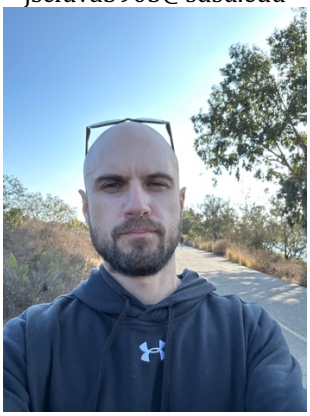
PROJECT TITLE

Flight Stabilizer and GPS Tracker

STUDENT/TEAM INFORMATION

Team Name if any: **Team # on Canvas you have self-signed-up for:**	**The Outsiders**
Team member 1 (Team Lead) (Lastname, Firstname; SDSU email; picture):	Sciuva, Jamie – jsciuva3903@sdsu.edu 

ABSTRACT (15 points)

(Summarize your project (motivation, goals, system design and results). Max 300 words).

My motivation for this project was originally thinking about how to use the servo motor as a spoiler for stabilization in coordination with the gyroscope/accelerometer module. In this project I focused on stabilization. To fulfill the project requirements, I also added a GPS component that would detect when the aircraft was outside of a certain latitude or longitude bound. The goals of the project were to coordinate the different components and the code to work together to simulate those two aspects of an aircraft flight using the TTGO ESP32 as the processor on the plane. The GPS data would be processed on the cloud server side and information was sent back to the "plane" indicating whether the plane was in-bounds. The results of the project turned out well and I was able to achieve the main goals of the project. The GPS module was a little slow and inaccurate, however I was still able to receive, send, and process the data effectively and the servo arm in conjunction with the accelerometer worked very well. I originally planned on using two servo motors, one for each wing, however I decided to only use one in the end, which worked fine to demonstrate the purpose. I also had planned to use Bluetooth and a cellular connection instead of Wi-Fi so that I could demo the device outdoors, however I chose to use Wi-Fi for simplicity. The last change was related to the battery, which I had also planned to use, but ordered the wrong kind.

INTRODUCTION (15 pts)

Motivation/Background (3 pts)

(Describe the problem you want to solve and why it is important. Max 300 words).

This project was solving two problems in aircraft operation which are stabilization and GPS tracking. Airplanes use spoilers for different reasons including stabilization, turning, and braking and are an integral component of the aircraft. Without them, flight would not be possible in the way we see it today. GPS tracking is heavily relied on in aircraft as well. Without GPS tracking planes would go off-course and possibly crash into other aircraft. Although Arduinos are not used for this purpose in commercial flight, they are used in smaller remote aircraft such as drones, and so I believe this project has some actual application.

Project Goals (6 pts)

(Describe the project general goals. Max 200 words).

- Create a viable circuit between all the necessary components including the servo arm, gyroscope, and battery.
- Plan the code-writing by function
- Write code to coordinate between sensors and cloud server
- Test the code and repeat previous step
- Attach the sensors to a prototype airplane
- Test and debug/re-write code
- Create a video showing all the features of the device

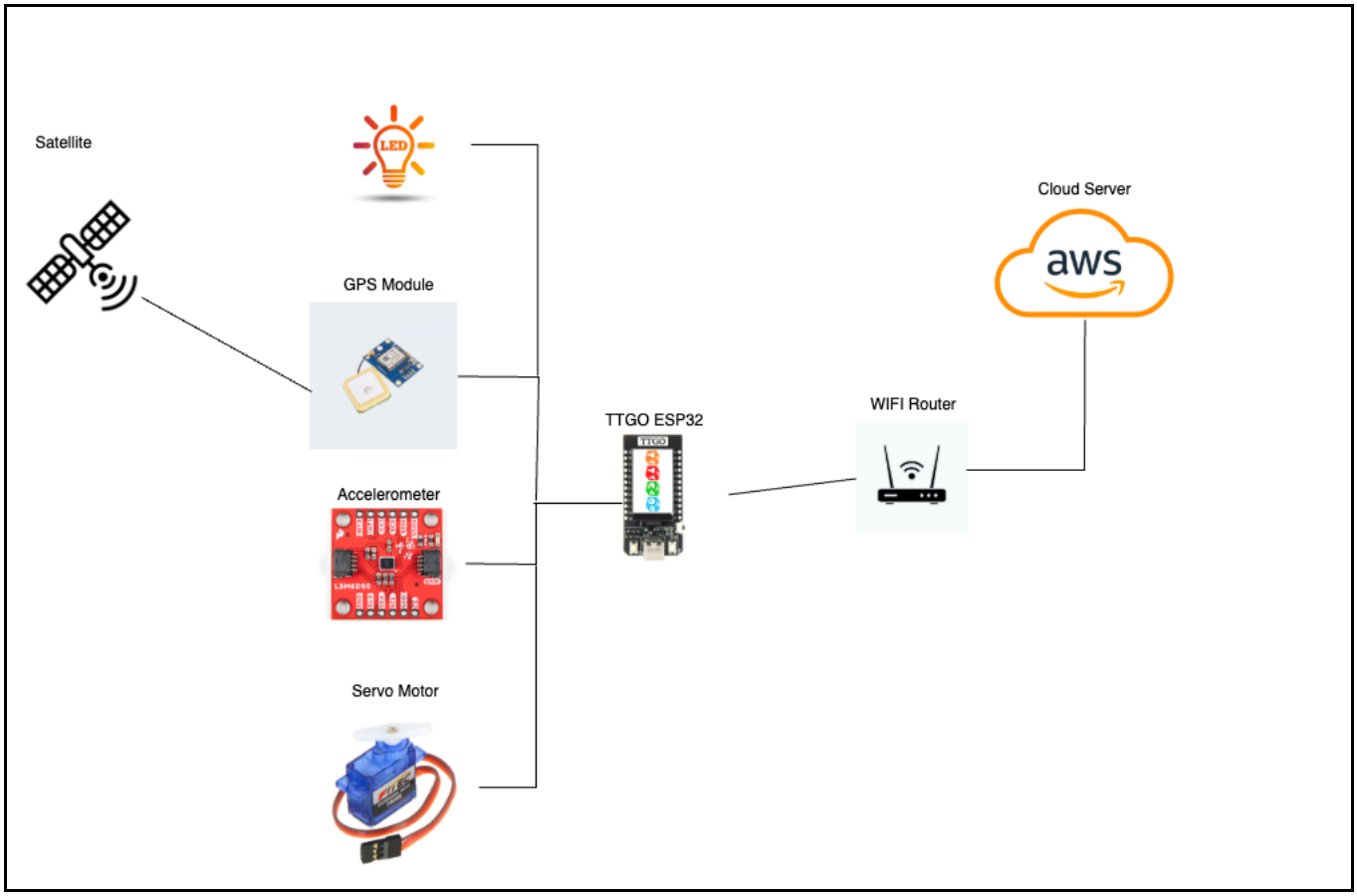
Assumptions (3 pts)

(Describe the assumptions (if any) you are making to solve the problem. Max 180 words).

I am assuming that this product will be used for non-critical applications due to the variability in the GPS tracking module, however, the module and code can be improved to possibly serve a higher level of criticality.

SYSTEM ARCHITECTURE (20 pts)

(Describe the final architecture you have implemented listing sensors, communication protocols (Wi-Fi, BLE, ...), cloud services and user interfaces. Include a block diagram of the system. Max 300 words).



FINAL LIST OF HARDWARE COMPONENTS (5 pts)

(Write the final list and quantity of the components you have included in your system)

Component/part	**Quantity**
TTGO ESP32	1
LSM6DS0 Gyroscope and Accelerometer	1
Servo Motor	1
NEO 6MV2 GPS Module	1
LEDs	2

PROJECT IMPLEMENTATION (30 PTS)

Tasks/Milestones Completed (15 pts)

(Describe the main tasks that you have completed in this project. Max 250 words).

Task Completed	**Team Member**
Set up and test servo motor	Jamie
Set up and test GPS module	Jamie
Set up and test accelerometer	Jamie
Code for functionality between accelerometer and servo motor to simulate stabilizer	Jamie
Code for functionality between the GPS module and cloud as well as LED indicator lights for in/out of bounds	Jamie
Combine the functionality into one program	Jamie
Shoot demo video	Jamie

Challenges/Roadblocks (5 pts)

(Describe the challenges that you have faced and how you solved them if that is the case. Max 300 words).

Figuring out how to get the accelerometer and servo motor to work together was challenging. There are different ways of measuring the degree of roll of the gyro/accelerometer so I had to figure out which one to use for this application and also research the math needed and code that.

The gps module is sort of imprecise and takes a while to update.

Tasks Not Completed (5 pts)

(Describe the tasks that you originally planned to complete but were not completed. If all tasks were completed, state so. Max 250 words).

Task	**Reason**
Power using battery	Bought wrong battery (incompatible)
Use two servo motors, one for each wing	I decided I could just use one motor to stabilize the aircraft to save money and simplify the project a bit.
Use BLE and Cellular network	I decided to use Wi-Fi to connect to the cloud, also to simplify things a bit.

WEAK POINTS / FUTURE WORK (15 pts)

(Mention at least two points of your project that have room for improvement. These points can be additions to the existing project setup (components) or improvement of the current implementation. Max 200 words).

The system only detects out of range with specific latitude or longitude values (actually, I only used latitude for this project, but it would be easy enough to add longitudinal boundaries). In the future, it would be cool to do more accurate and practical things with the GPS module, like maybe setting a full flight path for the aircraft to follow and using the servo motor to direct the flight. I would also like to use two servo motors, one for each wing. This is also a highly theoretical project, so in the future I'd like to use an actual drone for some real-world applicability.

SOURCE CODE (25 pts)

Please include a link to the source code of your project. A link to a repository (like GitHub) is preferred.

https://github.com/jsciuva/IoT_Project