RoboCupJunior Rescue B – Rules 2014

RoboCupJunior Rescue - Technical Committee 2014

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These are the official rules for RoboCupJunior 2014. They are released by the RoboCupJunior Rescue Technical Committee for Rescue. These rules have priority over any translations. **Changes from the 2013 rules are highlighted in red.**

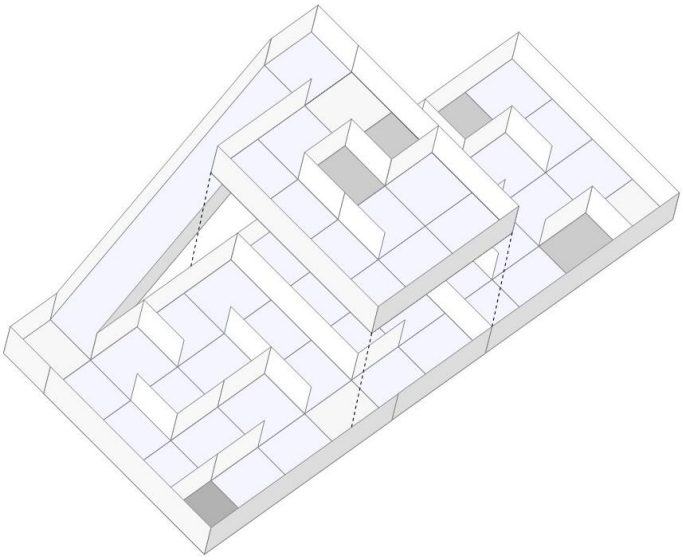
Preface

The land is simply too dangerous for human to reach the victim! Your team has been given the most difficult tasks. It must be able to carry out the rescue mission in fully autonomous mode with no human assistance. The robot must be strong and smart enough to navigate through a treacherous terrain with hills, uneven lands and rubble without getting stuck. The robot needs to seek out the victims, dispense rescue kit, and signal the position to the rescuers so the humans can take over.

Time and technical skills are the essential! Come and prepare to be the most successful Rescue Response Team.

Differences from Rescue A

There is no line on the floors of Rescue B arena. Instead, a robot must search inside of a labyrinth on its own. The paths in the labyrinth may vary between competition rounds (the walls inside will be repositioned each round). Also, there is more than one victim inside of Rescue B arena. The robot needs to signal where they are, but does not have to rescue the victims.



Contents

1. Arena

1.1 Description

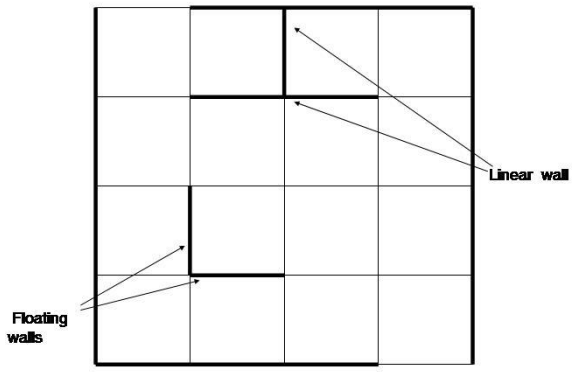
1.1.1 The maze may consist of different floors. Each floor is horizontal.
1.1.2 Different floors of the maze will be connected by a ramp with an incline of maximum 25 degrees from the horizontal surface. The ramp is always straight.
1.1.3 Walls that make up the maze are at least 15 cm high. The walls are white, or close to white.
1.1.4 Doorways and ramps are at least 30 cm wide with +/-2 cm variation.

1.2 Floor

1.2.1 Floors are white or close to white tone. Floors may be either smooth or textured (like linoleum or carpet), and may have steps of up to 3 mm in height at joints. There may be holes in the floor (about 5 mm diameter), for fastening walls.
1.2.2 Through the arena, there may exist black tiles that represent "no go" spaces. Black tiles will be placed randomly at the start of each round. Black tiles may not be completely fixed on the floor.
1.2.3 There may also exist silver tiles that represent checkpoints (see 3.6.2). Silver tiles may not be completely fixed on the floor.
1.2.4 A tile is defined as a 30x30 space, which is aligned to the grid made up by the walls with +/-2 cm variation.

1.3 Path

1.3.1 Walls may or may not lead to the entrance/exit. Walls that lead to the entrance/exit are called linear walls. The walls that do NOT lead to the entrance/exit are called "Floating Walls".
1.3.2 Paths will be approximately 30 cm wide with +/-2cm variation, but may open into foyers wider than the path.
1.3.3 One of the outermost tiles is the starting tile, where a robot should start and exit the run. This may be on the second floor but not on the ramp.
1.3.4 The starting tile is always a checkpoint.



1.4 Debris and Obstacles

1.4.1 Speed bumps are maximum height of 1cm. They are white and fixed the floor. They may be angled.

1.4.2 Debris are maximum height of 3mm, and will not be fixed on the floor. They are small materials such as toothpicks or small wooden dowel, etc.
1.4.3 Debris may be spread towards or adjacent to walls.
1.4.4 Obstacles may consist of bricks, blocks, weights and other large, heavy items. A robot is expected to navigate around obstacles. Obstacles that are moved/knocked over will remain where they fall and will be reset only once the robot has completed its scoring run.
1.4.5 An obstacle, when used, is not placed in a place where it might prevent a robot from discovering routes in the maze.
1.4.6 The obstacles are maximum height of 40 cm and a width of 20 cm. Their shape can be everything from rectangular to cylindrical.
1.4.7 The obstacles can only be placed in foyers with at least 20 cm to the nearest walls.

1.5 Victims

1.5.1 Victims are heated sources located near the floor of the arena (centered approximately 7 cm above the floor).
1.5.2 Each victim has a surface area greater than 16 sq cm.
1.5.3 The organizers will try to keep enough difference (minimum of 10 degrees) between victims' temperatures and the indoor temperature. The temperature of victim simulates human body temperature between 28°C to 40°C.
1.5.4 There will be a minimum of five (5) active victims in any round.
1.5.5 There may be objects that resemble victims in appearance, but are not heated. Such objects are not to be identified as victims by robots.
1.5.6 Victims will never be located on black tiles or on tiles with obstacles.

1.6 Rescue Kits

1.6.1 A Rescue Kit represents a basic health package distributed to a victim caught in a natural disaster. It symbolizes tools or devices used in rescue process, such as GPS Transponders or even something as simple as providing light source.
1.6.2 A Rescue Kit should preferably contain a lit-up LED, but could contain other electronics, weights or magnets.
1.6.3 Each rescue kit must have a minimum volume of 1 cubic cm.
1.6.4 Each team could only carry up to a maximum number of 12 of those kits.
1.6.5 Some sample instructions for creating the rescue lit-up kit can be found the end of this document, and may be found at the International RCJ Community Forum (http://www.rcjcommunity.org/). Each team is encouraged to design their own versions.
1.6.6 Each team is responsible for the whole rescue kits system (the maximum of 12 kits), including bringing the rescue kits to the competition. Team captain is responsible for loading their own Rescue Kits on their robots and cleaning the field with the referee's/judges' authorization after the game is called to complete.

1.7 Environmental Conditions

1.7.1 Teams should expect the environmental conditions at a tournament to be different from the conditions of at their home practice field.
1.7.2 Teams must come prepared to adjust their robots to the lighting conditions at the venue.
1.7.3 Lighting and magnetic conditions may vary along the course in the rescue arena.
1.7.4 The arena may be affected by magnetic fields (e.g. generated by under floor wiring and metallic objects).

1.7.5 Teams should prepare their robots to handle unexpected lightning interference. While the organizers and referees will try their best to minimize external lighting interference, it is not possible for them to foresee all unexpected interferences such as camera flash from spectators.
1.7.6 The Organizing Committee (OC) will try their best to fasten the walls onto the field floor so that the impact from regular robot's contact should not affect it. (Refer to 6.1)

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2. Robot

2.1 Control

2.1.1 Robots must be controlled autonomously. The use of a remote control or manual control, or passing information (by sensors, cables, other interference, etc.) to the robot is not allowed.
2.1.2 Robots must be started manually by the team captain.
2.1.3 Robots may utilize various maze navigation algorithm. Pre-mapped type of dead-reckoning is prohibited.
2.1.4 A robot must not damage any part of the arena in any way.
2.1.5 Robots should include a stop/pause button so they may be easily stopped/paused by humans to avert any potentially damaging or illegal robot actions.

2.2 Construction

2.2.1 The height of a robot must not exceed 30 cm.
2.2.2 Robots may not have any sensor or other device that enables it to 'see' over the walls.
2.2.3 Any robot kit or building blocks, either available on the market or built from raw hardware and materials, may be used, as long as the design and construction are primarily and substantially the original work of the students (see section 2.5. below).
2.2.4 Any commercially produced robot kits or sensors components that are specifically marketed to complete any single major task of RoboCupJunior Rescue will be disqualified. If there is any doubt, teams should consult the Technical Committee (TC) at the International RCJ Community Forum (*http://rcjcommunity.org)*.
2.2.5 For the safety of participants and spectators, no lasers are allowed on any robot.
2.2.6 Bluetooth Class 2, 3 and ZigBee communications are the only wireless types allowed in RoboCupJunior. Robots that have other types of wireless communications on board have to be either removed or disabled for possible interference with other leagues competing in RoboCup. If the robot has equipment for other forms of wireless communication, they must prove that they have disabled them. Robots that do not comply may face immediate disqualification from the tournament.

2.3 Team

2.3.1 Each team must have only one robot in the field. (This rule can be modified in a Super Team Competition such that two or more robots are deployed together and have to cooperate in completing given tasks.)
2.3.2 Each team must have a minimum of 2 members.
2.3.3 The number of team members per team is not limited but a team should choose their team size in a way that the learning experience of each member is maximized. Mentors/parents are not allowed to be with the students during the competition. The students will have to self-govern themselves (without mentor's supervision) during the long stretch of hours at the competition.

2.4 Inspection

2.4.1 The robots will be examined by a panel of referees before the start of the tournament and at other times during the competition to ensure they comply with all of the constraints described above.
2.4.2 It is the responsibility of teams to have their robots re-inspected, if modifications are made to the robot at any time during the tournament.
2.4.3 Students will be asked to explain the operation of their robot, in order to verify that the construction and programming of the robot is their own work.
2.4.4 Students will be asked questions about their preparation efforts, and may be requested to answer surveys and participate in video-recorded interviews for research purposes.
2.4.5 All teams will need to email a technical document containing the major list of hardware and software components at least 1 week prior to the competition. The purpose of this document is to allow judges to be more prepared for the interviews. For sample documentation, please refer to the "Bills of Materials Sample" at the official RCJ website under Rescue rules. Information about how to submit your document will be announced prior to the competition to the teams.
2.4.6 All teams have to submit their codes prior to the competition. The code is never shared with other teams without the team's permission.

2.5 Violations

2.5.1 Any violations of the inspection rules will prevent that robot competing until modifications are effected.
2.5.2 However, modifications must be made within the time schedule of the tournament and teams must not delay tournament play while making modifications.
2.5.3 If a robot fails to even with modification, it will be disqualified from that round (but not from the tournament).
2.5.4 No mentor assistance during the competition is allowed. See 6. Code of Conduct.

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3. Play

3.1 Pre-round Practice

3.1.1 Where possible, competitors will have access to practice arenas for calibration, testing and tuning throughout the competition.
3.1.2 Whenever there are dedicated arenas for competition and practice, it is at the organizers' discretion if testing is allowed on the competition arena.

3.2 Humans

3.2.1 Teams should designate one of its own team members as 'captain' and another one as 'co-captain'. Only these two team members will be allowed an access to the practice/competition arenas, unless otherwise directed by a referee. Only the captain will be allowed to interact with the robot during a scoring run.
3.2.2 The captain can move the robot only when s/he is told to do so by the referee.
3.2.3 Other team members (and any spectators) within the vicinity of the rescue arena are to stand at least 150 cm away from the arena while their robot is active, unless otherwise directed by the referee.
3.2.4 No one is allowed to touch the arenas intentionally during a scoring round.

3.3 Start of Play

3.3.1 A run begins at the scheduled starting time whether or not the team is present/ready. Start times will be posted prominently around the venue.
3.3.2 Once the run has begun, the robot playing is not permitted to leave the competition area for any reason. Each run lasts maximum of 8 minutes.
3.3.3 Calibration is defined as the taking of sensor readings and modifying a robot's program to accommodate such sensor readings. Once the clock has started, a team may calibrate their robot at as many locations as desired on the arena, but the clock will continue to count down. A robot is not permitted to turn on to move while calibrating.
3.3.4 Calibration time is not for pre-mapping the arena and/or victim location. Pre-mapping activities will result in immediate disqualification of the robot for the round.
3.3.5 Before a scoring run begins, a dice will be rolled to determine the location of the black and silver tiles.
The position of the black tiles will NOT be revealed to the team until when they are ready to start a scoring run (see 3.3.6). Referees will ensure the combination of black tile placements in a maze that is 'solvable' before a robot begins a scoring run.
3.3.6 Once the robot is started, a referee will place the black and silver tiles (determined by roll of dice as per 3.3.5).
3.3.7 Once a scoring run has begun, no more calibration is permitted (this includes changing of code/code selection).

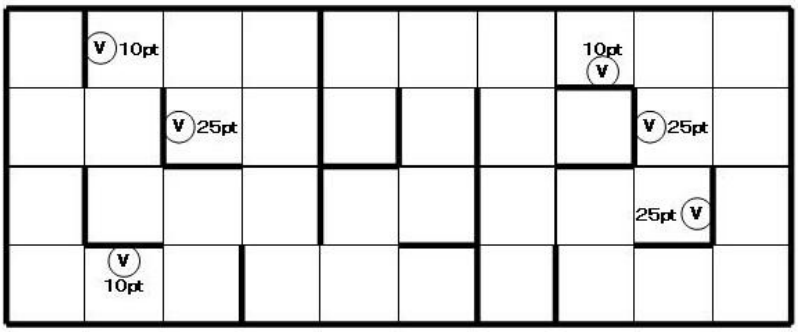
3.4 Game play

3.4.1 Modifying a robot during a run is prohibited; which includes remounting parts that has fallen off.
3.4.2 All parts that the robot is losing intentionally or unintentionally are left in the arena until the run is over. Neither the team nor the judge are allowed to remove parts from the arena during a run or LOP.
3.4.3 The teams are not allowed to give a robot any advance information about the field. The robot is supposed to recognize the field by itself.
3.4.4 A 'visited tile' means that more than half of the robot is inside the tile when looking down from above.

3.5 Scoring

3.5.1 Successful Victim Identification. Robots are rewarded points for each Successful Victim Identification in the arena:

- 25 points per "victim" on a floating wall.
- 10 points per "victim" on a linear wall. A victim on a tile where there is a linear wall on one side of the tile is rewarded 10 points even when the victim is placed on a floating wall. See the diagram below.



To identify a victim, a robot must stop within 15 cm of the victim while flashing a lamp on and off for five seconds, and/or release a Rescue Kit before moving on. When a robot completes both, it counts as one victim identification and one rescue kit deployment (see below).

3.5.2 Successful rescue kit deployment. Robot should drop a rescue kit on the tile where the victim is, and the deployment point needs to be within 15 cm proximity of the victim. The robot is awarded 10 points per successful rescue kit deployment. No extra points for multiple kit deployments per victim.
3.5.3 Reliability Bonus. Reliability bonus = the number of 'successful victim' identification" x 10 + the number of 'successful rescue deployment' x 10, minus the number of 'Lack of Progress' x 10. However, Reliability Bonus score can only be reduced down to the minimum of 0 points.
3.5.4 Successful Speed Bump Crossing. For each passed tile with speed bumps, a robot is awarded 5 points.
3.5.5 Successful Up Ramp Negotiation. A robot is awarded 20 points for a successful climb of the ramp. To successfully climb up the ramp, a robot needs to move from the flat tile before the ramp to the flat tile after the ramp.
3.5.6 Successful Down Ramp Negotiation. A robot is awarded 10 points for successfully landing at the bottom of the ramp. A robot needs to move from the top flat tile of the ramp to the bottom flat tile of the ramp.
3.5.7 Successful Checkpoint Negotiation. A robot is awarded 10 points for each visited checkpoint. Refer to 3.4.4 for definition of visited tile.
3.5.8 Successful Exit Bonus. A successful exit bonus is awarded when a robot successfully finishes a round on the start tile. It needs to stay there until the judges approve that it is stationary. (This is to simulate the retrieval of a robot from the disaster zone.) The points awarded will be 10 points per victim successfully identified.
3.5.9 Ties at the end. Ties in scoring will be resolved on the basis of the time each robot took to complete the run.
3.5.10 No duplicate rewards. For example, if a robot successfully crosses a tile with speed bumps multiple times, only one success score will be rewarded per tile. Same applies to all rewarding entries specified here.
3.5.11 A score sheet template is provided on the official RoboCupJunior website.

3.6 Lack of Progress

3.6.1 A Lack of Progress occurs when
A) The team captain declares a Lack of Progress.
B) A robot fails to retreat from 'visited' black tile. For a successful retreat it needs to back up without turning inside the black tile (it has to move straight backwards inside of a black tile). See definition of visited, 3.4.4.
C) A robot or a team member damages the arena.
D) A team member touches the arena or their robot without permission from a referee.
3.6.2 If a Lack of Progress occurs, the robot must be returned to the last visited checkpoint. The robot can be placed in any direction. Refer to 3.4.4 for definition of visited tile.
3.6.3 After a Lack of Progress the team captain may reset (turn on and off) the power supply and program. He is not allowed to change the program or give any information about the maze to the robot.

3.7 End of Play

3.7.1 The team captain may declare an "end of round" if the team wants to stop the round early. The team will be awarded all points achieved up to the call for end of round.

3.7.2 The round ends when:
A) The time expires.
B) The team captain calls end of round.
C) The robot returns to the start tile and gets the exit bonus.

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4. Open Technical Evaluation

4.1 Description

4.1.1 Your technical innovation will be evaluated during a dedicated time frame. All teams need to prepare for an open display during this time frame. This will be set up prior to the starts of the field competitions.
4.1.2 Judges will go around interacting with teams. It will be set up as more like a casual conversation or "questions and answers" atmosphere.
4.1.3 The main objective of the Open Technical Evaluation is to emphasize the ingenuity of innovation. Being innovative may mean technical advance as compared to the existing knowledge, or an out-of-the-ordinary simple but clever solution to existing task.

4.2 Evaluation Aspects

4.2.1 A standardized rubric system is used focusing on:
a) creativity
b) cleverness
c) originality
d) simplicity
e) functionality
4.2.2 "Your work" can include (but is not limited to) one of the following aspects:
a) creation of your own sensor instead of a pre-built sensor
b) creation of a "sensor module" which comprises of various electronics to provide a self-contained module to provide a certain special functionality
c) creation of a mechanic module which is functional, but out of the ordinary
d) creation of a new software algorithm to a solution
4.2.3 Teams must provide documents that explain their work. Each invention must be supported by concise but clear documentation. The documents must show concise inventive steps.
4.2.4 Documents must include one poster and one engineering journal (see the Engineering Journal document for more details). Teams are expected to be readily prepared to explain about their work.
4.2.5 Engineering Journal should demonstrate your best practice in your development process.
4.2.6 The poster must include:
- Identification of your team such as team name, league, country, etc.
- Important aspects of your hardware/software design

You may also include additional information of your interest, such as:
- Interesting or unusual features of the robot;
- Images throughout your teams development, etc.

4.2.7 Guidelines may be provided at the official RCJ website under Rescue rules (Engineering Journal document).

4.3 Awards

4.3.1 Awards may be divided into several categories.
a) Innovation:
- Mechanical innovation
- Electronic innovation
- Algorithm innovation

b) Robust Design:
- Mechanical design
- Electronic design
- Algorithm design

c) Team work – demonstration of great collaborations within the team.
d) Best Practice (in development) – demonstration of the best development practice from brainstorming, designing, prototyping, development, test plan, quality assurance plan, etc.

4.3.2 Awards will be given in the form of a certification.

4.4 Sharing

4.4.1 Teams are encouraged to review other's posters and presentations.
4.4.2 The awarded teams are required to post their documents and presentation at the International RCJ Community Forum (http://www.rcjcommunity.org/)

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5. Conflict Resolution

5.1 Referee

5.1.1 During game play, the referee's decisions are final.

5.2 Rule Clarification

5.2.1 If any rule clarification is needed, please contact the International RoboCupJunior Rescue technical Committee through the International RCJ Community Forum (*http://www.rcjcommunity.org/*)
5.2.2 If necessary even during a tournament, a rule clarification may be made by members of the RoboCupJunior Rescue Technical Committee and Organizing Committee.

5.3 Special Circumstances

5.3.1 Specific modifications to the rules for accommodating special circumstances, such as unforeseen problems and/or capabilities of a team's robot, may be agreed upon at the time of the tournament, when a majority of the contestants agree.
5.3.2 If any of team captains/mentors do not show up to the teams meeting to discuss the problems and the modification to the rules, it is considered as an agreement.

Code of Conduct

6.1 Fair Play

6.1.1 Robots that cause deliberate or repeated damage to the arena will be disqualified.
6.1.2 Humans that cause deliberate interference with robots or damage to the arena will be disqualified.
6.1.3 It is expected that the aim of all teams is to participate fairly.

6.2 Behavior

6.2.1 Participants should be mindful of other people and their robots when moving around the tournament venue.
6.2.2 Participants are not to enter setup areas of other leagues or other teams, unless explicitly invited to do so by team members.
6.2.3 Participants who misbehave may be asked to leave the building and risk being disqualified from the tournament.
6.2.4 These rules will be enforced at the discretion of the referees, officials, tournament organizers and local law enforcement authorities.

6.3 Mentors

6.3.1 Mentors (teachers, parents, chaperons, translators and other adult team members) are not allowed in the student work area.
6.3.2 Sufficient seating will be supplied for mentors to remain in a supervisory capacity close to the student work area.
6.3.3 Mentors are not permitted to repair robots or be involved in programming of their team's robots.
6.3.4 Mentor interference with robots or referee decisions will result in a warning in the first instance. If this recurs, the team will risk being disqualified.
6.3.5 Robots have to be principally students' own work. Any robot that appears to be identical to another robot may be prompted for re-inspection.

6.4 Ethics and Integrity

6.4.1 Fraud and misconduct are not condoned. Fraudulent acts may include the following:

a) Mentors working on the software or hardware of students' robot(s) during the competition.

b) "Higher league group" and/or more advanced group of students may provide advice, but should not do the work for "Lower league group". For example, a secondary group helped to fix its peer primary group's work, software or hardware prior to and/or during the competition. This may risk the secondary group to be disqualified as well. See "Code of Conduct, 6.3.3 & 6.3.5". This applies not just to mentors, but also to higher league (advanced) group of students as well.

6.4.2 RoboCupJunior reserves the right to revoke an award if fraudulent behavior can be proven after the awarding ceremony took place.
6.4.3 If it is clear that a mentor intentionally violates the code of conduct, and repeatedly modifies and works on the students' robot(s) during the competition, the mentor will be banned from future participation in RoboCupJunior competitions.
6.4.4 Teams that violate the code of conduct can be disqualified from the tournament. It is also possible to disqualify only a single team member from further participation in the tournament.
6.4.5 In less severe cases of violations of the code of conduct, a team will be given a warning. In severe or repeated cases of violations of the code of conduct, a team can be disqualified immediately without a warning.

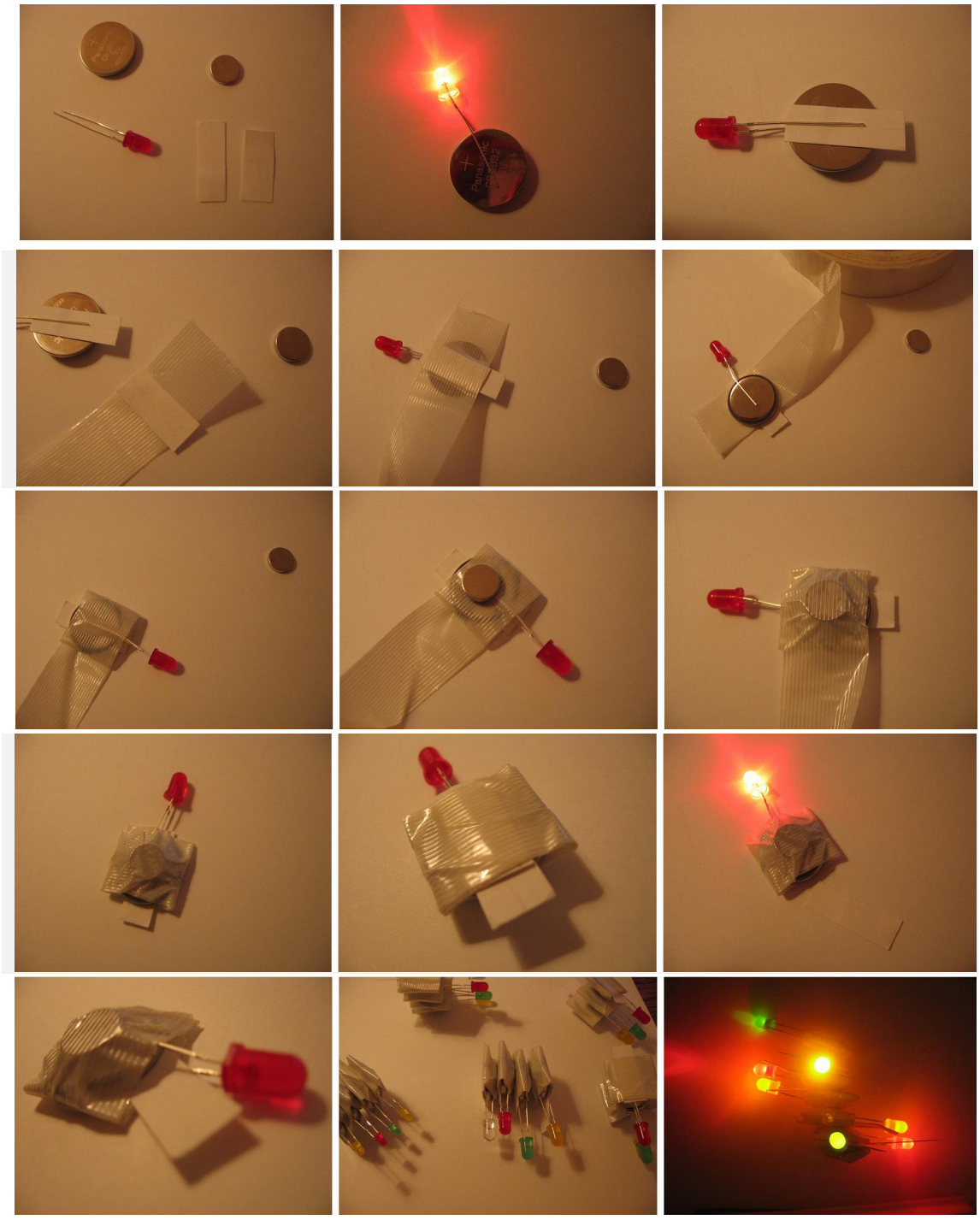
6.5 Sharing

6.5.1 The spirit of world RoboCup competitions is that any technological and curricular developments should be shared with other participants after the tournament.
6.5.2 Any developments may be published on the RoboCupJunior website after the event.
6.5.3 This furthers the mission of RoboCupJunior as an educational initiative.

6.6 Spirit

6.6.1 It is expected that all participants (students and mentors alike) will respect the RoboCupJunior mission.
6.6.2 The referees and officials will act within the spirit of the event.
6.6.3 ***It is not whether you win or lose, but how much you learn that counts!***

A. Suggested instructions to build LED Throwies (Rescue kits)



References

Joyce, A. (n.d.). *LED Throwies with On/Off Tab How-To.* Retrieved October 2013, from Flickr: http://www.flickr.com/photos/everythingdigital/sets/72057594069888500/