

Satellite Follower App

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Introduction

- **What:** Web Application that tracks and displays satellites currently visible overhead
- **Why:** Simple tool for satellite observation
- **Who:** Hobbyists, amateur astronomers, space enthusiasts
- **Motivation:** Interest in satellite technology and space systems

Satellite Follower App

Satellites Near Galway:

68 (SatID)
GLONASS
Russia

BEIDOU-3S M2S
55.17986285169659 (Latitude)
-9.541348385425682 (Longitude)

GSAT0219 (GALILEO 23)
48.636754263816236 (Latitude)
-11.652675889896743 (Longitude)

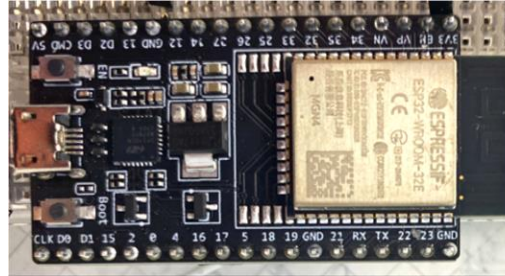
STARLINK-1190
53.18754752061046 (Latitude)
-4.50720805287306 (Longitude)

ICEYE-X7
56.65395677694333 (Latitude)
-9.384217411642663 (Longitude)

Technologies Used

Hardware

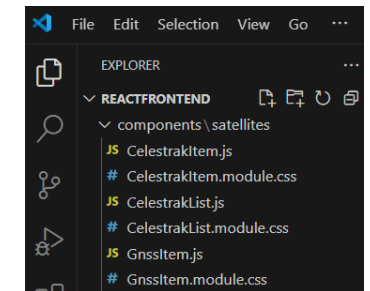
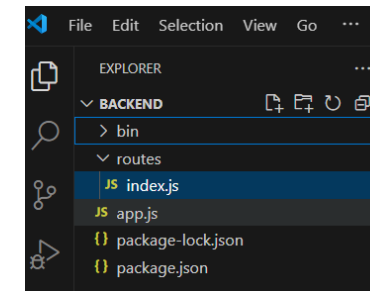
- ESP32 Microcontroller
- GNSS Receiver (L86-M33)



Software

- ESP32 Firmware (Arduino/C++)
- Backend Server (Node.js)
- Frontend Interface (React.js)

```
void setup() {  
  
  pinMode(16, INPUT);  
  
  Serial.begin(9600);  
}
```



Libraries

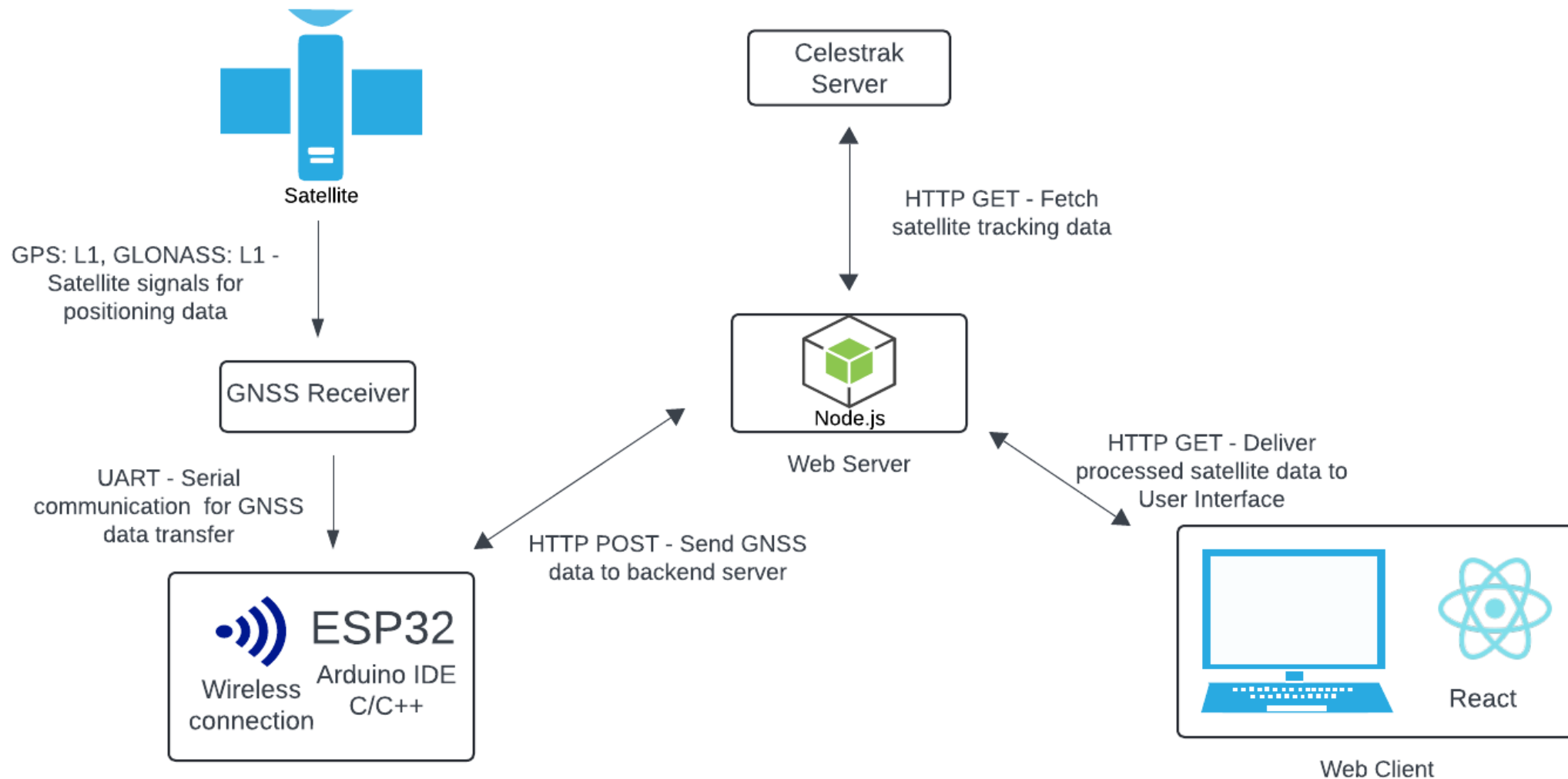
- Satellite.js (Orbit Calculation)
- HardwareSerial (UART communication)
- HTTPClient (Web Requests)

```
//Calculate satellite's position in Earth-Centered Inertial (ECI) coordinates  
const satPositionVelocity = satellite.propagate(satelliteRecord, currentTime)
```

```
HardwareSerial gnssSerial(1);
```

```
http.begin(serverURL);  
http.addHeader("Content-Type", "application/json");  
  
String payload = "{\"satellites\": " + satelliteList + "}";  
int httpStatusCode = http.POST(payload);
```

Architecture Diagram



Challenges

GNSS Hardware Configuration

- V_BCKP pin not properly powered, preventing GNSS startup
- Solution: Researched module via YouTube tutorial and datasheet



NMEA Sentence Parsing

- Studied NMEA sentence structure to identify relevant information
- Extracting Satellite ID (PRN code) required careful parsing
- Solution: Developed parsing logic by splitting sentences using commas to extract satellite IDs. Tested parsing logic on a dummy/static NMEA sentence

```
COM4
$GPGSA,A,1,,,,,,,,,,,,,2*00
$GPGSV,3,1,11,21,75,261,,08,73,148,,02,51,258,,10,44,060,,0*6C
$GPGSV,3,2,11,27,36,127,14,14,24,314,,32,16,104,14,22,10,326,,0*60
$GPGSV,3,3,11,23,08,038,,30,06,281,,03,03,200,,0*5B
$GPGSV,2,1,06,88,74,014,,79,41,287,,81,34,282,,65,28,131,,1*71
$GPGSV,2,2,06,78,25,225,,87,22,078,,1*73
$GPGLL,,,,,192216.000,V,N*75
$GPTXT,01,01,02,ANTSTATUS=OPEN*2B
Data sent: 200
$GPRMC,192217.000,V,,,,,0.00,359.18,060225,,,N,V*3C
$GPVTG,359.18,T,M,0.00,N,0.00,K,N*34
$GPGGA,192217.000,,,,,0,0,,,M,M,,*46
$GPGSA,A,1,,,,,,,,,,,,,1*03
$GPGSA,A,1,,,,,,,,,,,,,2*00
```

TLE Data Filtering for Galway

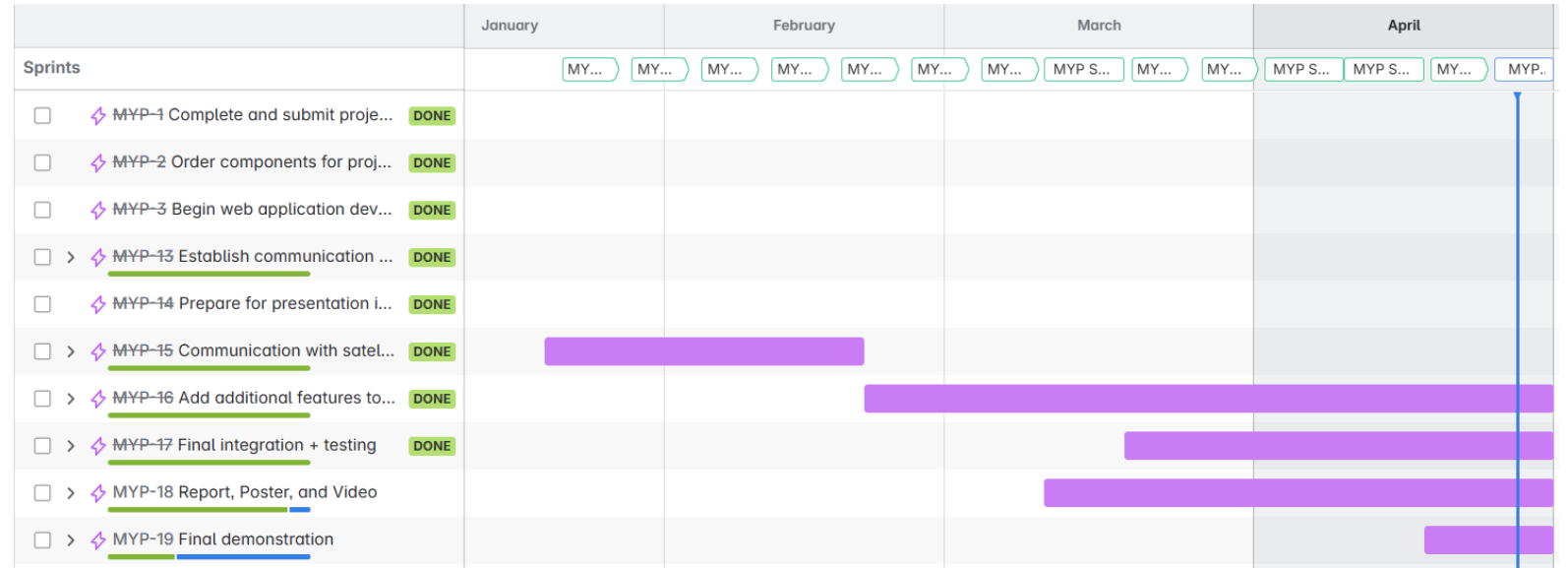
- Develop backend logic to filter satellites from CelesTrak passing over Galway
- Solution: Utilizing Satellite.js library to calculate satellite positions

```
INMARSAT 3-F1
1 23839U 96020A 25116.16696115 -.00000249 00000+0 00000+0 0 9996
2 23839 9.7305 50.3284 0003517 348.1443 205.1690 0.99998822106383
USA 119
1 23893U 96029A 25115.94358862 .00001345 00000+0 27850-3 0 9997
2 23893 63.3259 202.1364 0829263 42.8651 323.4056 13.44746512 49136
JAS-2 (FO-29)
1 24278U 96046B 25116.17003544 .00000018 00000+0 51621-4 0 9994
2 24278 98.5803 15.8998 0350929 97.6300 266.4837 13.53244989417018
INMARSAT 3-F2
1 24307U 96053A 25115.53028106 .00000127 00000+0 00000+0 0 9996
2 24307 8.9087 58.0520 0006586 348.8257 208.6697 0.99989748104749
INMARSAT 3-F3
1 24674U 96070A 25115.75808795 -.00000304 00000+0 00000+0 0 9994
2 24674 9.4132 53.5167 0004078 322.5650 218.4209 0.99989301103731
NAVSTAR 43 (USA 132)
1 24876U 97035A 25115.39052753 .00000087 00000+0 00000+0 0 9992
2 24876 55.7871 114.9184 0088839 53.6964 307.1488 2.00562492203577
```

Organisation

Jira

- Scrum Framework
- Timeline
- Child Tasks
- Sprints
- Burndown Charts



Sprint burndown chart

[How to read this report](#)

☐ MYP Sprint 17 10 Apr – 17 Apr (3 issues)

☐ MYP-37 Improve frontend for satellite information

☐ MYP-47 Start final demo PowerPoint

☐ MYP-46 Summary, Introduction, and Schematic sections for report

[+ Create issue](#)

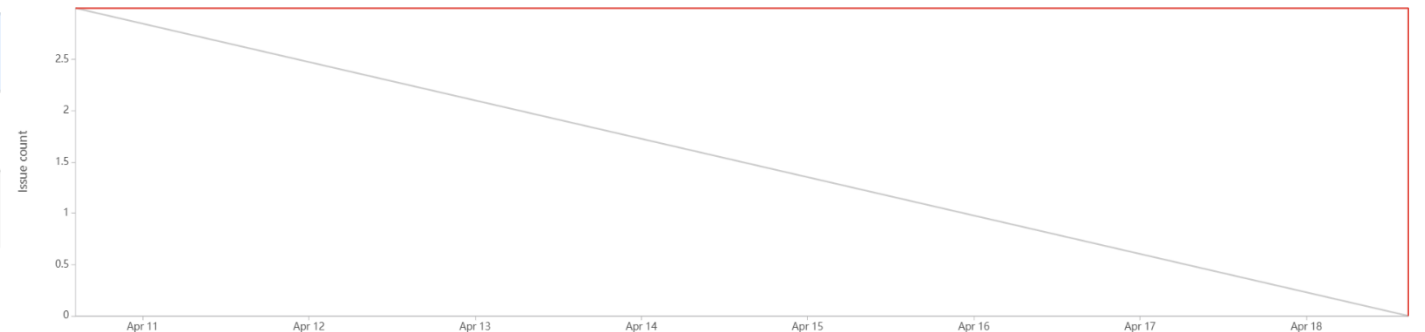
Sprint
MYP Sprint 17

Estimation field
Work item count

Date - 10 April 2025 - 17 April 2025

Remaining work
Number of issues left to complete this sprint

Guideline
Ideal burn rate



Organisation

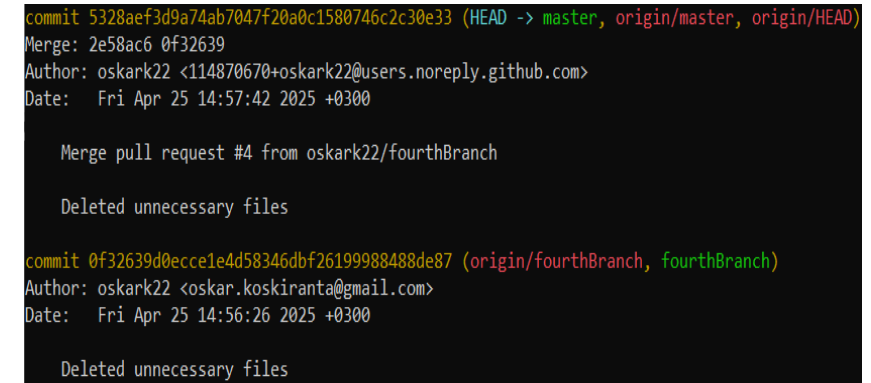
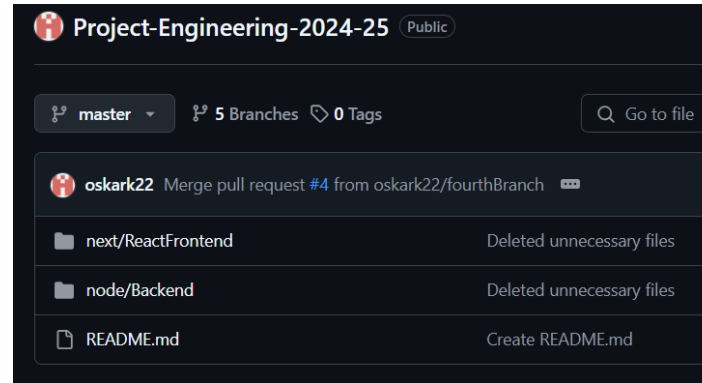
GitHub

- Repositories
- Branches
- Pull Requests
- Commits

Links:

<https://github.com/oskark22/Project-Engineering-2024-25>

https://github.com/oskark22/Project-Engineering-2024-25_ESP32



OneNote

- Weekly Logs
 - Teamwork (Weekly Standup Meetings)
 - Personal (Project Tracking & Reflection)

A screenshot of a OneNote notebook titled 'Class Notebook'. The notebook is open to '24-25 6802 -- PROJECT ENGINEERING Notebook'. The left sidebar shows a list of sections: 'Welcome', '._Collaboration Space', '._Content Library', 'DAN KOSKIRANTA - S...', 'Teamwork Weekly L...', and 'My Weekly Log'. The main content area shows 'Easter Break Week 1' for '15 April 2025 12:02'. The text reads: 'Tuesday 15/4/2025: I noticed I still have some CSS styling issues in my frontend:'. Below this is a code block for a Starlink location: 'STARLINK-11183 [DTC ID]', '49.51973605467786 (Latitude)', and '-11.127134646798858 (Longitude)'. A note says: 'Sometimes if the satellite ID is longer, it will block the SatID label. Fix the CSS formatting on the frontend.' At the bottom, it says: 'I finished the Background section for my project report:'. To the right of the notebook, there is a table for 'Week 8' dated '11 March 2025 12:05'.

Week 8

11 March 2025 12:05

OLAMIDE	Last week: Worked on front-end. Selected dataset. This week: Train on new dataset.
EMEKA	
RAYAN	
JAMES	Last week: Got TLS working. This week: Writing to a file, from the front end. Start creating a driver report. Also need to debug a <u>Ubidots</u> issue.
ROSS	Last week: Front-end: added footer, new buttons. New profile page. Digital mode in sensor seems better. This week: Add User ID to control user access.