



FIRA Smart Home Simulation League Competition Rules (U14 / U19)

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Abstract

The FIRA Smart Home Simulation League is an autonomous robot-vacuum programming competition for students in **separate U14 and U19 divisions**. Competitors write controller software to navigate a simulated house, handle obstacles and maximize the cleaning outcome measured by an official scoring engine. **Two materially different environments appear in the reviewed public materials**: the current public Webots cleaning simulation and a proposed head-to-head tile-ownership format. This draft identifies both; it does not present unverified head-to-head settings as confirmed FIRA rules. Clauses labeled [RELEASE GATE] remain inactive until the organizer publishes and verifies the applicable simulator release.

Latest Version of the Rules

Revision note: Text shown in red highlights provisions updated or added compared with the previous rulebook (Version 3.1, February 2026).

The Technical Committee shall publish a dated and versioned competition rulebook, an identified simulator build, a supported Python/SDK package, tested starter controllers and the scoring annex. A binding release must specify **whether the event uses Webots cleanliness scoring or a distinct head-to-head ownership mode**. The official event package and signed amendments take precedence over historical web pages, samples and practice games. If any material behavior differs between the approved text and released executable, the affected feature must be withheld or corrected before competitive use.

FIRA Smart Home Simulation League

The league develops sensor interpretation, navigation, map exploration, programming, debugging and autonomous decision-making. Routine results are calculated by the validated scoring engine. Technical checks may establish source authorship, execution integrity and conformance; **they shall not silently generate additional points**. Only properly announced assessment elements may influence the competition ranking.

Rules of the Game

Sections SH-5 through SH-17 describe a PROPOSED head-to-head tile-ownership variant discussed during drafting. They are not a statement that the public Webots implementation already supports these mechanics. The event must choose one mode and publish its complete scoring interface and test results before registration closes. If the competition uses the publicly documented Webots cleanliness format instead, its approved scoring annex replaces the provisional ownership and two-robot provisions without ambiguity.

[SH-1] Divisions and Age Eligibility

Two divisions compete independently: U14 and U19. [RELEASE GATE — eligibility] For a provisional 2026 reference date of 30 June 2026, U14 means younger than 14 (birth date on or after 1 July 2012); U19 means at least 14 but younger than 19 (birth dates from 1 July 2007 through 30 June 2012). The organizer must confirm the exact event year, minimum-age exception, reference date and whether qualified younger teams may elect U19. A competitor shall be registered on one roster and in one division only; official proof of age may be requested.

[SH-2] Team Composition

[RELEASE GATE — roster] The proposed team size is 2–6 students and one designated captain; the organizer must verify that range against the registration circular before publication. The captain is responsible for technical notices and formal protests. Roster changes after check-in require a documented, organizer-approved exception. During official runs and code quarantine, mentors, parents and unregistered persons shall not modify the submitted program or provide live tactical instructions.

[SH-3] Eligible Software and Equipment

The organizer shall publish one reproducible competition baseline: simulator installer or archive and checksum, approved operating system or system image, Python version, helper SDK version, robot worlds, required plugins and allowed third-party libraries. All teams in a division shall be offered equivalent execution resources. Unapproved access to privileged

supervisor objects, opponent code, unpublished map data, scoring variables, system files, external networks or operating-system processes is prohibited. The released controller interface—not its undocumented implementation details—is the participant API.

[SH-4] Autonomous Operation

Only the student's approved, submitted program may issue robot control commands after the official start. Manual steering, changing source code during play, external tactical updates, direct interference with the simulation clock and runtime modification are prohibited. Any officially provided educational assistance feature shall require a separately published, division-specific description of its exact allowed actions; no such feature may be assumed from the Chogan league.

[SH-5] Robot and Competition Format

[PROPOSED FORMAT; RELEASE GATE] The head-to-head draft uses **one autonomous vacuum robot per team in a shared house, with both robots competing simultaneously for a proposed 180 seconds of SIMULATED time**. These robot counts, timing semantics, start positions and controller launch contracts **MUST** be validated against the event executable. The publicly distributed Webots cleaning simulator does not, by itself, establish that this alternative format is installed or approved.

[SH-6] Arena and Floor Cells

[PROPOSED MAP; RELEASE GATE] **A 22×22 logical grid is proposed for the head-to-head variant**. The annex shall define which cells are traversable, which are eligible for scoring, how partial overlaps are rounded, how cell centers map to world coordinates, whether furniture occupies whole cells, and how map generation is seeded. A logical grid size must not be mistaken for the dimensions of the publicly distributed Webots house. Maps shall be disclosed or withheld using a policy announced equally to all teams.

[SH-7] Initial Conditions and Map Fairness

For each official match the referee shall record the chosen map identifier and seed, controller revisions, robot placements, division and clock configuration. In a simultaneous match **both competitors shall face the same world state**, but equivalent world access does not by itself make asymmetric starting positions fair. If starts are not demonstrably symmetric, fixtures must use **a pair of games with swapped sides** and a documented aggregation method. Teams may neither select their own start positions nor modify the arena.

[SH-8] Obstacles and Environment

Static walls and furniture may be treated as obstacles only according to the approved physics and collision model. If pets, hazards, moving actors or randomized objects are enabled, their motion, visibility and score effects must be described and reproducible from recorded scenario data. A collision is not automatically a separate numeric penalty unless the approved scoring specification explicitly says so.

[SH-9] Sensors and Authorized Data

The authorized U14 and U19 APIs shall be listed by exact property/device name, argument and return type, coordinate frame, unit, update interval, valid range and failure behavior. The current public helper package exposes four convenient distance-related properties (`distance_front_left`, `distance_front_right`, `distance_left` and `distance_right`), bumpers, wheel encoders and wheel commands; the public Webots rule page also describes **eight underlying distance sensors** and an IMU. These descriptions refer to different interface layers and cannot be substituted without an API mapping. GPS is documented in the U19 public helper; battery and charging access remain an event-specific [RELEASE GATE]. No private supervisor data may be used.

[SH-10] Actuators and Motion

Movement, wheel commands, cleaning activation (if any), sensor collection and other actions must use the published controller API. The public Webots helper uses writable `left_motor` and `right_motor` properties; **the Chogan-style `getDevice()/setVelocity()` examples are NOT interchangeable with this helper**. The annex must specify motor saturation, units, direction

conventions, acceleration limits and legal input types. Competitors may not write robot coordinates or invoke unauthorized teleportation.

[SH-11] U14 Profile

U14 matches and standings are separate from U19. Under the public Webots helper, a U14 example can read distance properties, bumpers and wheel encoders; GPS is not listed as a U14 public helper feature. The exact U14 underlying devices, availability of IMU/compass and any cleaning controls must be confirmed in the actual competition world. Battery depletion and mandatory charging shall not be introduced into U14 without a published configuration and working student example.

[SH-12] U19 Profile

U19 may receive location/orientation data, energy limits, charging areas and additional obstacles. In the public helper RobotU19 exposes gps and imu tuples. **The event may not require a 'charge' command, battery-saving behavior or hazard response unless the official SDK supplies documented properties or methods**, valid units, rates, acceptance conditions and a runnable U19 example. Identical initial capacity and the same power model shall be applied to both teams within a fixture.

[SH-13] Scoring Principle

[PROPOSED OWNERSHIP SCORING; RELEASE GATE] **Each eligible floor cell has a single ownership state: neutral, Team A or Team B. A valid cleaning event transfers the cell to the acting team; recleaning a cell already owned by that team must not add another cell. The proposed base score is the number of eligible cells owned at finalization**; only separately specified, engine-recorded penalties may modify it. A reference scoring test must publish the event trigger, overlap threshold, tie-at-same-tick ordering, cell masking and score floor. **If the approved event uses Webots cleanliness/coverage metrics, this clause is inapplicable** and shall be replaced by that tested formula.

[SH-14] End of Match and Winner

[PROPOSED 180-SECOND FORMAT; RELEASE GATE] When the official simulation clock reaches its published terminal event, the engine shall freeze the final state and record team identities, scores, penalties, map/seed, program hashes and build version. **The team with the higher final score wins; equal scores constitute a draw where draws are permitted.** A frozen log and replay take precedence over an out-of-date visual overlay. No referee may retroactively allocate additional cleaning points without a documented correction of a technical fault.

[SH-15] Inactivity and Recovery

[UNCONFIRMED MECHANIC; RELEASE GATE] A previously proposed rule specifies **automatic repositioning after 10 seconds without meaningful progress and a possible two-cell deduction.** This mechanic may be enforced only if the exact simulator version and scoring tests establish the progress predicate, time basis, respawn location, whether the match clock pauses, deduction conditions and minimum score. **Until then neither an automatic teleport nor an independent human-applied point deduction is authorized** by this draft.

[SH-16] Battery, Charging and Failure Conditions

Where an approved battery model is enabled, its initial energy, drain formula, sample period, sensor precision, charge-zone geometry, trigger protocol, charging time and empty-battery outcome must be versioned and published. Only the engine determines whether a charge event is valid. A participant-code crash or a robot that becomes stuck does not automatically warrant a second attempt; any recorded score or forfeiture follows the event-specific failure/timeout annex. An organizer infrastructure failure is handled through SH-24.

[SH-17] Tie-breaks and Balanced Fixtures

[PROPOSED FIXTURE POLICY; RELEASE GATE] Qualification may award **3 standing points for a match win, 1 for a draw and 0 for a loss.** **A tied ranking is resolved in this order: total standing points; score difference across all group games;** total official score across all group games; head-to-head result IF precisely two teams remain tied; otherwise the pre-announced multi-team mini-table. The official scheduler must specify an unambiguous last-resort method before play. For a knockout, **two mirror/side-swapped games are**

recommended; aggregate scores decide advancement. If still tied, run an announced additional mirror pair under a new recorded seed. Do not choose a winner by an improvised draw or by an untested tie-break algorithm.

[SH-18] Qualification and Bracket Publication

Before the first official round, the organizer shall publish the **qualification groups, tie-break order, number of advancing teams, match length, fixture schedule, bracket structure and no-show policy**. Draw and knockout procedures must be executable with the event's staffing and computers. Changes following withdrawals or system faults require a dated notice to all affected teams before their subsequent match; they shall not alter a concluded result except through the documented appeals procedure.

[SH-19] Practice, Quarantine and Code Freeze

Teams may practice with the published code, worlds and practice maps until the announced freeze. **At freeze the organizer shall accept and hash one defined submission bundle per team**, record its runtime/dependencies and archive the approved executable source. **The tournament uses that immutable submission** except under a written, equally available authorized correction process. Quarantine prevents outside contact and unapproved live code edits. A single-robot Webots controller submission **must not be forced into the Chogan four-controller ZIP structure**.

[SH-20] Submission Format and Validation

The binding technical annex shall give the exact required files, launch command, controller entry point, **allowed dependency versions, timeout, memory limits, network policy and a validator** that checks imports, initial step, command interfaces and normal shutdown. A missing or invalid submission receives a documented validation result and **a fixed correction deadline made known to all teams**. If the deadline expires without a valid package, the announced no-show/forfeit procedure applies; officials shall not fabricate a score.

[SH-21] Permitted Code Reuse, Libraries and AI

Teams must be able to explain the submitted algorithm. The official sample controller and permitted open-source examples may be reused under their licenses and with attribution; copied rival submissions and undisclosed third-party turnkey competition solutions are prohibited. AI-assisted learning or drafting may be permitted only under a published event policy describing attribution, external service access and authorship checks. Because the public historic rules stress original student work, this draft does NOT silently grant unrestricted AI-generated competition code. No network/model API calls during an official match unless expressly authorized.

[SH-22] Security and Integrity

No program may inspect or alter private referee state, hidden scoring data, competition seeds before disclosure, another team's files or restricted environment variables. Privilege escalation, exploitation of simulator vulnerabilities, unauthorized external communication, excessive resource consumption or tampering with the map invalidates the relevant run and may trigger disciplinary review. The official must preserve evidence, notify the captain and provide a reasonable opportunity to respond before applying a competition-level sanction.

[SH-23] Referee and Match Record

The automatic scorer is authoritative for normal runtime events. A human referee verifies the setup, team identities, launch hashes, program status and technical incidents; the referee cannot invent new scored cells or discretionary numeric deductions. Each match record shall identify its match and division, program and map hashes, software versions, clock start/end, final score, penalty event IDs, exceptions and replay data where available. Records must be retained through the appeal period.

[SH-24] Technical Incidents and Replays

A documented organizer-side power failure, environment crash, corrupted initial map or unequal configuration requires the technical panel to invalidate the affected attempt and schedule a full replay. A team-code exception, unsupported import, deadlock or timeout is not an automatic replay entitlement. Where the true cause is uncertain, staff shall inspect logs

and reproduce the issue on a neutral baseline before certification. Replays must use the event's announced seed/side policy, and the decision and evidence must be recorded.

[SH-25] Protests and Appeals

Only the registered team captain may challenge a posted result. [RELEASE GATE — administration] **The proposed filing deadline is 15 minutes after the result and technical log become accessible to the team**; the event circular must confirm the deadline, channel, panel membership and final review method. A protest must identify the match ID, contested clause, evidence and requested remedy. A reviewer not responsible for the initial decision should participate when possible. The panel shall issue a written reasoned outcome and, where justified, an amended result or a full replay.

[SH-26] Conduct, Penalties and Disqualification

A first minor violation may receive a recorded warning. Intentional match manipulation, plagiarism, unauthorized code alterations, interference with competitors or attempts to bypass private runtime boundaries may lead to a forfeiture or disqualification following notice, evidence review and the team's response. **A numeric deduction is permitted only when the binding scoring annex fixes its trigger and amount.** Different penalties for the same verified conduct cannot be imposed ad hoc.

[SH-27] Equality and Accessibility

Every team within a division shall have **equivalent hardware resources, software build, sensor access, allowed libraries, timing and technical support**. Organizers may implement reasonable accessibility measures without changing the protected game state or scoring. Technical updates and answers to material questions shall reach all teams at the same time through a published change log.

[SH-28] Documentation Hierarchy

Precedence, highest first: **(1) signed, uniformly distributed amendments for the event**; (2) the approved event rulebook together with its expressly incorporated, version-locked scoring and

technical annexes; (3) the supported public SDK/API reference; (4) educational guides, web pages and samples. **No published rule may rely on an unpublished engine behavior to impose a score or penalty.** When binding text and the testable executable disagree materially, the organizer shall postpone the affected competition feature until the software or the published rules are corrected.

[SH-29] Required Technical Appendix Before Release

Before release, publish a signed implementation manifest: simulator name/build/hash; operating systems; **Webots version if applicable**; Python and smarthome_robot versions; allowed modules; U14/U19 devices and API; number of competitors/robots; official match time; map and seed handling; **scoring/ownership semantics**; recovery, penalties and collisions; U19 battery/charging contract where active; error/timeout outcomes; submission layout, validator, quarantine and appeals. Scoring test vectors must include at least one neutral-cell cleaning, one repeat cleaning, one opponent claim where supported, one boundary case and one invalid controller.

[SH-30] Acceptance Tests / Release Gates

Prior to final approval, execute and log: (a) successful fresh install on event-supported machines; (b) runnable U14 and U19 example controllers; (c) verified sensor names, units and motor direction; (d) unchanged-score tests for re-reading/re-cleaning if ownership applies; (e) **an opponent transfer and simultaneous-claim arbitration if the two-robot mode applies**; (f) timer start/stop and final-score capture; (g) recovery/penalty boundary cases if enabled; (h) charging success/failure in U19 if enabled; (i) invalid submission and no-show handling; (j) replay after organizer failure; and (k) repeatability tolerance for recorded simulator seeds. Archive the resulting logs and build checksums.

[SH-31] Open Items Blocking Final Approval

FINAL APPROVAL BLOCKERS: 1) Obtain a direct, readable copy of SmartHomeLeague-Rulebook-EN.pdf and reconcile each article; the supplied link currently cannot be fetched. 2) **Choose ONE final competition runtime: public Webots cleanliness scoring or an independently delivered head-to-head ownership simulator.** 3) If head-to-head is chosen, verify **two robots, 22×22 cells, 180 seconds, ownership transfer and 10-second**

recovery in the real executable. 4) Reconcile Python 3.10 on the website versus 3.12 in the project README. 5) Publish U14/U19 sensor and charging APIs with executable examples. 6) Confirm age cutoff, team size, submission format, fixtures, appeals and AI-use policy. These unresolved matters are not editorial errors that can be safely guessed away.

Sources and Revision Notes

Primary supplied source (requires direct PDF verification):
<https://smarthomeleague.ir/downloads/SmartHomeLeague-Rulebook-EN.pdf>

Public league overview and Webots download instructions: <https://smarthomeleague.ir/>

Public simulator repository: <https://github.com/smart-home-league/simulation>

Historic public FIRA Smart Home Google Doc:
<https://docs.google.com/document/d/1usuOFnlEMLpfWBMUB8BmrpyFh8ETkLasBooZijI2Yto/edit>

Education/API helper package: <https://pypi.org/project/smarthome-robot/>

Student Programming Guide — Draft v0.2:
<https://docs.google.com/document/d/13z8w56i7zNWNyl6v4MusLo9vVwEVTfhYWZFLg-LIDsY/edit>

Copyediting and technical review completed for every draft section SH-1 to SH-31. Changes include distinguishing incompatible competition modes, precise age-window wording, separating public helper properties from underlying Webots sensors, removing any implied Chogan API compatibility, clarifying score ownership and tie-at-same-tick uncertainty, improving replay/error causation, and requiring published sanctions, reproducible tests and a transparent appeals process. Draft parameters remain marked as release gates until verified; no invented constants were promoted to binding rules.

End of Rules

Draft v0.2 — Copyedited, technically reviewed, logo updated. Not approved for competition publication.

