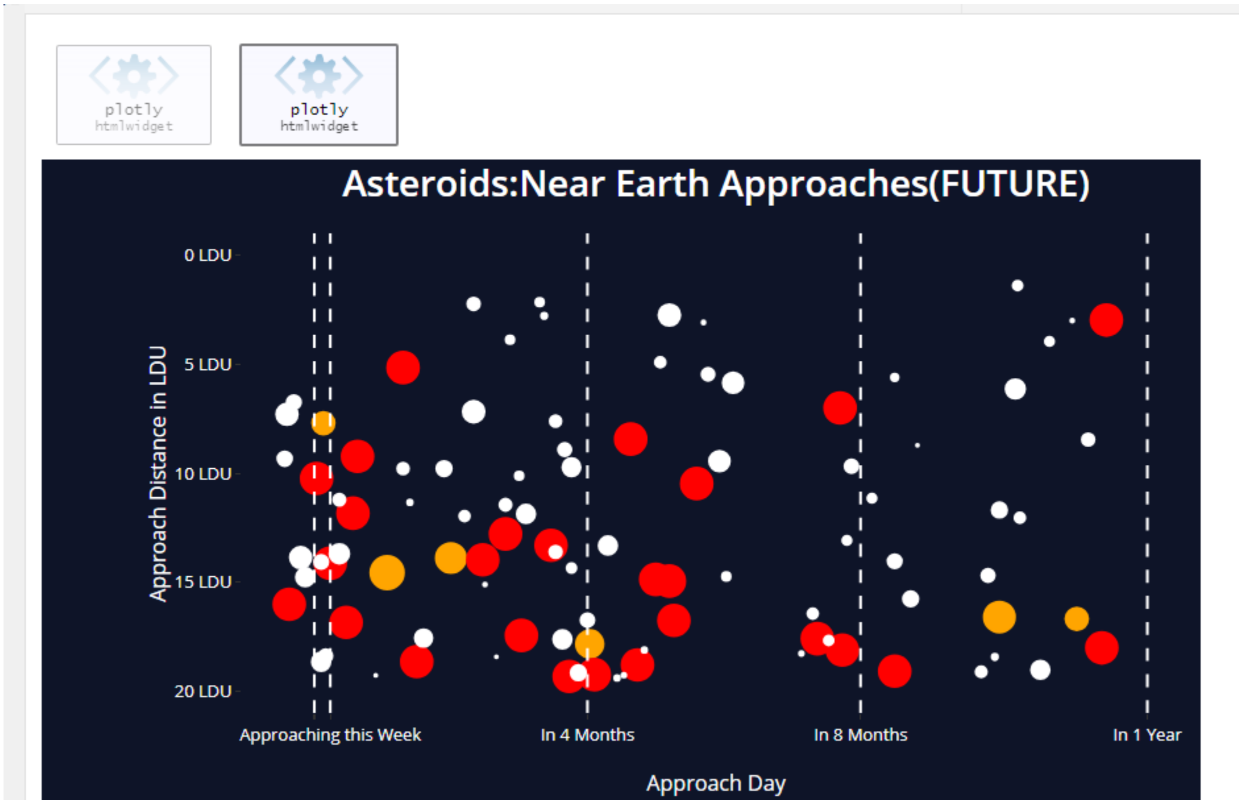
And in the final section we can see the possible habitable conditions that some planets provide. Even though they might be out of our reach for now but if we keep on exploring and keep on finding these planets with habitable conditions one day when the technologies catch up with the reach we can finally go there as an inter planetary civilization.

10. APPENDIX:

- ## SCREENSHOTS:







- **SAMPLE CODING:**

```
sp <- ggplot(data=asteroid_data, aes(x=(as.double(app_day)), y=(as.double(CA_Dis_Nom)) , colour
= col_arr ,
                              text = paste(
                               "Object:Name: ",Object, "\n",
                               "Closest Approach Date: ", CA_Date, "\n",
                               "Closest Approach Distance : ", CA_Dis_Min, "(au)\n",
                               "Velocity(Relative): ", V_Infi, "(km/hr)\n",
                               "Diameter: ", Diameter, "(m)\n",
                               sep = ""),group = 1  )) + geom_point( aes(size = size_arr)) +
scale_color_manual(name = "Size vs Colour Mapping(FUTURE)", values = c("orange","red","white")
,labels = c("Orange : Diameter > 110m and < 300m", "Red : Diameter >= 300m", "White : Diameter
<=110m")) + scale_size(name = "Diameter mapping",range = c(-1, 6),labels = c("Diameter < 100m
","Diameter >= 100m ","Diameter >= 200m ","Diameter >= 300m "))
sp = sp + theme(
  panel.background = element_rect(fill = "#0e1428", colour = "#0e1428",
                                size = 2, linetype = "dashed"),
  panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(),
  plot.background = element_rect(fill = "#0e1428"),
  axis.line.x = element_line(color = "#0e1428"),
  axis.line.y = element_line(color = "#0e1428"),
```

```
  axis.title.x = element_text(color = "white"),
  axis.title.y = element_text(color = "white"),
  axis.text.x = element_text(color = "white"),
  axis.text.y = element_text(color = "white"),
legend.background = element_rect( fill = "black", size = 0.5, linetype = "solid", colour = "white"),
  plot.title = element_text(color="white", size=19,hjust = 0.5, face="bold"),
legend.text = element_text(colour = "white", size = 12),
legend.title = element_text(colour = "white", size = 15)
)


sp = sp + geom_vline(xintercept=c(0,7,120,240,366),linetype='dashed',colour = "white")
sp = sp + scale_y_continuous(trans = "reverse",name ="Approach Distance in LDU" ,limits=c(20,0) ,
labels=c("0 LDU" , "5 LDU" , "10 LDU" , "15 LDU" , "20 LDU"))
sp = sp + guides(size = "none")
sp = sp + scale_x_continuous(name ="Approach Day",breaks=c(0,7,120,240,366),labels =
(c("","Approaching this Week","In 4 Months","In 8 Months","In 1 Year")))
sp = sp + ggtitle("Asteroids:Near Earth Approaches(FUTURE)")
ggplotly(sp,tooltip = "text")%>%
    layout(legend = list(
     orientation = "h",
     y = -0.2,
     xanchor = "center",
     x=0.5
    )
    )
```