

VEHICLE-CPS

Institutional Government Research Package

Cyber-Physical System for Civil Protection, Security Support and Real-Time Simulation

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Submission status	Research contribution - open to institutional review, audit, validation and collaboration
Operational position	Not an alert, not an accusation, not an autonomous enforcement system
Primary pathway	Review -> audit -> validation -> agreement -> phased funding -> prototype -> delivery -> support
Delivery target	Project completion: June 2027 Delivery and support: July 2027
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Website: <https://vehiculesystemslab.com>

GitHub: <https://github.com/vehiculesystemslab/VEHICLE-CPS>

Zenodo: <https://zenodo.org/records/20046955>

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Recommended use: Send the cover letter and executive summary first. Provide the full package after a government agency, laboratory, university, civil protection office or security innovation unit requests technical review.

1. Institutional Cover Letter

Dear Sir/Madam,

My name is Magister Roberto Borda Milan, representing VEHICLE Systems Lab.

We respectfully submit VEHICLE-CPS for institutional review as a scientific and technological research initiative focused on cyber-physical systems for civil protection, security support, leader protection, real-time simulation and preventive analysis of complex scenarios.

This submission is not an operational alert, accusation or emergency claim. It is a research contribution intended to open a serious channel for technical review, public scientific evaluation, institutional audit and potential staged collaboration with qualified agencies, laboratories and governmental security or civil protection institutions.

For clarity, a Cyber-Physical System, or CPS, connects the physical world with the digital world. It allows sensors, devices, data, simulation models and response systems to work together so a real situation can be observed, analyzed in real time and brought to human decision-makers in a structured form.

VEHICLE-CPS is designed around a local operational logic: the CPS module does not require a direct internet connection for its main operational function. This reduces exposure surfaces, preserves integrity and supports use in sensitive contexts where autonomy, stability and security are priorities.

The architecture is developed by VEHICLE Systems Lab and is structured around the Borda Milan Pyramid, a layered model for organizing nodes, relations, risk fields, operational regimes and auditable decision-support logic.

We invite your institution to review the public materials, technical architecture, funding phases and pilot proposal. The intended pathway is: review, audit, validation, agreement, phased funding, prototype, delivery and support.

We remain available to provide further documentation, answer technical questions or coordinate a formal presentation if your team considers it appropriate.

Sincerely,

Magister Roberto Borda Milan

VEHICLE Systems Lab

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2. One-Page Executive Summary

VEHICLE-CPS is an auditable civil protection architecture designed to anticipate structural risk around leaders, institutions, infrastructure and critical decision environments.

Problem: High-risk institutional environments can fail when visual security, fixed perimeters and verbal coordination are no longer sufficient. Protection teams need a way to understand field structure, node continuity, perimeter pressure and abnormal relational patterns before damage becomes irreversible.

Proposed approach: VEHICLE-CPS models the protection environment as a cyber-physical system. It combines wearable proximity devices, local infrastructure, real-time simulation, dynamic protection rings, operational regimes and human-supervised workflows.

Non-technical definition: A CPS connects sensors and physical devices with digital models and decision-support systems. It observes a real environment, analyzes the data in real time and supports human decision-making.

Security principle: The main operational CPS module is designed not to require a direct internet connection. This supports safer use in sensitive environments and reduces external exposure.

Architecture: The project is built around the Borda Milan Pyramid, a layered architecture for information, nodes, relations, field tension, risk regimes, audit layers and human oversight.

Collaboration request: VEHICLE Systems Lab seeks institutional review, technical audit, public scientific review, validation support and possible phased research collaboration.

Funding structure: Four phases of USD 80,000 each, totaling USD 320,000. Participating countries, institutions or agencies that fund the development may receive a complete pilot kit of up to 1,000 bracelets, together with technical documentation, architecture, support and implementation guidance.

Timeline: The project is planned for completion in June 2027, with delivery, initial implementation and technical support projected for July 2027.

Ethical position: VEHICLE-CPS is not a surveillance platform, not an offensive system and not an autonomous enforcement mechanism. It is a preventive, defensive, auditable and human-supervised research framework.

3. Main VEHICLE-CPS Document - Consolidated Research Position

3.1 Research Identity

VEHICLE-CPS is a project of VEHICLE Systems Lab focused on civil protection, leader protection, institutional continuity and critical decision environments. It transforms complex protection scenarios into auditable structures composed of layers, nodes, relations, risk fields and human oversight mechanisms.

3.2 Problem Statement

In large events, institutional environments or high-risk gatherings, the most dangerous moments often occur when a protected person is surrounded by many people. Traditional protection methods depend heavily on visual detection, verbal communication and fixed perimeters. VEHICLE-CPS responds by treating the environment as a dynamic graph rather than a static perimeter.

3.3 Core Research Question

How can a protection system detect structural risk in a crowded or critical environment before damage becomes irreversible, while maintaining human supervision, auditability and ethical limits?

3.4 System Position

- Decision-support architecture, not replacement for trained authorities.
- Real-time simulation and structural risk interpretation, not accusation or intent detection.
- Local operational design without mandatory direct internet connection.
- Open to technical audit, public scientific review and institutional evaluation.
- Designed for staged development before any operational deployment is considered.

3.5 Intended Domains

- Civil protection and emergency management.
- Leader protection and high-responsibility public events.
- Institutional risk and continuity.
- Critical infrastructure and controlled access environments.
- Defensive and human-supervised security research.

4. Technical Architecture Brief

VEHICLE-CPS represents people, zones, devices, risk signals and decision conditions as a dynamic structural field. Each authorized participant or operational element can be modeled as a node, while relations between nodes create a real-time graph of protection continuity.

Layer	Function	Indicative Components
Physical layer	Observation of authorized participants, zones and field conditions.	Bracelets/badges, UWB/BLE devices, anchors, gates, tamper indicators.
Local infrastructure layer	Local processing and operational continuity without mandatory cloud dependency.	Local server, operator tablets, local storage, controlled interfaces.
Graph layer	Representation of nodes, relations, continuity and discontinuity.	Node graph, dynamic protection rings, compatibility functions.
Simulation layer	Real-time interpretation of field tension and scenario evolution.	Field state T(X), regime transitions, crowd/zone models.
Operational layer	Human-supervised response support.	P0-P6 regimes, confirmation workflows, escalation protocols.
Audit layer	Traceability for review, accountability and learning.	Logs, event records, operator actions, technical review outputs.

4.1 Structural Logic

VEHICLE-CPS treats authorized participants as nodes within a structured field. A node may be represented as a state vector. Compatibility between neighboring nodes can be evaluated through relational distance, expected proximity, continuity and authorized role patterns. When abnormal relations, degraded continuity, perimeter disruption or elevated decision pressure appear, a field tension measure T(X) can rise and operators can receive a localized alert.

4.2 Operational Regimes

Regime	Meaning	Human Response
P0	Passive monitoring / normal state.	Routine observation.
P1	Minor discontinuity or weak anomaly.	Operator awareness.
P2	Localized abnormal relation or degraded continuity.	Human verification.
P3	Elevated field tension around protected zone.	Team coordination and closer review.
P4	Confirmed structural disruption.	Controlled protective adjustment.
P5	Critical risk escalation.	Emergency protocol consideration.
P6	Full protective or evacuation protocol.	Authority-led action only.

5. CPS Explanation for Non-Technical Authorities

A Cyber-Physical System, or CPS, is a technology that connects the physical world with the digital world. In simple terms, it allows sensors, devices, data, simulation models and response systems to work together.

Example: In a protected event, physical devices can observe positions, movement, proximity or continuity. The digital model analyzes whether the environment remains structurally normal or whether an unusual gap, interruption or pressure appears. The result is then shown to trained human operators.

A CPS does not need to be understood as a mysterious technology. It is a bridge: physical signals enter the system, digital models interpret the situation, and human decision-makers receive structured support.

5.1 What VEHICLE-CPS Does Not Claim

- It does not identify guilt or intent automatically.
- It does not replace police, security teams or civil protection authorities.
- It does not require public alarm or public exposure.
- It does not operate as an offensive tool.
- It does not make autonomous coercive decisions.

5.2 What VEHICLE-CPS Tries to Support

- Earlier recognition of structural discontinuity.
- Better understanding of crowded or high-pressure environments.
- Human-supervised analysis before risk becomes irreversible.
- Auditable records for technical and institutional review.
- Safer coordination between existing security and protection systems.

6. Roadmap 2026-2027

Period	Milestone	Expected Output
2026 Q2-Q3	Institutional review package and public research positioning.	Cover letter, executive summary, main document, GitHub/Zenodo/ORCID references.
2026 Q3-Q4	Technical audit preparation and architecture validation.	Architecture brief, CPS explanation, risk plan, data plan, ethical use statement.
2026 Q4-2027 Q1	Prototype and simulation validation.	Dashboard prototype, real-time simulation tests, P0-P6 operational regime refinement.
2027 Q1-Q2	Pilot kit integration and controlled testing.	Bracelet kit planning, local infrastructure model, operator protocol, audit logs.
June 2027	Project completion target.	Validated research/prototype package ready for qualified delivery review.
July 2027	Delivery and support target.	Initial implementation support, documentation, training and technical assistance.

The roadmap is intentionally staged. No operational deployment should be considered before review, audit, validation and agreement are completed.

7. Budget by Phases - USD 80,000 x 4

Phase	Budget	Primary Objective	Representative Deliverables
Phase 1	USD 80,000	Architecture validation, documentation and security review.	Technical architecture package, simulation baseline, CPS module requirements, audit preparation.
Phase 2	USD 80,000	Prototype development and controlled simulation.	Dashboard prototype, bracelet/badge pilot specifications, local server model, test scenarios.
Phase 3	USD 80,000	Pilot kit integration and external validation.	Up to 1,000 bracelet kit plan, interoperability testing, operator workflows, validation report.
Phase 4	USD 80,000	Delivery preparation, support, training and public scientific review.	Final documentation, training materials, support plan, review dossier, handover package.
Total	USD 320,000	Full staged development pathway.	Research-to-prototype package for qualified institutional collaboration.

7.1 Indicative Cost Categories

- Research leadership and coordination.
- Mathematical modeling and simulation.
- Software development and dashboard interface.
- Hardware integration research for wearable devices.
- Local infrastructure and security design.
- Documentation, training and technical manuals.
- Independent review, audit and ethical evaluation.
- Support, testing, maintenance and controlled pilot preparation.

8. Security and Risk Management Plan

The security principle of VEHICLE-CPS is conservative: the system should reduce exposure, preserve operational continuity and support human-supervised decision-making.

Risk Area	Risk	Mitigation
Connectivity	External exposure if sensitive operations depend on internet access.	Main operational CPS module designed without direct internet requirement; use local infrastructure and controlled updates.
False confidence	Operators may overtrust a technical alert.	Human oversight, clear regime definitions, training and requirement for confirmation.
False positives	System may flag harmless discontinuities.	Calibration, scenario testing, logging and post-event review.
False negatives	System may miss a relevant risk.	Redundant observation layers, controlled validation and continuous improvement.
Data misuse	Operational data could be accessed or interpreted improperly.	Access control, minimization, encryption, logs and institutional governance.
Hardware failure	Bracelets, anchors or local server components may fail.	Graceful degradation, backup protocols and maintenance cycle.
Ethical misuse	Use beyond civil protection purpose.	Ethical use statement, contract limits and audit rights.

8.1 Security Requirements Before Pilot

- Documented threat model.
- Local operation and backup protocol.
- Access control matrix.
- Audit logging policy.
- Data retention and deletion policy.
- Operator training and escalation limits.
- Independent technical review before any field use.

9. Data Management and Privacy Plan

VEHICLE-CPS should follow a data-minimization approach. The system should collect only what is necessary for the authorized protective purpose and should avoid unnecessary personal profiling.

Data Category	Purpose	Control
Device identifier	Recognize authorized nodes or devices during an event.	Event-specific identifiers; avoid permanent public identity exposure.
Proximity/position signal	Support graph continuity and dynamic protection rings.	Local processing; limited retention; access control.
Regime transitions	Record changes from P0 to P6 for audit and learning.	Immutable or controlled audit logs.
Operator actions	Trace human response and accountability.	Role-based access; review by authorized institution.
Technical diagnostics	Maintain system reliability.	Separate from personal data where possible; limited retention.

9.1 Privacy Principles

- Purpose limitation: use only for defined protection/civil safety objectives.
- Data minimization: collect the minimum viable data.
- Local control: prioritize local infrastructure where possible.
- Retention limits: delete or anonymize data after review windows.
- Access control: only authorized staff may access operational records.
- Transparency to institutional partners: documented data flows and auditability.

10. Ethical Use Statement

VEHICLE-CPS is proposed as a preventive, defensive, auditable and human-supervised research framework. It is not designed for offensive use, mass surveillance, political persecution or autonomous coercive enforcement.

10.1 Core Ethical Commitments

- Human authority remains responsible for all operational decisions.
- The system provides structured decision support, not autonomous judgment of guilt or intent.
- The project is open to audit and scientific review before deployment.
- Use must be limited to lawful civil protection, security support and risk-management contexts.
- The system should not be used to suppress lawful civic activity or target individuals based on political, ethnic, religious or social identity.
- Any field use must include institutional governance, operator training and accountability.

10.2 Required Contractual Limits

- No autonomous enforcement.
- No unauthorized surveillance expansion.
- No transfer to prohibited users or unlawful purposes.
- Data protection and deletion obligations.
- Audit rights and review mechanisms.
- Human-supervised escalation only.

11. Audit and Public Scientific Review Statement

VEHICLE-CPS is intentionally presented as an open research initiative subject to technical audit, public scientific review and institutional evaluation before any operational consideration.

11.1 Review Scope

- Architecture of VEHICLE Systems Lab.
- Borda Milan Pyramid structure.
- VEHICLE-CPS model and simulation logic.
- Security of the module without direct operational internet connection.
- Data governance and privacy plan.
- Ethical use limits and human oversight.
- Pilot kit feasibility and support model.
- Budget, milestones and technical deliverables.

11.2 Suggested Review Sequence

16. Initial document review by qualified technical unit.
17. Architecture audit by independent or institutional experts.
18. Controlled simulation validation.
19. Legal, ethical and data-protection review.
20. Memorandum of understanding or research agreement.
21. Phased funding authorization.
22. Prototype development and testing.
23. Delivery preparation and support.

12. GitHub / Zenodo / ORCID / Website References

Reference	URL	Purpose
Official website	https://vehiclesystemslab.com	Institutional public reference.
GitHub repository	https://github.com/vehiclesystemslab/VEHICLE-CPS	Technical repository for VEHICLE-CPS materials and review.
Zenodo record	https://zenodo.org/records/20046955	Public research archive and DOI-style research record.
ORCID profile	https://orcid.org/0009-0009-9047-1036	Researcher identity reference for Magister Roberto Borda Milan.
Institutional contact	contact@vehiclesystemslab.com	General laboratory contact.
Direct contact	bordamilan@vehiclesystemslab.com	Direct project correspondence.

Note: References should be reviewed by agencies using their official cybersecurity and link-verification procedures before downloading or executing any files.

13. Pilot Proposal - up to 1,000 Bracelets

Participating countries, institutions or agencies that support the staged development may receive a complete pilot kit of up to 1,000 bracelets, subject to final technical validation, procurement conditions, regulatory review and agreed implementation scope.

Pilot Component	Description
Bracelets or badges	Up to 1,000 wearable devices for authorized participants, staff or protected-event roles.
Anchors and gates	Local infrastructure for proximity, zone continuity and access modeling.
Local CPS module	Operational module designed without mandatory direct internet connection.
Operator dashboard	Human-supervised interface for field state, alerts and regime review.
Simulation environment	Controlled testing of scenarios, continuity, field tension and P0-P6 regimes.
Documentation	Architecture, operational protocol, data plan, security plan and training materials.
Support	Implementation guidance, technical assistance and post-delivery review.

13.1 Pilot Conditions

- Pilot use only after review, audit, validation and agreement.
- No public operational claim before controlled validation.
- Institutional governance required.
- Technical logs and review reports required.
- Country-specific regulatory requirements to be assessed before deployment.
- Certification pathway to be defined according to the target country.

14. Support and Delivery Plan - July 2027

The target plan is to complete the project by June 2027 and begin delivery, initial implementation and technical support in July 2027.

Support Area	Planned Support
Technical handover	Delivery of system documentation, architecture overview and pilot configuration materials.
Training	Operator orientation for dashboard use, P0-P6 regimes, escalation limits and audit logs.
Maintenance	Guidance for bracelets, anchors, local infrastructure and replacement cycles.
Security review	Support for local security review, access control and connectivity policy.
Data governance	Support for data retention, deletion, privacy and review workflow.
Post-pilot assessment	Structured review of results, limitations, false positives, false negatives and improvements.

14.1 Deliverables at Handover

- Final technical architecture package.
- Validated prototype/pilot kit scope.
- Operator manual.
- Security and risk management plan.
- Data management and privacy plan.
- Ethical use statement.
- Audit and review report template.
- Support and maintenance guide.

15. Institutional Collaboration Pathway

For governmental and institutional audiences, the strongest path is not to ask for immediate funding as the first step. The recommended institutional pathway is:

Step	Meaning	Outcome
1. Review	Agency receives and reads the cover letter, executive summary and public references.	Initial awareness; VEHICLE-CPS becomes known to the institution.
2. Audit	Technical and institutional reviewers examine architecture, security, data and ethics.	Credibility, weaknesses identified, improvement path.
3. Validation	Controlled simulation and prototype logic are tested.	Evidence base for future decision.
4. Agreement	Qualified institution signs research collaboration, MOU or technical review agreement.	Formal channel for cooperation.
5. Phased funding	Funding is released by milestones rather than as an undefined lump sum.	Accountability and measurable progress.
6. Prototype	System components, simulation, dashboard and pilot kit are refined.	Controlled working prototype.
7. Delivery	Approved pilot kit and documentation are delivered.	Institutional pilot readiness.
8. Support	Training, review, maintenance and improvement are provided.	Sustainable relationship and future expansion.

Strategic message: Even if an institution does not approve funding immediately, this package allows VEHICLE-CPS to be formally recognized, reviewed and remembered as an auditable research initiative with a staged and responsible development path.

Closing Institutional Position

VEHICLE Systems Lab understands that governmental collaboration and research funding require transparency, technical responsibility, auditability, data protection, ethical use, phased budgeting and measurable milestones. For this reason, VEHICLE-CPS is presented as an open research initiative, subject to technical audit, public scientific review, institutional evaluation and staged development before any operational deployment is considered.