Scenario & Functional Modelling

Overview

- Function Definition

- Operational Assumptions

- Structured Model

- Structure Model Example

- Integration into game strategy

Robot Functions

- Generic List of robot functions to create guidance of the basic functions of the robot

- Function describe what we want the robot to do, and how we want it to do it.

- Best descriptions is 2-3 words
  - Noun + Verb

- We add a basic measure to provide context to the action

- Notes are added to provide additional detail.

- More can be added to describe the robot function

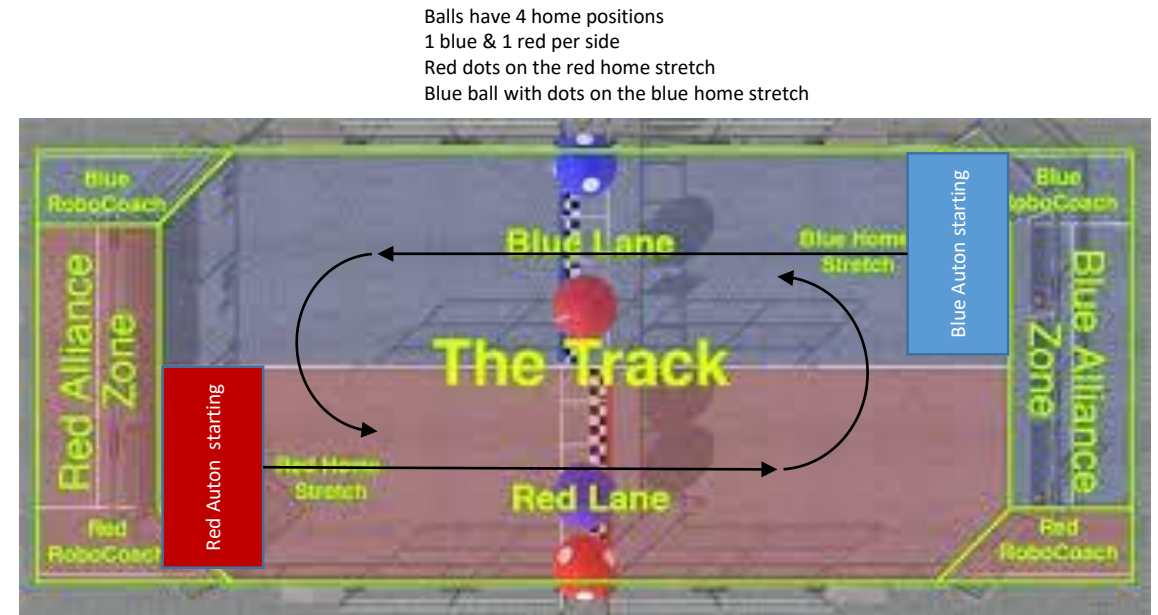| #	Function	Measure	Notes
1	Position Robot	Describe location	Only for Auton mode
2	Robot start		Only for Auton mode
3	Start Moving	"Direction"	
4	Turn robot	Angle & Direction	
5	Move robot	distance or to a position	
6	Stop Moving		
7	Pause Robot		Describe why it pauses
8	Pick up game piece	Piece name	
9	Move game piece	distance or to a position	
10	Place Game Piece	Placed position	
11	Aim to Shoot	shooting location	
12	Load Shooter		
13	Shoot Game Piece	Shooting location	
14	Align robot	Align to what	for specific action
15	Raise arms	distance or to a position	used only if robot has arms
16	Lower arms	distance or to a position	used only if robot has arms
17	Traverse left	distance or to a position	used only if robot has capability
18	Traverse right	distance or to a position	used only if robot has capability
19			
20			

Operational assumptions

- Operational assumptions are the basic robot movements and the time or speed that they will operate.

- Assumptions may need to be modified to align with the robot design

- Additional actions / metric's may need to be added based on the game.

Actions	Operational Metric	Notes
Start	1 sec	thinking time for the drivers
Stop	1 Sec	thinking time for the drivers
Drive Fast	20 ft / sec	used for straight motions
Drive Slow	5 ft / sec	used for precision movements
Pick-up object	5 sec	Generic time may need to be changed based on the complexity of the discussion
Place object	5 sec	
Aim	3 sec	
Shoot	2 sec	
Load shooter	2 sec	
Translate Rt/lft	1 ft / sec	
Turn 90 deg angle	2.5 sec	
Turn 90 deg short	1 sec	need to stop / start

Visualize the action steps

Step 1

- Get the picture from the game manual

- Label the map with key areas

Balls have 4 home positions
1 blue & 1 red per side
Red dots on the red home stretch
Blue ball with dots on the blue home stretch

Step 2

- Define scoring action
  - Auton mode crossing finish lines and lane marker.
- Describe scoring action in a paragraph
  - Drive forward, turn corner and come back
- Visually map the actions

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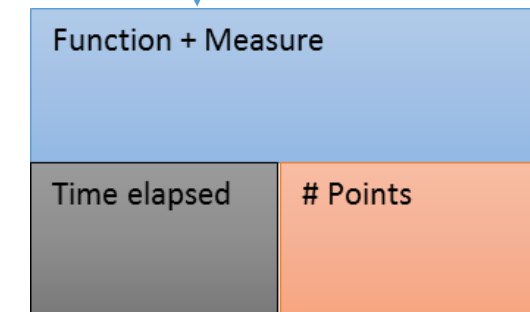FIRST®Robotics Competition

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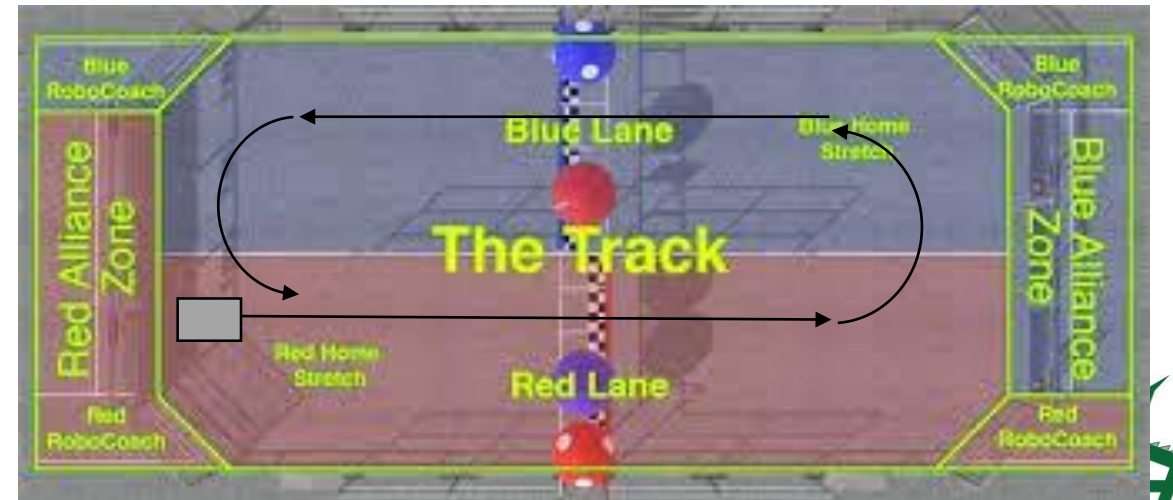
Functional Model- USE case scenario model

- Starting point:
  - Scenario name & Definition
  - Picture / illustration of the scoring cycle (simple)

- Use case scenario models utilize 3 elements to define how the system will interact with the users (drivers) and environment (game field).

- Each event is a singular action (or set of actions all happening in parallel).

- Each action is input with
  - Function + Measure
  - Time elapsed
  - # of points scored

- Output
  - Sequence of actions
  - Time elapsed over the scoring cycle (simple summation)
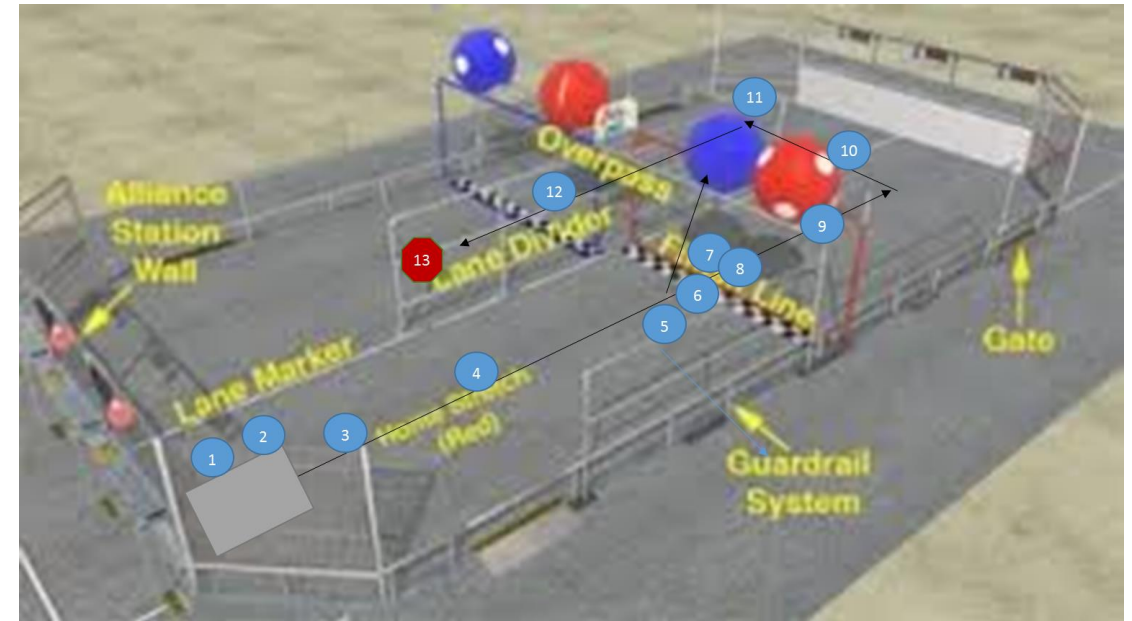 - Points scored in the scoring cycle (simple summation)

		Event				
		1	2	3	4	5
U	User	Action				
	Sub-system 1		Action			
	Sub-system 2		Action			
S	Sub-system 3			Action		
	Sub-system 4				Action	
	Sub-system 5					Action
E	Environement			Action		

Time →

Function + Measure	
Time elapsed	# Points

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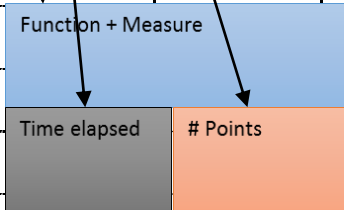
Scenario Modeling application

- FRC 2008 Season –

    Scoring cycle: Auton Mode

    1. Define starting point
    2. Drive to the overpass
    3. Knock off ball
    4. Drive around to cross the alliance finish line.

Scenario model example

USE	1	2	3	4	5	6	7	8	9	10	11	12	13
User action	Place Robot	Robot Starts											
	0	0	0										
System 1 / Drive System		Start Moving Forward	Drive Forward (slow) (5 Ft)	Drive Forward (Fast) (20 Ft)	Pause	Drive Forward Slow 2 ft		Drive Forward (Fast) (20 Ft)	Turn Right fast 90 deg	Drive Forward (Fast) (10 Ft)	Turn Right fast 90 deg	Drive Forward (Fast) (20 Ft)	
		1 0	1 0	1 0		2 0		1 0	1 0	0.5 0	2.5	1	
System 2 / Ball Loader					Raise Ball loader	Knock down ball	Lower Ball Loader						
					5	2 0	4 0						
System 3													
System 4	Function + Measure / Time elapsed / # Points												
Environment						ball falls down		Cross Finish line		Coss Lane Marker		Cross Finish line	Auton Cycle Stop
						0 8		0 4		0 4		0 4	
Notes	Start on wall					Knock the ball off the bridge. Drive forward while pushing ball		Crossing opponent finish line		Cross opponent marker		Crossing Alliance finish line	Field stops robot Finish position:
Total Time Elapsed	0	1	1	1	5	4	4	1	1	0.5	2.5	1	0
Total Points Obtained	0	0	0	0	0	8	0	4	0	4	0	4	0

Result →

Total Time Elapsed	22
Total Points Scored	20

Integration with game strategy

- Application to scoring calculator
  - Action list
  - Elapsed time
  - Points scored

- Establish models for each of the scoring actions & scoring cycles

- Establish models for each of the connecting cycles

- Apply to the game strategy to establish the points / cycle with success rates

Total Time Elapsed	22
Total Points Scored	20