Autonomous Drone Code

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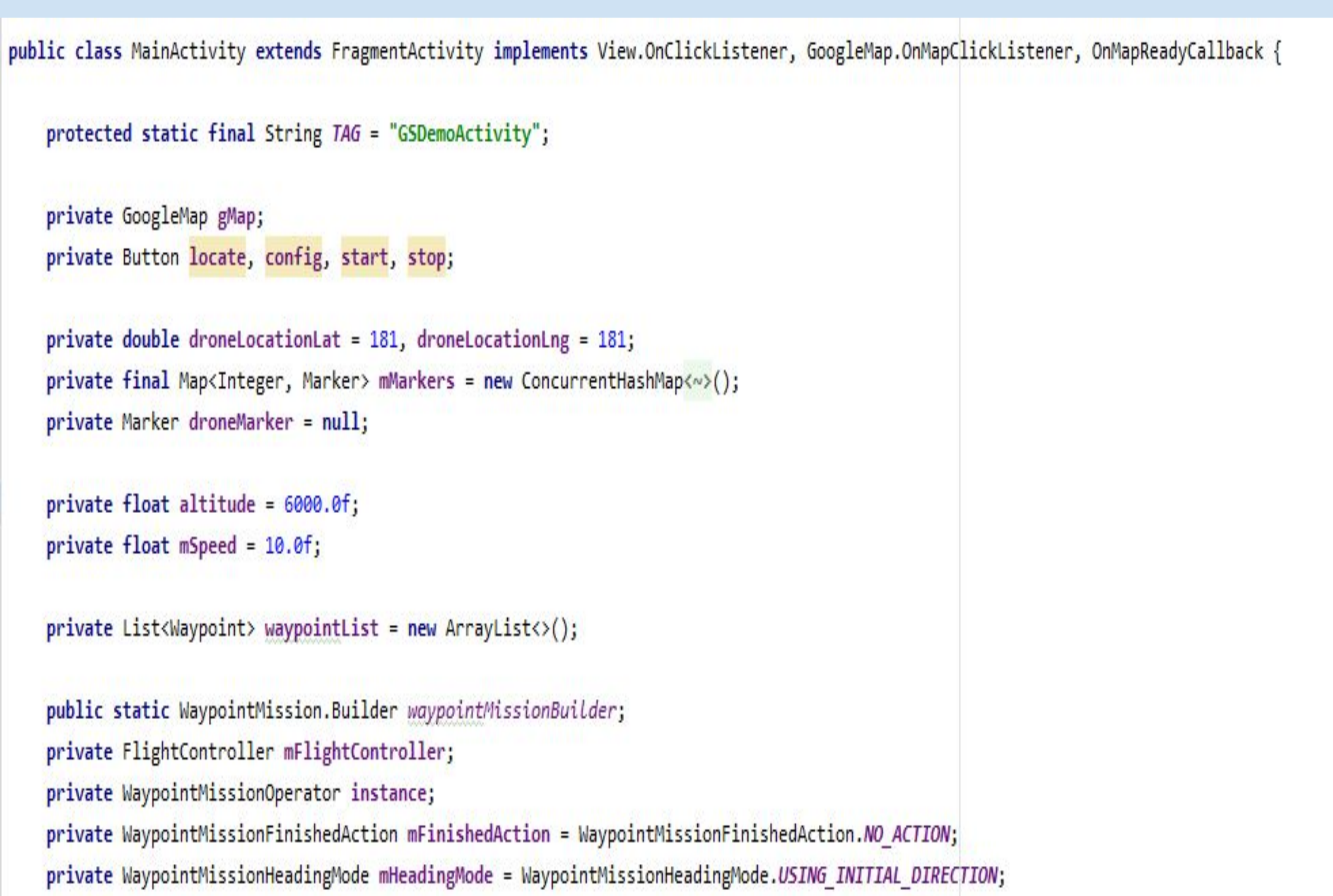
Abstract

The emerging and expanding drone industry presents many near-term opportunities, such as home delivery and power grid surveillance [1]. Incorporating Artificial Intelligence, AI, to automate drone control could expand potential applications as well as efficiency. The goal of this project is to test the feasibility of using an AI agent to control the speed and altitude of a drone, approaching autonomous, onboard real-time decision-making ability based on in-flight camera observations.

Introduction and Background

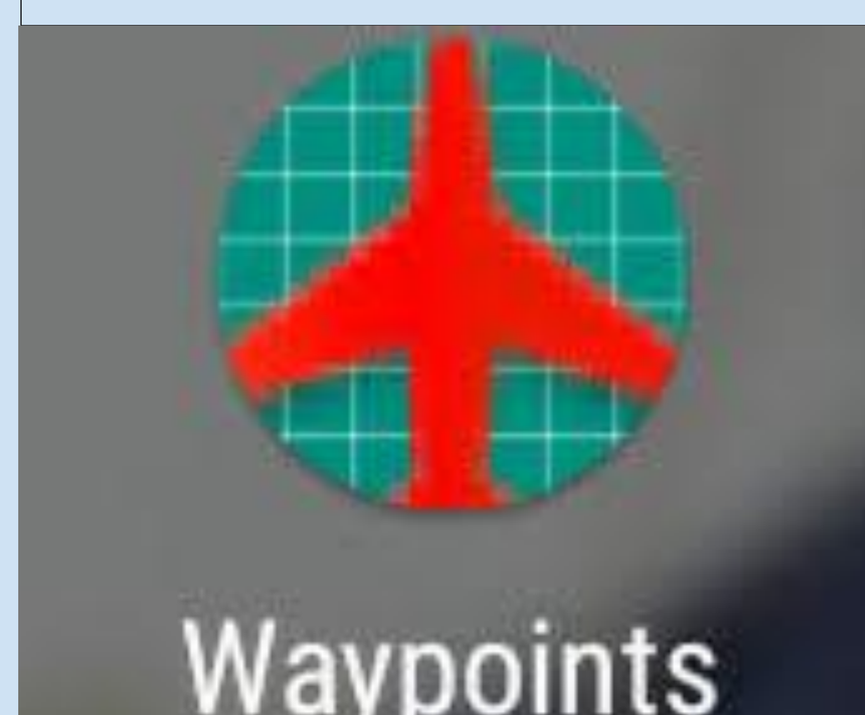
Drones are currently used in a variety of real-world applications, such as law enforcement and aerial photography. The addition of AI-enhanced decision making could increase their usefulness to these and other applications. Using AI, we explore the feasibility and capability of java-based code for automated drone control and decision making: flying and conducting tasks autonomously.

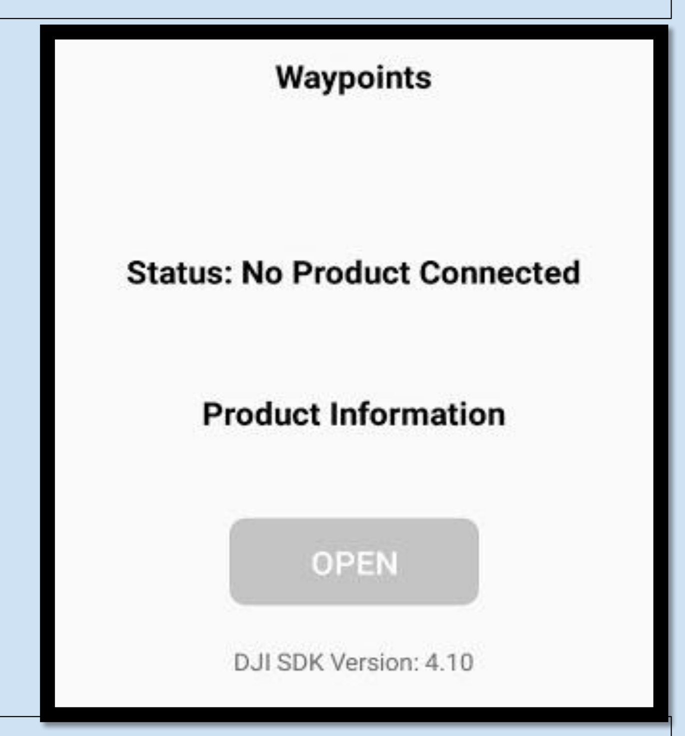


```java
public class MainActivity extends FragmentActivity implements View.OnClickListener, GoogleMap.OnMapClickListener, OnMapReadyCallback {

    protected static final String TAG = "GSDemoActivity";

    private GoogleMap gMap;
    private Button locate, config, start, stop;

    private double droneLocationLat = 181, droneLocationLng = 181;
    private final Map<Integer, Marker> mMarkers = new ConcurrentHashMap<~>();
    private Marker droneMarker = null;

    private float altitude = 6000.0f;
    private float mSpeed = 10.0f;

    private List<Waypoint> waypointList = new ArrayList<>();

    public static WaypointMission.Builder waypointMissionBuilder;
    private FlightController mFlightController;
    private WaypointMissionOperator instance;
    private WaypointMissionFinishedAction mFinishedAction = WaypointMissionFinishedAction.NO_ACTION;
    private WaypointMissionHeadingMode mHeadingMode = WaypointMissionHeadingMode.USING_INITIAL_DIRECTION;
```

Methodology and Approach

We combined Android Studio with a drone emulator platform (DJI Assistant 2 for Matrice[3]) to access, edit and enhance existing drone-controlling code. This was geared toward autonomous decision-making.





Results and Conclusion

We we able to modify the current Waypoints project to investigate integrating onboard image processing abilities for flight-path decision-making. However, without physical access to a drone (due to COVID-19 restrictions) we could neither flight-test our edited code nor obtain flight data.

Future Work

Improvements would include enhancing drone autonomy with regards to speed, altitude and data collection. Accurate analyses would require physical drone flights. Other investigations could include onboard versus non-onboard data analyses and studying associated network-related issues.

Acknowledgements

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References

[1] Li J. J., Silva T., Franke M., Hai M., Morreale P. (2021) Evaluating Deep Learning Biases Based on Grey-Box Testing Results. In: Arai K., Kapoor S., Bhatia R. (eds) Intelligent Systems and Applications. IntelliSys 2020. Advances in Intelligent Systems and Computing, vol 1250. Springer, Cham. https://doi.org/10.1007/978-3-030-55180-3_48.

[2] Alex Krizhevsky, Ilya Sutskever, Geoffrey E. Hinton, ImageNet classification with deep convolutional neural networks, Proceedings of the 25th International Conference on Neural Information Processing Systems, p.1097-1105, December 03-06, 2012, Lake Tahoe, Nevada.

[3] Available at https://www.dji.com/matrice-300/downloads?site=brandsite&from=insite_search.