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Natural-Language Mission-Programming Adapter Compiling Operator Briefs into Validated Transmedium Mission Parameters with Medium-Transition Safety Interlocks and Human-Authority Hand-off

Marginal · 59.9/100

12 claims

TECHNICAL FIELD

Mission planning and validation for transmedium unmanned vehicles, translating natural-language operator briefs into checked flight-controller parameters with safety interlocks.

ABSTRACT

A mission-programming adapter receives an operator mission brief expressed in natural language and compiles it into a validated set of mission parameters for a transmedium drone flight controller. A parser maps the brief to candidate parameters such as waypoints, depths, payload actions, and transition points. A validator checks the candidate parameters against vehicle limits, geofences, depth and altitude envelopes, and a rules base, and inserts or verifies medium-transition safety interlocks for each air-to-water and water-to-air transition. The adapter rejects or flags parameters that violate limits and requires explicit human authority for sensitive actions, providing a human-authority hand-off rather than autonomous decision-making for those actions. The adapter compiles and validates missions; it does not autonomously decide to interfere with crewed vessels, and any such action is gated to a human authority. The result is faster, less error-prone mission setup for a vehicle that crosses the air-water interface, with safety and authority constraints enforced at compile time and carried into the executable parameter set.

BACKGROUND

Programming a transmedium mission by hand is slow and error prone. An operator must specify waypoints, dive depths, payload actions, and the points at which the vehicle transitions between air and water, while respecting vehicle limits, geofences, and legal constraints. Mistakes at a medium transition are especially dangerous. Natural-language and block-based programming front ends for drones exist, and ground control stations validate some parameters, but known systems do not specifically compile a natural-language brief into a transmedium parameter set in which medium-transition safety interlocks are inserted and verified for each air-water crossing, nor do they bind sensitive actions to an explicit human-authority hand-off at compile time. There is also a risk that a natural-language interface is over-trusted and allowed to authorise sensitive or unlawful actions. There remains a need for an adapter that translates an operator brief into validated, limit-checked transmedium mission parameters, that enforces medium-transition interlocks, and that explicitly requires human authority for sensitive actions rather than letting the language model or planner decide autonomously, so that the convenience of natural-language tasking does not weaken safety or lawful control.

SUMMARY OF THE INVENTION

The invention provides a mission-programming adapter and method. A parser converts a natural-language operator brief into candidate transmedium mission parameters including waypoints, depths, payload actions, and medium-transition points. A validator checks the candidates against vehicle limits, geofences, depth and altitude envelopes, and a rules base, and for each air-to-water or water-to-air transition inserts or verifies a safety interlock, for example confirming a permitted entry attitude, a ballast precondition, or a rotor-inhibit. Parameters that fail validation are rejected or flagged for correction. Sensitive actions are tagged as requiring an explicit human-authority hand-off and cannot be armed by the adapter alone. The validated parameter set, with interlocks and authority gates embedded, is emitted to the flight controller in an executable form. The adapter compiles and validates missions and does not autonomously decide to interfere with crewed vessels; such actions are gated to a human authority. The result is faster, safer, and auditable transmedium mission setup.

DETAILED DESCRIPTION

FIG. 1 is a block diagram of the mission-programming adapter showing a natural-language input (80), a parser (82), a validator (84), a rules base (86), an interlock inserter (88), and an output to a flight controller (90). FIG. 2 is a flowchart of the compile and validate method. FIG. 3 is a schematic of a transmedium mission with waypoints, a dive segment, a transit depth, and air-to-water and water-to-air transition points. FIG. 4 is a detail of a medium-transition interlock record. FIG. 5 is a flowchart of the human-authority hand-off for a sensitive action. FIG. 6 is an example of a validation report returned to the operator. Referring to FIG. 1 and FIG. 2, the parser (82) receives the natural-language brief (80) and produces candidate mission parameters: a sequence of waypoints, commanded depths, payload actions, and the points at which the vehicle transitions between air and water. The validator (84) checks each candidate against vehicle limits, geofences, and the depth and altitude envelopes, and against the rules base (86), which encodes safety and legal constraints. Candidates that violate a limit are rejected or flagged with an explanation in the validation report (FIG. 6) so the operator can correct the brief. Referring to FIG. 3 and FIG. 4, for each air-to-water and water-to-air transition the interlock inserter (88) inserts or verifies a medium-transition safety interlock, for example a precondition on ballast state, entry attitude, depth confirmation, or rotor-inhibit, so the executable mission cannot cross the interface without the interlock being satisfied. Referring to FIG. 5, actions tagged as sensitive, including any action affecting other vessels, are bound to a human-authority hand-off: the adapter marks the action as requiring explicit human authorisation and does not arm it autonomously. The validated parameter set, carrying its interlocks and authority gates, is emitted to the flight controller (90) in an executable form, and a record of the compilation, including which rules were applied and which actions require hand-off, is retained for audit. In an embodiment the parser is a language model whose output is constrained to the validator schema, so the language model proposes but the validator and rules base dispose.

DRAWINGS

FIG. 1 is a block diagram of the mission-programming adapter with natural-language input, parser, validator, rules base, interlock inserter, and flight-controller output; FIG. 2 is a flowchart of the compile-and-validate method; FIG. 3 is a schematic of a transmedium mission with waypoints, a dive segment, a transit depth, and air-water transition points; FIG. 4 is a detail of a medium-transition interlock record; FIG. 5 is a flowchart of the human-authority hand-off for a sensitive action; FIG. 6 is an example validation report returned to the operator.

CLAIMS

1. A method of programming a transmedium unmanned vehicle, the method comprising: receiving an operator mission brief expressed in natural language; parsing the brief into candidate mission parameters including waypoints, commanded depths, payload actions, and medium-transition points between air and water; validating the candidate mission parameters against vehicle limits, a geofence, depth and altitude envelopes, and a rules base; for each medium-transition point, inserting or verifying a medium-transition safety interlock; tagging a sensitive action as requiring an explicit human-authority hand-off; and emitting a validated mission-parameter set to a flight controller in an executable form.
2. A mission-programming system for a transmedium unmanned vehicle, the system comprising: a parser configured to convert a natural-language operator brief into candidate mission parameters including waypoints, depths, payload actions, and medium-transition points; a validator configured to check the candidate mission parameters against vehicle limits, a geofence, depth and altitude envelopes, and a rules base; an interlock inserter configured to insert or verify a medium-transition safety interlock for each medium-transition point; and an output configured to emit a validated mission-parameter set, in which a sensitive action is gated to an explicit human-authority hand-off, to a flight controller.
3. The method of claim 1, wherein validating comprises rejecting or flagging a candidate mission parameter that violates a vehicle limit, the geofence, or an envelope, and returning a validation report identifying the violation for operator correction.
4. The method of claim 1, wherein the medium-transition safety interlock comprises a precondition on at least one of a ballast state, an entry attitude, a depth confirmation, and a rotor-inhibit such that the mission cannot cross an air-water interface unless the precondition is satisfied.
5. The method of claim 1, wherein the sensitive action comprises any action affecting another vessel, and tagging the sensitive action prevents the action from being armed without explicit human authorisation.
6. The method of claim 1, wherein parsing the brief uses a language model whose output is constrained to a schema defined by the validator, such that the language model proposes candidate parameters and the validator and rules base determine validity.

7. The method of claim 1, wherein the adapter compiles and validates the mission and does not autonomously authorise interference with a crewed vessel, any such action remaining gated to a human authority.
8. The method of claim 1, further comprising retaining an audit record of the compilation including which rules were applied and which actions were tagged as requiring a human-authority hand-off.
9. The system of claim 2, wherein the validator is configured to return a validation report identifying any candidate parameter that violates a vehicle limit, the geofence, or an envelope.
10. The system of claim 2, wherein the interlock inserter is configured to insert, for each air-to-water and water-to-air transition, a precondition on at least one of ballast state, entry attitude, depth confirmation, and rotor-inhibit.
11. The system of claim 2, wherein the parser comprises a language model constrained to a validator schema, the validator and rules base retaining authority over validity of the candidate parameters.
12. The system of claim 2, wherein the output is configured to embed the medium-transition safety interlocks and the human-authority gates within the validated mission-parameter set emitted to the flight controller.

PATENTABILITY SELF-ASSESSMENT (30-FACTOR)

Patentability	62.0%
Prior-art position	52.0%
Technical merit	64.0%
Commercial	60.0%
Composite genius score	59.9/100 (Marginal)

FILING ROUTES

United Kingdom (UK IPO)

GB national application at UK IPO with combined search and examination; frame claims around the technical medium-transition interlock and controller effect to address computer-program and mental-act exclusions under UK practice.

Ireland (IPOI / Irish PATO)

IE filing at IPOI; an IE 10-year short-term patent is a pragmatic keystone, with EPO or PCT pursued only if the technical-effect framing holds against software-exclusion objections.

PRIOR-ART VERIFICATION (LIVE SEARCHES)

UK IPO patent search (Ipsu

UK national register and file inspection
<https://www.search-for-intellectual-property.service.gov.uk/SearchByNumber>

Espacenet (EPO)

European/worldwide prior-art search
<https://worldwide.espacenet.com/patent/search?q=nl%20mission%20programming%20adapter%20drone>

Google Patents

Full-text + family view
[https://patents.google.com/?q=\(nl%20mission%20programming%20adapter%20drone%20UAV%20transmedium\)&type=PATENT](https://patents.google.com/?q=(nl%20mission%20programming%20adapter%20drone%20UAV%20transmedium)&type=PATENT)

IPOI (Irish Patents Office)

Irish national filing route (short-term + full-term)
<https://www.ipoi.gov.ie/en/types-of-ip/patents/>

EPO CPC B64U (UAS)

Unmanned-aircraft classification
<https://worldwide.espacenet.com/patent/search?q=cpc%3DB64U>

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