# An introduction to Robotics with LEGO® MINDSTORMS (X)

## *Interview with the designer of the competition table of the FLL*

*By Koldo Olaskoaga*

The FLL is a program of Science, Technology and Innovation which, among other things, uses a component that arouses interest and motivation of young people: building and programming a robot to be confronted with a series of challenges on its own.

Every year in early September the challenge of the robot is released, ie the missions that robots will face and under what conditions they have to do it are released. It is the starting point for thousands of youth teams of 10 to 16-years-olds from more than 60 countries to start thinking and unleash their creativity (10 to 14 years in the United States and Canada). The design of the competition table includes the development of a series of models of mission and rules that define how you can score points. Since the beginning of the FLL, table design is the responsibility of Scott Evans, and we wanted to approach him to see what the process of creation and game design of the robot is, once the central theme underlying the challenge has been decided. The interview was conducted via email in December 2011 and by then, Scott already had the table with the mat and the missions of the **Senior Solutions** challenge that will be released in September 2012 in his office.

## Getting Started

Once the issue the challenge will deal with is decided, in May of the year before the challenge, there is a meeting with a large panel of experts in the field of study that comes from government, business and universities. Besides them, FLL staff, implementing partners of the state, referees, coaches, former team members, LEGO® staff and Scott also participate in this meeting .
The purpose of this meeting is to generate ideas, and around 60 basic ideas that will be taken as a starting point for the design of the missions come out of the meeting. Once the scientific elements are clear, work begins on the precise requirements of the robotic game and how to assign the corresponding score. This is a task that is carried out with the help of a small group of enthusiasts to contrast the ideas and develop them further.

## Development of prototypes

When the ideas on which to work have been selected, Scott begins with the development of the mission prototypes and the design of the mat and then travel to Denmark. This is where he finishes the models and draws the mat.
But you can never know the suitability of the mission models and the missions before trying them, so they are subjected to an intensive testing process. Sometimes, this process leads him to realize that there is a particular mission that doesn´t work or has an unsolvable problem, so he has to find ways to eliminate it. Unfortunately by then the models are in production and cannot be modified. This is why some years there are

elements that we all wonder what they are for, as the stretcher on the challenge of **Body Forward** or the farm animals in **Food Factor**. These are elements that generate numerous inquiries but have no value toward missions.

## How important is the use of sensors?

When we think about the parts that a robot has, there is a very important one, its sensory system. Sensors are what allow it to receive information from the environment, and to take appropriate decisions based on that information. From the standpoint of a professional or a teacher a robot without sensors is an incomplete machine of lower technological level, whereas there are many teams that do not use sensors to solve the missions.
The **BodyForward** challenge surprised us with several missions which forced the teams to use sensors, even in one of these missions, conditions varied each time the robot went outside the base, so it was absolutely necessary to use a sensor to differentiate the malignant cells (black as opposed to non-damaged white). It seemed that they wanted to force
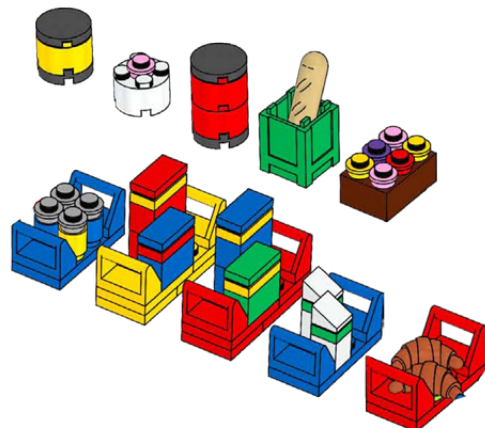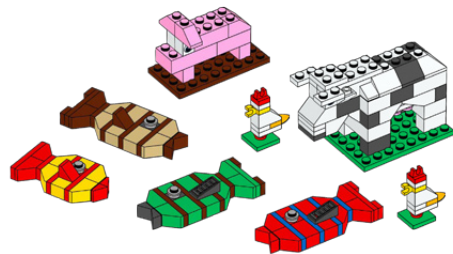
teams to use the sensors but it is something that has not been continued this year. When I put this question to Scott he replied:

*"As you can see when looking at the mat from almost any year, and by the use of solid border walls every year, the use of light and touch sensors is always encouraged. But it is rare for me to design a mission that is impossible to do without sensors, because*

*- I do want all teams to be able to complete any particular mission if they decide to work at it*
*- In real engineering you are not told how you must solve a problem*
*- There is some value in being able to do something with a simple robot*

*That said, I reserve the right to put in a mission that STRONGLY encourages sensor use, but I purposefully don't want to establish any pattern with the inclusion of such missions. The teams and especially the veterans need to be kept guessing."*

## Difficulty of the missions

One of the first tasks the team faces is to understand the missions thoroughly and assess the level of difficulty. This way they can categorize and define their work strategies. This is where the first comments arises: this year it is harder than the past, some are easier but there are some very complicated missions... But how do you determine that the missions are not too difficult to complete in two and a half minutes?

*"One can only guess. But personally, I've been playing with LEGO since 1969, I've been doing this job for some 13 years, I've attended about 60 tournaments, I've run the direct communication team support for the United States and Canada all this time, and I do a lot of stopwatch testing. Outside of that I have a mini test camp, and I have LEGO® Company MINDSTORMS division engineers make robots for questionable areas. That said, it does still come out wrong here and there. A little too hard one year, a little too easy another. But it's always in the ballpark, and it's always still a fun technical challenge at its heart."*

While in previous years many teams completed the maximum number of points, this year it must be stressed that the maximum score has become mission impossible. At the end of the season we will see what the highest attainable score was.

## The work of the referees

One question that always worries referees and the organization is the control of mission elements on the table and the process of relocating all to its initial conditions in the

shortest time possible. This year the number of elements of mission that could change places at the table is about 100 which caused some uncertainty. However the problems have been fewer than with the table of the **Body Forward** challenge where rebuilding a damaged brain required a long time. Do you take into account the task that is presented to the referees to define models of mission?

*"I have to honestly say that there are many design concerns that have to be met as priorities to that one. I think about it, but if I need realism, or difficulty/easiness, or strength, or reliability, or ease of construction, etc., those concerns will be served first. Unfortunately often, realism, or ease-of-construction, or cost can sort of force me to end up with a compromise model that's weaker or more hard to deal with than I would like."*

## The challenge is released in September

The challenge will be released in September and thousands of teams around the world (in 2010 they were 16,762) will begin to analyze, interpret ... missions. And having more than 150 000 young people working on it brings out questions, problems ... that had not been detected in advance. Scott maintains an open line of communication for these matters and when an issue is identified that needs public clarification or modification or exceptions in the missions or regulation he publishes it on the official website of the FLL in "Robot Game

Updates" paragraph. In the challenge that is developing during this course there have been 37 updates and it is very important that teams follow them as they have more value than even the rules.

We hope this article clarifies some of the questions that arise every year, but we will not close without mentioning a comment with which Scott ended the answer to our questions.

*"I want to remind the readers what the purpose of all this is… It's to give kids a positive association (FUN) with SOLVING technical problems instead of just USING technical solutions. If you ask modern kids if they like technology, most will think of the last time they used their smart-phone, and say YES! What we're showing them is that the process that led to the production of that phone was not only a lot more fun than using it, but that process involved deep interdependence between people on a TEAM."*

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