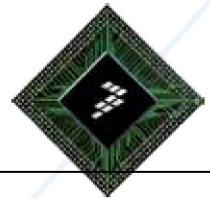
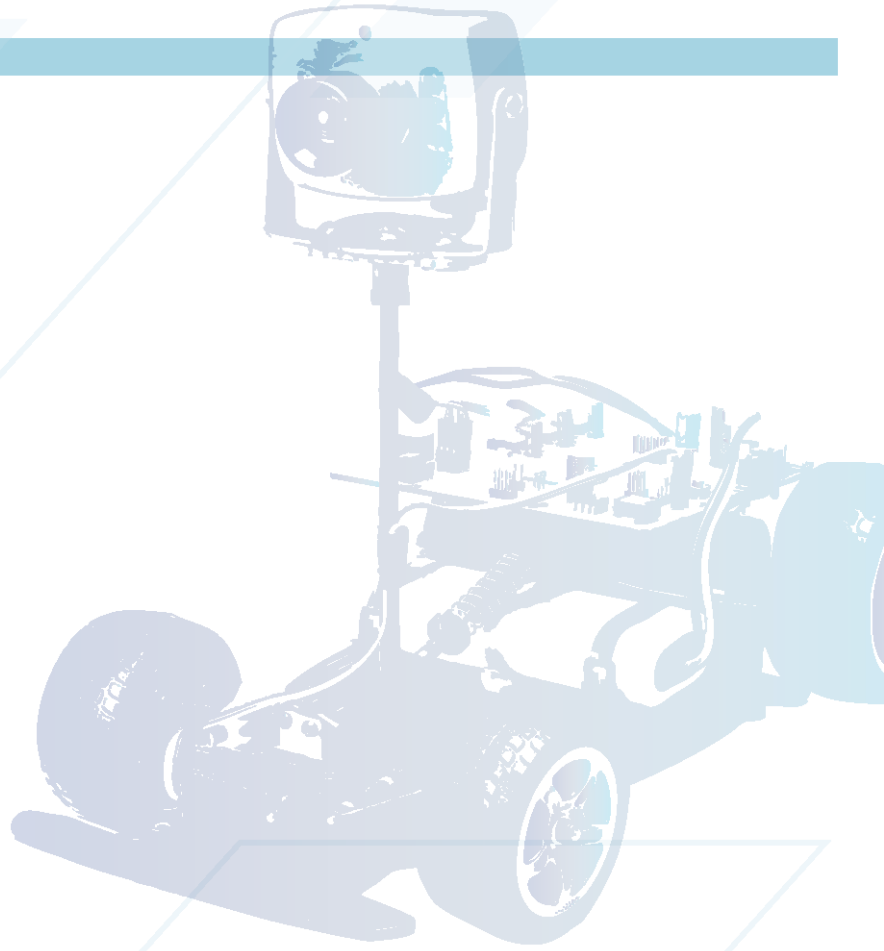


The Freescale Cup *Advanced Category* 2012 Rules – Mexico

Revised: August 29th, 2012



Overview

All racing teams will use the car model suite designated by Freescale Semiconductor. The MPC5604B Board and the iMX53 Quick Start Board from Freescale Semiconductor are the core control units.

Each team should design the software control scheme, the racing car system hardware, the wireless communications and HMI (Human Machine Interface) themselves. The software to develop should include camera imaging collection and processing, drive motor control, steering motor control algorithm, wireless communication, and HMI development.

The judging committee of the event will rank using the racing rules contained in this document for the preliminary round and the final competition. Equality and fairness will be ensured as much as possible. The Freescale Cup committee will invite guest judges to supervise the racing as well during the competition.

Table of Contents

Overview	2
Section 1: Document Revision History	3
Section 2: Team Rules and Requirements	3
Section 3: Equipment Requirements	4
Section 4: Referee and Technical Judgment	5
Section 5: Race Day Competition Procedure	5
Section 5.1: Race description.....	6
Section 5.2: Race	7
Section 6: Scoring and Awards.....	7
Section 6.1: Fouls, Fails and Disqualifications	7
Section 6.2: Awards.....	8
Section 7: Technical Report Requirements.....	8
Section 8: Parameters of the Race Track.....	8
Section 9: Questions or Clarification	9



Section 1: Document Revision History

Date	Notes
July 23, 2012	Original Release
August 29, 2012	Updated General Rules <ul style="list-style-type: none">• No auxiliary processor or other programmable devices are allowed besides the MPC5604B and iMX53 microcontrollers. Participants can choose to dismiss the use of the MPC5604B board, if they develop the functionality that was meant for the MPC5604B using the iMX processor.• Maximum of one (1) sensor/camera.• The CAR movements can only be dictated via the HMI commands that the participant will input, the CAR cannot make any movement decision by itself.

Section 2: Team Rules and Requirements

1. The maximum number of people on a team is 4, and the minimum is 3, and made up with the following conditions:
 - a. Two of the participants must be undergraduate students from a University and in their last year before graduation.
 - b. One or two of the rest team members must be advanced, which means they have to be studying Master Degree, PhD or working in the industry.
 - c. The Coordinator will be one of the advanced members.
2. All team members must reside in Guadalajara City, or nearby.
3. Only 3 teams will be allowed to participate in the competition.
 - a. These 3 teams will be chosen by The Freescale Cup Committee accordingly to their merits in the electronics field.
 - b. All team members must send their CV to defend their qualification to the race.
4. ALL work on the cars must be done by the team members.
5. Team members are required to submit a final report regardless of attendance to the race event.
6. Participants are expected to exhibit good sportsmanship. Any inappropriate behavior or cheating may result in disqualification.



Section 3: Equipment Requirements

The following rules are in place to keep the race vehicles overall operating performance fair. The spirit of the game is to demonstrate excellent hardware integration and superior programming.

- The following original and unaltered equipment must be used in the design. If any standard component of the car model is damaged, then a replacement part of the same specifications should be used.
 - a. Tires
 - b. Two (2) Drive - DC motors (2 DC car model)
 - c. Transmission Ratio(s) of Drive Motor
 - d. Servo Motor (Futaba S3010)
 - e. Battery (7.2V, up to 2800mAh, NiCd)
 - i. Only one (1) battery at a time may be used, this single source must power all on-board electronics.
 - f. The chassis can be modified, with some restrictions:
 - i. The footprint of the frame may not be altered
 - ii. You may not change the distance between wheels
 - iii. No part of the car shall exceed dimensions of 250mm (W) x 400mm (L)
 - iv. You may drill holes or install auxiliary racks on the chassis
- Additional external circuitry and sensors will be necessary
- The control boards may be modified.
- Teams are allowed to create custom control boards.
- No auxiliary processor or other programmable devices are allowed besides the MPC5604B and iMX53 microcontrollers. Participants can choose to dismiss the use of the MPC5604B board, if they develop the functionality that was meant for the MPC5604B using the iMX processor.
- DC-DC boost circuit cannot be used to power drive or steering motors.
- Total capacity of all capacitors should not exceed 2000 uF; the highest charging voltage capability of capacitors should not exceed 25 V.
- The following limits on hardware will be enforced per vehicle:
 - a. One (1) microcontroller in the control board on the car
 - b. One (1) microprocessor in the control board on the car
 - c. One (1) microprocessor in the HMI command board
 - d. Maximum of three (3) servos
 - e. Maximum of one (1) sensor/camera
- The software shall be created using CodeWarrior Development Tools and Rappid Initialization for Power Architecture.
- **NO REPRODUCTION IS ALLOWED IN THE DESIGN OF THE CAR MODEL. HARDWARE AND SOFTWARE OF CAR MODELS OF COMPETING TEAMS WITHIN SAME UNIVERSITY/COMPANY SHOULD BE ORIGINAL AND CLEARLY DIFFERENT.**



Section 4: Referee and Technical Judgment

The Freescale Cup will be carried out by the undertaking universities at the direction of the organizing committee.

1. The submission of a Technical Report is mandatory to continue in the competition. Teams that do not turn in a Technical Report by the specified date will be disqualified.
2. The referees are responsible for on-track activities. This includes race track management such as starting and stopping vehicles, as well as timing and scorekeeping.
3. The judges are responsible for non-time based judging activities. This includes design judging and/or report judging.
4. Prior to race, judges will perform a technical inspection of all entries. This includes vehicle specifications, dimensions, and non-modifiable parts. Violations may result in disqualification.
5. Any racing disputes will be taken up and resolved by the racing executive committee.
6. Workers of the organizing committee or the event team shall not participate in coaching or training for any specific race team (except for microcontroller training) and shall not disclose any information that might compromise fairness of the competition.

Section 5: Race Day Competition Procedure

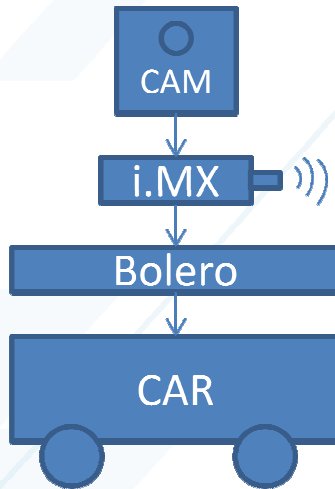
1. Prior the race, each racing team can test the track environment on site. The test racing track is different from the actual racing track in shape but the material and environment will be the same. Final calibration may be made at this time.
2. Before each race series begins, all cars must be placed in the race staging area to be inspected. During and after this time, the teams are not allowed to modify software or hardware of the car.
3. The racing event will be held on **Saturday, December 1st, 2012** in Guadalajara, Jalisco.
4. A referee will direct each team when to pick-up car from the staging area and to enter the race track.
5. Only one team at the track at any given time.
6. After being called by a referee, each racing team should designate a member to take the race car to the track and place it behind the start/finish line.
7. Upon entering the playing field, a team has 3 minutes to set up the car and signal "Ready" to referee.
8. After the referee announces the start of the race, the vehicle should leave the starting area within 30 seconds and run for one (1) lap.
9. The designated member of the team has the opportunity to change the battery and adjust the car for a second attempt. Car must stay on the track. No software change/reprogramming can be done on the car. Teams can proceed in cleaning tires, adjust camera angle or adjust other mechanical parts during this pause of maximum 2 min.
10. Same car runs for a second attempt of one (1) lap on the track.
11. The same process applies for the third attempt.
12. After the race car finishes, a member of the team shall take the vehicle away from the track.
13. Event displays will post the best time for a single lap.



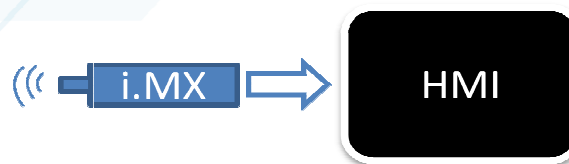
Section 5.1: Race description

The prototype developed by each team consists of two parts:

- CAR: Car model suite developed by Freescale, a MPC5604B board, a Motor Control Board, an iMX53QSB, a Wi-Fi board, and a camera.



- HMI command board: iMX53QSB, a display (which must show the video received from the CAR and at least four parameters also received from the CAR), a Wi-Fi board, and a HMI to send the control commands to the CAR. ([HMI definition](#))



- The prototype developed by the participating teams must complete the track as fast as possible. To do so, the CAR will capture, process and send via Wi-Fi the video signal from a camera to the HMI command board.
- Then the HMI command board will display this video along with the additional parameters in the display, in order for the participants to see the position and control the movement of the CAR, emulating a wireless remote control car. The CAR movements can only be dictated via the HMI commands that the participant will input, the **CAR cannot make any movement decision by itself.**
- The control commands will be sent back from the HMI command board to the CAR also via Wi-Fi, indicating the CAR how to move in order to complete the track.
- During the race, the team members will not be allowed to watch the position of the CAR in the track directly. They will have to control the CAR based on what they see through the HMI only.

Section 5.2: Race

1. The technical judges will perform on-site technical inspection for all the cars eligible for the final.
2. Race order will be determined by random drawing.
3. The race track configuration for the final may change from the test track race. This can include shape, size, and distance.
4. Each finalist has three (3) attempts to complete the track.
5. Each vehicle must complete at least one (1) lap.
6. The shortest time taken to run a single lap will be taken as the final score of the racing car.

Section 6: Scoring and Awards

1. Equality and fairness will be ensured as much as possible on the condition of actual feasibility. Disputes will be resolved by a vote of organizing committee and judges.
2. Time starts when the race car crosses the start/finish line.
3. Time will be captured using an electronic gate or handheld timer.
4. Technical report judging will be scored on quality of content, design approach, innovation on the concept/design, and concept understanding.
5. The winner will be determined by the best time score.

Section 6.1: Fouls, Fails and Disqualifications

1. During a race, the on-track referees watch for and determine fouls.
2. The following condition will be considered a foul and will result in the addition of time:
 - a. The race car fails to leave the starting area within 30 seconds after beginning of the race [+1 second penalty].
3. A failure forfeits the current attempt. Any of the following conditions will be considered a failure and no time will be scored:
 - a. Three or more wheels leave the race track.
 - b. The race team fails to enter the field and ready to race within two (2) minutes after being called by the referee.
 - c. Any team member touches the race car after the start of the race without consent of the referee.
 - d. The racing car fails to finish one lap within five minutes after leaving the starting area.
4. Disqualification eliminates team from the competition and no attempts will be given or scored. Any of the following conditions will be considered a disqualification:
 - a. Any auxiliary lighting equipment or other auxiliary sensors around the race track.
 - b. Modifications of the hardware or software after the cars have been inspected.
 - c. Any behavior that might interfere with the movement of any teams car.
 - d. Any cheating during the competition.
 - e. Plagiarizing the car design including hardware or software. Cars from the same University but different teams must be clearly different.
 - f. Failure to pass the technical inspection.



Section 6.2: Awards

1. The competition winner will be the car with the smallest recorded time to complete one lap in the Finals.
2. The surprise award for the winner will be given at the end of the competition.

Section 7: Technical Report Requirements

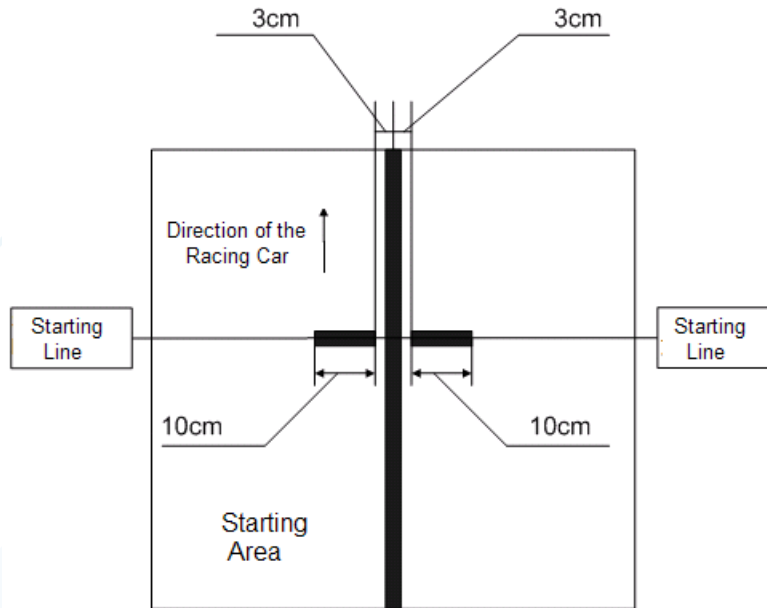
Technical reports will be reviewed and rated by the experts invited by the organizing committee of the event. The Technical report must be delivered by **November 16th, 2012**. Technical reports should be clear with detailed text, diagrams, and bibliography. Technical reports must contain a brief description of major concepts and specific technical implementation schemes for design and production of car models including:

1. Description of control software design:
 - a. SW architecture and module interaction block diagram.
 - b. SW Design per module.
1. Description of the HMI command board design
 - a. Description of the HMI design
 - i. SW architecture and module interaction block diagram
 - ii. SW design per module
 - iii. HW design composition/description
2. Submitted via email to the Freescale contact two weeks prior to the race.

Section 8: Parameters of the Race Track

1. The actual layout of the final racing track will be unknown to competitors until competition day.
2. For a limited time on race day, a test track made from the same material will be available on a first come, first serve basis for calibration and design modifications.
3. Width of the racing track shall not be less than 600mm.
4. Material specifications regarding the surface of the racing track will be provided on the web site of the event.
5. Surface of the racing track is matte white, with a continuous black line (25mm wide) drawn in the middle as the pilot line.
6. The minimum bending radius of the racing track shall not be less than 500mm.
7. The racing track can intersect with a crossing angle of 90°.
8. Any slope in the track will be equal to or less than 15 degrees in a straight section of the racing track, including upgrade and downgrade.
9. There is a straight starting area of 1000mm long in the racing track, as shown in figure below. In addition, there is a black starting line 100mm long at both sides of the starting point. Start time and end time will be determined when the front part of the racing car passes the starting line. The car must be able to automatically stop within three meters of the starting line after finishing the race.





Section 9: Questions or Clarification

Prior to the race, please post any questions regarding the rules to Streetsmarts community – Advanced Category [streetsmarts.freescale.com/group/tfc-mexico-avanzado]

During the race event, all interpretation of the rules will be at the discretion of the on-site executive event team members.

The rules and conditions are subject to change by Freescale if necessary. Freescale reserves the right in their sole discretion to cancel, suspend and/or modify The Freescale Cup race at any time. These official rules are drawn up in the English language. If these official rules are provided in any other language and there is a conflict in the text, the English language text shall prevail.

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