https://www.spaceappschallenge.org/blog/

Track the Space Station in 3D

Nasa Internartional Space Apps Challenge

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Introduction

Our goal is the creation and publication of an open source web application that tracks the space station in three dimensions, in which the user can have interaction with the satellite and the planet earth.

Tools used

In order to achieve the objective we used Visual Studio Code, using React (Html, Css, javascript) for web development, Three.js for 3D figures, Earth 3D Model, International Space Station 3D Model, TLE API, SSC RESTful Web Services, "satellite.js, three, tle.js, web-vitals, buffer, sass, timers, stream and xml2js.

General description of the project process and expected scopes.

By means of tools such as those mentioned above, we will use two 3D representations of the earth and the satellite, which through APIs will be connected, this to show the real position of the satellite near the earth. The movement of these two objects will be done through libraries provided by TLE and data provided by NASA. In addition, the user will have the possibility to move the space station to see its next or previous positions. There is an animated menu, which also directs you to pictures of the space station over the years.

We hope that this site will reach young people interested in space and its wonders, being able to have interactivity and exploration.

How your project contributes to the area.

Our project is a 3D visualizer, which will not only have a real time visualization of the space station, it will also be open source which can be modified, improved or copied, by anyone who wants to make use of it, creating a solid base for anyone who ventures to a bigger challenge.

The project had a very limited time (less than 48 hours), so there was no time for prototypes, nor for a deepening towards the user for which it was developed, it was about developing what was done for an academic environment where the main objective was its usability and to create a "fast" solution but with a lot of dedication, the work methodology used was Kanba and all the research was obtained from the libraries and databases of Nasa.

Planning and implementation

An open source web application that tracks the space station in three dimensions.

APIs consumption

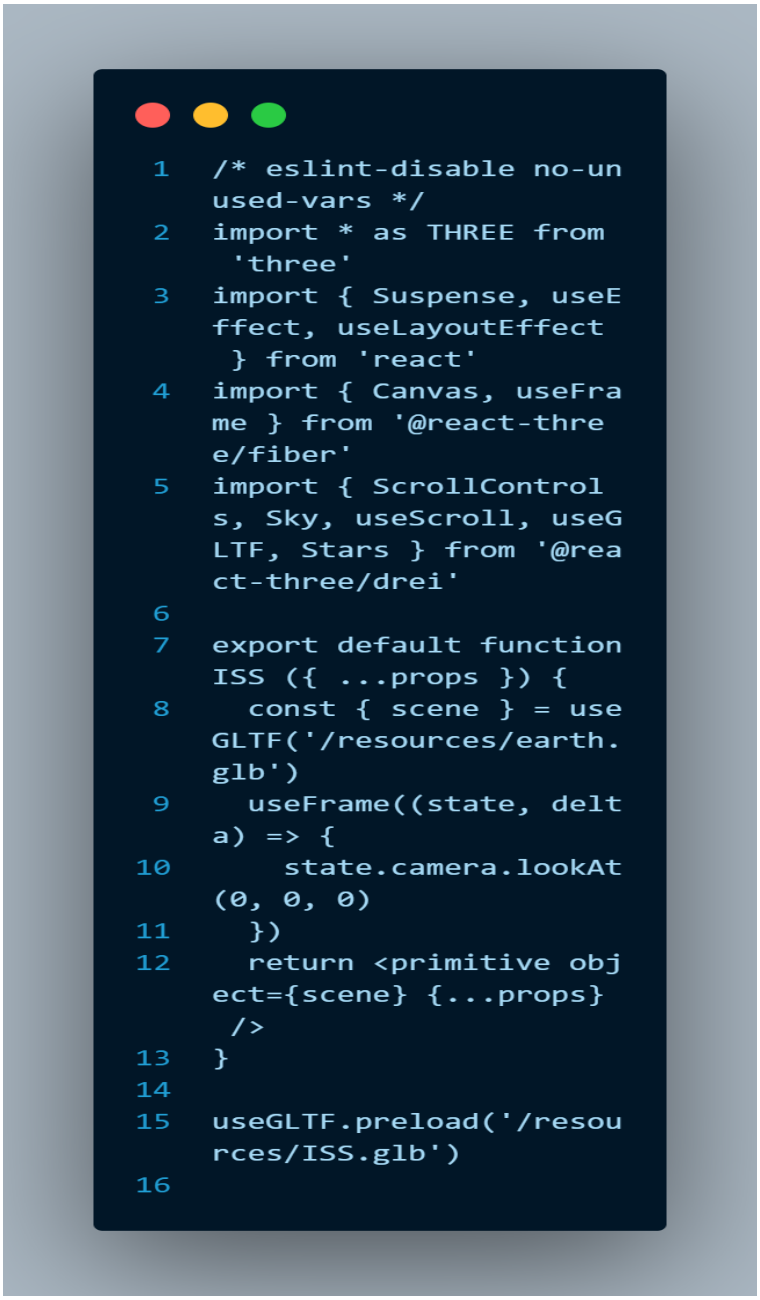
//This Api connects the space station web page with its real time movement.

```
import $ from 'jquery'
import swal from 'sweetalert2'

const ApiMedia = () => {
  $.ajax({
    url: 'https://images-api.nasa.gov',
    type: 'GET',
    dataType: 'json',
    async: true,
    crossdomain: true,
    success: function (datos) {
      // eslint-disable-next-line no-unused-vars
      const obj = JSON.stringify(datos)
      let fechas = []
      console.log(obj)
    //   for (let i = 0; i < datos.Observatory[1].length; i++) {
    //     console.log(datos.Observatory[1][i].StartTime[1].substring(0, 10), 'datos.Observatory[1][i].EndTime[1]')
    //     fechas.push({StartTime:datos.Observatory[1][i].StartTime[1].substring(0,10), EndTime:datos.Observatory[1][i].EndTime[1].substring(0,10)})
    //   }
      return fechas;
    //   console.log(fechas, 'fechas')
    //   const date = new Date()
    //   console.log(date, 'date')
    },
    error: function () {
      swal('Error', 'An internal server error has occurred, please contact the site admin', 'error')
    }
  })
}

export default ApiMedia
```

// code for 3D model of the earth



```
/* eslint-disable no-unused-vars */
import * as THREE from 'three'
import { Suspense, useEffect, useLayoutEffect } from 'react'
import { Canvas, useFrame } from '@react-three/fiber'
import { ScrollControls, Sky, useScroll, useGLTF, Stars } from '@react-three/drei'

export default function ISS ({ ...props }) {
  const { scene } = useGLTF('/resources/earth.glb')
  useFrame((state, delta) => {
    state.camera.lookAt(0, 0, 0)
  })
  return <primitive object={scene} {...props} />
}

useGLTF.preload('/resources/ISS.glb')

```

// Space station code

```
/* eslint-disable no-unused-vars */
import * as THREE from 'three'
import { Suspense, useEffect, useLayoutEffect } from 'react'
import { Canvas, useFrame } from '@react-three/fiber'
import { ScrollControls, Sky, useScroll, useGLTF, Stars } from '@react-three/drei'

export default function ISS ({ ...props }) {
  // This hook gives you off
  const { scene } = useGLTF('/resources/iss.glb')
  useFrame((state, delta) => {
    // The offset is between 0 and 1, you can apply it to your models any way you lik

    state.camera.lookAt(0, 0, 0)
  })
  return <primitive object={scene} {...props} />
}

useGLTF.preload('/resources/ISS.glb')

```

// For movement on the station

```
import './LeftControls.scss';
import { default as Square } from '../Square/Square';

export default function LeftControls() {

   useEffect(() => {
      window.addEventListener('keydown', handleKeyDown)
         window.addEventListener('keyup', handleKeyUp)
      return () => {
         window.removeEventListener('keydown', handleKeyDown)
         window.removeEventListener('keyup', handleKeyUp)
      };

   }, []);

   const handleKeyDown = (e) => {
       const key = e.key;

         if (key === 'w') {
            setStyleOne({backgroundColor: 'white', color: 'black'});
         }
         if (key === 'a') {
            setStyleTwo({backgroundColor: 'white', color: 'black'});
         }

         if (key === 's') {
            setStyleThree({backgroundColor: 'white', color: 'black'});
         }

         if (key === 'd') {
            setStyleFour({backgroundColor: 'white', color: 'black'});
         }

   }

   const handleKeyUp = (e) => {
      setStyleOne({backgroundColor: 'transparent'});
      setStyleTwo({backgroundColor: 'transparent'});
      setStyleThree({backgroundColor: 'transparent'});
      setStyleFour({backgroundColor: 'transparent'});
   }
```

//program for javascript controls, importing styles for modeling and keystroke control

```
import React from 'react';

import './App.css';

import { default as Canvas } from '../Components/Canvas/Canvas.js';

import { default as NavBar } from '../Components/NavBar/NavBar';

import { default as LeftControls } from '../Components/LeftControls/LeftControls';
import { default as RightControls } from '../Components/RightControls/RightControls';

export default function App() {
  return (
    <div className='App'>
      <Canvas />

      <LeftControls />
      <RightControls />
    </div>
  )
}

```

Evaluation and Analysis

When the challenge was analyzed, there were no problems to find the resources that would be used to solve the problem, however many of the mishaps occurred when the execution began, since many of the necessary tools were not fully mastered.

We were close to achieving all the objectives that we had proposed at the beginning: user interaction with the planet and the satellite, user visualization with the planet and the satellite, use of UX, photo visualization through the history of the international space station.

We consider the project to be successful, given that even with the short time we were given to achieve the objectives the team managed to get very close to the goal that NASA had given us, we failed in the integration of novel functions that were planned, in allowing users to search the position of the space station over time (including future and past positions), predicting overhead passes given a geographic location, being able to give space station position data, and in determining uplink/downlink availability by calculating line-of-sight to available ground stations. The organization could have been different, agile methodologies such as scrum or Kanban could have been used.

Everything is possible thanks to Nasa, UNAQ (Aeronautical University in Queretaro) and the state of Queretaro. Joining forces and resources for the development of this great challenge, which will give advances in technologies, which can be used from October 2, 2022 and as a basis for future projects.

Conclusion

The project was carried out in the facilities of UNAQ (Aeronautical University in Queretaro) in a period of 48 hours, with the support of Nasa, UNAQ and the Polytechnic University of Santa Rosa Jauregui. If we continue working with the project, we would like to add these objectives to the app:

- Predict overhead passes given a geographic location.
- Determine uplink/downlink connection availability by calculating line of sight to available ground stations.
- Display space debris conjunction alerts on the orbital path.
- Display accurate representations of solar panel orientation

References:

Keeter, B., & Keaton, J. (2022). Spot The Station International Space Station. Retrieved October 2, 2022, from Nasa website: https://spotthestation.nasa.gov/

Keeter, B., & Keaton, J. (2022). Live Space Station Tracking Map. Retrieved October 2, 2022, from Nasa website: https://spotthestation.nasa.gov/

open source(2022). World Wind. Retrieved October 2, 2022, from Nasa website: https://worldwind.arc.nasa.gov/web/

Keeter, B., & Keaton, J. (2022). World Wind. Recuperado 2 de octubre de 2022, de Nasa website: https://worldwind.arc.nasa.gov/web/