RoboCupJunior Resuce Building tips

Before you read this, you MUST have read through the latest rules from www.robocupjunior.org first. The following only serves as some preliminary tips you should keep in mind when you design your contraption. These not meant for building instruction.

Also, you do not have to use lego materials, anything you may think of to improvise.

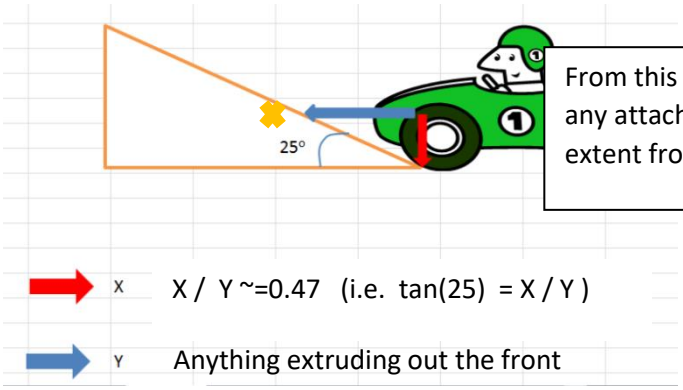
You can learn from many building samples from online and book. Look at the SR's link : http://www.stormingrobots.com/prod/roboclub.html#resource , go to "Books for Mechanical Buildiing" section . For sites where you may purchase extra building materials – look at "Extra Hardware Components" section.

Contents

FOR RESCUE LINE

RAMP

1) For the 25 degrees incline.
    a. Whatever mounted in front of the front wheels must not obstruct its path going up the 25 degrees uphill. For example:



From this image, you can see how far any attachment, such as claw, can extent from the front wheel.

e.g. ➡ is a claw, its length measures 15cm from ✱ . Clearance from ground ➡ > 7.5 cm.

    b. Watch out for the center of gravity (COG) of your robot. Check this out as one easy way to check the COG - http://www.brickengineer.com/pages/2008/03/16/center-of-mass-of-lego-nxt-motors/ . However, the best test is to test run your bot.
2) Watch out for the condition at landing during the transition from 25 degree uphill to flat ground.
    a. distance of the light sensors to the ground
    b. loss of traction.

3) Bumpers – most likely only exist in international.

CHASSIS & DRIVE TRAIN

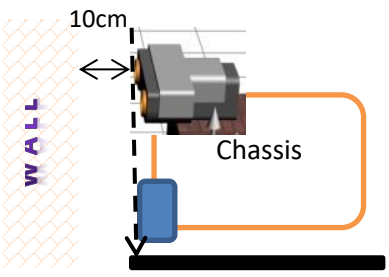
1) Watch out Debris getting into the drive train.
2) The 8cm skinny wheel is not a good idea if it is by itself, as it has less friction comparing to other 4.96 or 5.6cm balloon tires. The key in this case is the 'traction". Bigger wheels do not give more traction, nor gives you more force (torque).
3) Your will need a gripper which is capable of lifting at the same time closing & opening. It is a 3D movement. If you have an idea, please share with others. I have a model at the center, but a bit too bulky.
4) Your will need a gripper which is capable of lifting at the same time closing & opening. It is a 3D movement. If you have an idea, please share with others. I have a model at the center, but a bit too bulky.

FOR LINE DETECTION:

1) The lines measured about 2cm thick… basically equivalent to a standard electrical tape from hardware store
2) Can use 2 light sensors pointing down. If you may be able to get away with only one light using PID algorithm; but ONLY if you fully understand how to tune it.
3) May use the Mindsensors' light array.
4) Ideal locations and mounting for the Light sensors:
    - Vertical to the field will be much more accurate than pointing in an angle.
    - About 0.5 to 1cm off the ground. Should not stick out far from front wheels, as it will stop your robot from going 25^{o} uphill. Unless it is on a movable system.
    - If you the light sensor is on a movable system, think about if it should be on a tile with hinge, or a linear lift system?
    - In order to keep feedback as consistent as possible, it should be mounted in some area where the light source is kept consistent. This may require some kind of shield around to prohibit other light interfering such as a flash from a camera, or just a bright spot from the window, etc. Why? It is because your light sensor will have to run some both bright and shady spots, bumpers and debris. The light sensor has its own light (the led). So, take advantage of that.
    - If you do build a shield around the light sensor, make sure it does not obstruct it from going across bumpers and debris
5) Watch out for the distance at both going up the Ramp and landing back onto the flat land.
6) Watch out the 1cm bumper. Clearance is importance. Also, location of the light sensor should not come into too close to the bumper.

OBSTACLE AVOIDANCE

1) Most will use an ultrasonic sensor, pointing forward. Some even mount it on a mobile head.
2) Obstacle initially is situated with line right at the center. But, if you robot moved it, it will be left where it is!!!
3) Some may use IR. However, you must make sure you are familiar with your IR ability to detect various shade, e.g. Reading against dark surface is different from light color surface.
4) Mountit on a mobile head is an excellent option.
5) Considering that some lines may be only 10cm from the wall. Location of the Ultrasonic sensor should align with the location of the light sensor. See the image on the right. If you US sensor extrudes out, it will mis-identify the wall as an obstacle, and start doing obstacle avoidance (i.e. go around the obstacle. In this scenario, it will try to go around the wall... cannot do!!!)



GAP

Need to recognize 20cm gap on the line (may not apply every year). Read the rules online, http://rcj.robocup.org, carefully about this one. We shall discuss this further during the term. How we handle this will depending on the levels of each group.

EVAC ROOM

1) Think about should you search for the safety zone first or find the victim first?

2) Data collection! Whatever you come up with, you must perform some level of data collection during run test. Just use the view or display statically is not enough.

3) For your orientation on the victim delivery: For more experienced students who use RobotC software, you may start using compass to localize yourself too. You do not have to purchase this extra sensor until you are ready for it; as you may not even end up using it. Just to mention here for your future reference.

4) If you choose to do the "pick-up" version of the safety zone, you will need some form of structure to pick up as well as dropping off the silver balls (victims).

5) If you choose to do a claw or gripper, you should think about the possibility of building a end-effector which is capable of two planes motion with a single motor. This can be quite a challenging mechanical task. You may find the right sample from the LEGO Mindstorms EV3 Idea book - https://www.amazon.com/LEGO-MINDSTORMS-EV3-Idea-Book/dp/1593276001/ref=sr_1_1?ie=UTF8&qid=1544818019&sr=8-1&keywords=lEGO+MINDSTORMS+EV3+Idea+Book.
   DO note: this can be very helpful even if you are not using EV3.

6) You most likely will run out of ports. Therefore, you will learn how to use a sensors multiplexer. If you want to get a head start, you will find sample tutorial and sample codes at http://robotc.stormingrobots.com. Look for "I2C" tutorial.

NEED MORE PORTS

1) You most likely will run out of ports. Therefore, you will learn how to use a sensors multiplexer.
2) Sample codes at http://learn.stormingrobots.com. Look for "I2C" tutorial.
3) Very important: More ports do not necessarily mean more robust result!

LEARN DATA LOGGING

1) This is an indispensable step for robust software and automation.
2) This will allow you to gather the necessary information to make more informed and educated decisions in order to create and/or improve efficiency and reliability.
3) This is especially important when you notice unstable results.
4) I highly recommend to do some form of data logging whenever you use any sensors which are susceptible to environment changes, such as IR, gyro, compass, ultrasonic.
5) Again, samples are online at http://learn.stormingrobots.com – Robotics Projects Track -> RobotC II (ch. 6) . You should read the samples for that. You may also find more samples from the RobotC IDE as well.

FOR RESCUE MAZE

(There is no Primary Division for **Maze**. So, you will be going against high schoolers.)

1) Watch the robot dimension restriction in order to maneuver around the maze easily. The smaller the better. As it needs to go uphill, a bit longer from front to back is better than from side to side.
2) Need to go up 25 degrees incline. So, you should watch out for:
    a. the center of gravity of your robot.
    b. whatever mounted in front of the front wheels must not obstruct its path going up the 25 degrees uphill.

3) Watch out the obstacle:

    Ideally, if you keep your robot as small as possible, you do not even need to worry about obstacle avoidance routine. You should always consider to have a rim around the robot to protect your robot's part being stuck at a corner turn, etc.

4) About the center for victims detection:

    We'll try the thermal sensors from Dexter Industry, http://www.amazon.com/dp/B0057ABHZ0/. Need two. The heat source (the simulated victims) are flat and placed on the wall of the field.
    The location can be on right below the top edge or the bottom of the wall. So, you should try to to come up with a mounting on the side to be capable of detecting in different height, one up and one down facing to the side. You can just use any sensor as a test for mounting purpose.

5) Create your rescue kit.

    This can be anything which can dispense one object at a time. Be creative. It can use some rotating actuator (like a rotating disc allowing to drop one at a time) or linear actuator (like pushing mechanism to push one out at a time).

6) Traction! Depending on your robot's weight, you might need a set of wheels which give more friction.

PROJECT PLAN & RULE OF THUMBS

1 - Clear detailed projects plan with clear milestones. Use the online Project Plan Template as a general guide – http://www.stormingrobots.com/prod/pdf/rcjProjectPlanningTemplate.pdf.
2 - Milestones must be in in progressive phases
3 - March 1st, every team must have a preliminary phase done, and a full version locked down before moving onto the next phase.
4 - Divide and Conquer
5 - Clear division of main and all other subsystems
6 - Clear communication protocol among members, including:
7 - how and when to sync codes,
8 - who and where to save the main library codes which shared by everyone.
9 - Everyone must follow best practice - https://www.stormingrobots.com/prod/tutorial/programmingStyle.pdf