Mapping PX4 ~ MAVSDK - MiniSpec Skills

Proposed high-level and low-level skills expand MiniSpec functionality, introducing barometric readings, sensor-based navigation, path planning, and real-time obstacle avoidance. Below is the refined categorization of these skills along with their MAVSDK equivalents, ensuring seamless execution in PX4 SITL.

🛠️1️⃣Pre-Flight & Setup Skills

These skills ensure that the UAV is properly configured before takeoff by verifying sensor data, GPS, and flight parameters.

#	MiniSpec Abbr.	MiniSpec Command	MiniSpec Definition	MAVSDK Equivalent	Description
1️⃣	`motors_arm`	`arm_motors`	`motors_arm();`	`await drone.action.arm();`	**Arm the motors before flight.**
2️⃣	`motors_disarm`	`disarm_motors`	`motors_disarm();`	`await drone.action.disarm();`	**Disarm the motors after landing.**
3️⃣	`set_throttle`	`set_throttle`	`set_throttle($1);`	`await drone.manual_control.set_throttle($1/100);`	**Set throttle power percentage.**
4️⃣	`set_attitude`	`set_attitude`	`set_attitude($1);`	`await drone.manual_control.set_attitude($1);`	**Set UAV tilt angle (attitude).**
5️⃣	`baro_read`	`baro_read`	`_1=baro_read();?_1!=F`	`async for altitude in drone.telem`	**Read the barometric altitude.**

			`alse{->True};->False;`	`etry.altitude(): return altitude.relative_altitude_m`	
6	`gps_read`	`gps_read`	`_1=gps_read($1);?_1!=False{->True};->False;`	`async for position in drone.telemetry.position(): return position.latitude, position.longitude`	**Read GPS coordinates.**
7	`sensor_check`	`sensor_check`	`_1=sensor_check();?_1!=False{->True};->False;`	`await validate_sensors(drone);`	**Check for obstacles using onboard sensors.**

🛫2 Basic Flight Skills

These commands control basic flight maneuvers such as takeoff, landing, and hovering.

#	MiniSpec Abbr.	MiniSpec Command	MiniSpec Definition	MAVSDK Equivalent	Description
8️⃣	`tk`	`takeoff`	`motors_arm();set_throttle(50);?baro_read()>=safe_altitude{->True};`	`await drone.action.arm(); await drone.action.takeoff();`	Launch UAV into flight.
9️⃣	`ld`	`land`	`set_throttle(0);set_attitude(0);motors_disarm();->True;`	`await drone.action.land();`	Descend and touch down safely.
🔟	`hv`	`hover`	`12{?_1=gps_read()!=False&_2=baro_read()!=False{set_throttle(hold);d(100)}};`	`await asyncio.sleep(3);`	Maintain a fixed position in the air.

📍3️⃣Navigation & Waypoint-Based Skills

These skills allow the UAV to navigate to specific locations, follow waypoint sequences, and return to the home position.

#	MiniSpec Abbr.	MiniSpec Command	MiniSpec Definition	MAVSDK Equivalent	Description
1️⃣1️⃣	`wp`	`navigate_to_waypoint`	`12{?_1=gps_read($1)!=False{set_attitude(0);mf(10);d(500);}};`	`await drone.action.goto_location(x, y, z, 0);`	Navigate to a specified waypoint.
1️⃣2️⃣	`wr`	`follow_waypoint_route`	`_1=route[0];?_1!=False{wp(_1);wr(route[1:])};`	`for wp in waypoints: await drone.action.goto_location(wp.x, wp.y, wp.z, 0);`	Follow a predefined waypoint sequence.
1️⃣3️⃣	`rh`	`return_home`	`wp(home_coords);ld();`	`await drone.action.return_to_launch();`	Return to home position and land.

🛑4️⃣ Obstacle Avoidance & Path Planning

These skills plan routes, detect obstacles, and avoid collisions dynamically.

#	MiniSpec Abbr.	MiniSpec Command	MiniSpec Definition	MAVSDK Equivalent	Description
1️⃣4️⃣	`pp`	`path_plan`	`_1=path_planner($1);?_1!=False{wp(_1)};`	`await plan_safe_route(destination);`	Compute an optimal flight path and navigate to the destination.
1️⃣5️⃣	`pr`	`path_replan`	`?od()==True{_1=path_planner(current_target);?_1!=False{wp(_1)}};`	`await replan_route(drone);`	Replan the path in real-time if an obstacle is detected.
1️⃣6️⃣	`oa`	`obstacle_avoidance`	`?od()==True{mf(-5);tc(45);mf(5);}`	`await avoid_obstacle(drone);`	Avoid unexpected obstacles.
1️⃣7️⃣	`od`	`obstacle_detect`	`_1=sensor_check();?_1!=False{->True};->False;`	`await check_obstacles(drone);`	Detect obstacles in the UAV's path.

📡5️⃣ Perception & Object Interaction

These skills enable the UAV to scan, track, and measure objects.

#	MiniSpec Abbr.	MiniSpec Command	MiniSpec Definition	MAVSDK Equivalent	Description
1️⃣8️⃣	`tp`	`take_picture`	`tp();`	`await drone.camera.take_photo();`	**Capture an image.**
1️⃣9️⃣	`p`	`probe`	`p(question);`	`await query_ai_for_answer(drone, question);`	**Ask AI for reasoning.**

📷6️⃣ Low-Level Control Skills

These fundamental motion commands handle precise directional movement.

#	MiniSpec Abbr.	MiniSpec Command	MiniSpec Definition	MAVSDK Equivalent	Description
2️⃣0️⃣	`mf`	`move_forward`	`mf(distance);`	`await drone.action.set_manual_control_input(1.0, 0.0, 0.0, 0.0);`	**Move forward by a distance.**
2️⃣1️⃣	`mb`	`move_backward`	`mb(distance);`	`await drone.action.set_manual_control_input(-1.0, 0.0, 0.0, 0.0);`	**Move backward.**

2️⃣2️⃣	`ml`	`move_left`	`ml(distance);`	`await drone.action.set_manual_control_input(0.0, -1.0, 0.0, 0.0);`	**Move left.**
2️⃣3️⃣	`mr`	`move_right`	`mr(distance);`	`await drone.action.set_manual_control_input(0.0, 1.0, 0.0, 0.0);`	**Move right.**

🚀 Summary

✅ **Expanded MiniSpec skills for PX4 SITL**
✅ **Mapped each skill to an equivalent MAVSDK function**
✅ **Introduced barometric, GPS, and sensor-based navigation**
✅ **Added real-time obstacle avoidance & AI-driven path planning**

🚀 **Next Steps:**
Would you like a Python framework to automatically execute MiniSpec commands via MAVSDK?