REPUBLIC OF TURKEY

MINISTRY OF NATIONAL EDUCATION

The General Directorate of Technical and Vocational Education

13. INTERNATIONAL

MEB ROBOT CONTEST

THEMATIC ROBOT CATEGORY

COMPETITION RULES

2019 - SAMSUN

"ARTIFICIAL INTELLIGENCE IN INDUSTRY 4.0"

ARTIFICIAL INTELLIGENCE

Intelligence can be defined as the capacity of cognitive features such as learning , understanding, planning or comprehensing. Artificial intelligence (AI) which we can describe as to gain these skills to computers is an important research field.

First proposal to test the capacity of AI was suggested by Alan Turing at 1950 .In this experiment which is known "Turing test" , one person talks another unseen terminal via computer by asking some questions. If this person cannot distinguish whether terminal was human or computer by judging answers, AI is successfully pass Turing test.

To design AI which has similar competences like human brain , scientists have researched for many years by copying human behaviors. But explaning the mechanism of human thinking to computer with logic rules is pretty much complex.

In addition, using the solutions from nature maynot be the most efficient method for reaching the target. For example, people have developed planes which designed according to physical rules instead of simulating birds. Therefore, such approaches that copying the system of human thinking is no longer preferred.

Today, there are some AI applications that perform a specific task successfully with sensing parameters. For example:

- ✓ In chess game, AI understands opponent's move, calculates all possibilities and do its next move.

- ✓ In healt sector, AI receives all test results and vital data. After that makes diagnostics.

- ✓ AI receives all data from camera and radar of driveless vehicle and control engine power and steering wheel.

Today AI applications can learn by analyzing too much data due to rapid increase in digital data (big data) and powerful computers that can process such a big amount of data (i.e parallel programming with graphics cards). For example driveless vehicle can make decision by using 4 million km drive experiences. Google translator and other translator applications don't use grammer rules while learning a language. Instead of this, they analyze millions of translation samples and then make similar decisions.

For instance,a translator senses the word "insan" in all sentences which include word "human" while making English-Turkish translation and learns the meaning of this word in Turkish by own. This approach leads us to artificial learning, a concept associated with artificial intelligence. Artificial learning means that computers are programmed to make the most accurate decisions using raw data / experience to solve a problem.

Today AI applications (such as image processing, driveless vehicles in traffic or recognizing voices) can do tasks as successful as humans or even more. However, as in science fiction films, the possibilities for robots to build their own colonies or take over the world are still very remote. Today, successful AI applications are models which were developed for a particular task. Unfortunately, our technologies are not at such level to be able to work on many different tasks and cases simultaneously like human brains.

***http://bilimgenc.tubitak.gov.tr/makale/yapay-zeka-ve-yapay-ogrenme

RELATION BETWEEN INDUSTRY 4.0 AND ARTIFICIAL INTELLIGENCE

The philosophy "future will be in the hands of robots", which appears frightening to people, although someone is working on it, is shelved for the manufacturing industry. The manufacturing industry spends millions on research together at a high rate.

The era is the time of having a more efficient life together with "smart robots". All of the high level topics such as Artificial Intelligence, Industry 4.0, IoT (Internet of objects) which are all useful for now and future are created together with algorithms.

Artificial Intelligence in industrial manufacturing

We know that each science field is divided into sub-branches and most important one is that all science disciplines are related to each other. Therefore, the effect of physics on AI and also the effect of AI on other science fields are inevitable.

Artificial Intelligence in Plant

All of cases which are most interesting things of Industry 4.0 such as machine communications, smart machines informing data about who produced the goods or the factories which are able to work even in the dark are called "factory equipped with artificial intelligence" although it is not said like that.

Artificial Intelligence in Logistic

Another topic related with Industry 4.0 is logistics. We can see the effect of industry 4.0 on this sector as well. We can get info about where trucks are and theirs speeds by using algorithms created according to data getting from machine learning, so

4

that we can increase efficiency in logistics sector.

Internet of Things means that electrical devices have communication with each other. Objects exchange data with using their properties such as software, sensors and network connections. IoT has also ability to send warnings to computer if network infrastructures are damaged.

Efficiency of systems interconnectivity and the communication between the Machine and the Machine (M2M) are increased.

IoT is not a specific subject of Industry 4.0. It can be used any kind of projects that you can think of such as smart cities,intelligence transportation, home automation, remote controlled and monitored devices like oven or freezer.

Big corporations spend their money for researches.

Companies discovering that AI will have a great importance in today and in the future spend millions on AI researches. For example, a company in Turkey developed a bot(software) which can understand what we say from Facebook Messenger and responds accordingly. This bot gets data about what we request and where we are , and sends the product automatically. This project, which is not yet in use, is manufactured by an insurance company. We understand how this business is serious when we saw that how some companies like Google, Facebook, IBM, Microsoft etc. developed AI technologies rapidly after investing to this field in the first quarter of 2017. Nowadays, there is no way other than use these companies products for us. We hope that this will also change.

***https://yapayzeka.ai/endustri-4-0-ve-yapay-zeka-iliskisi/
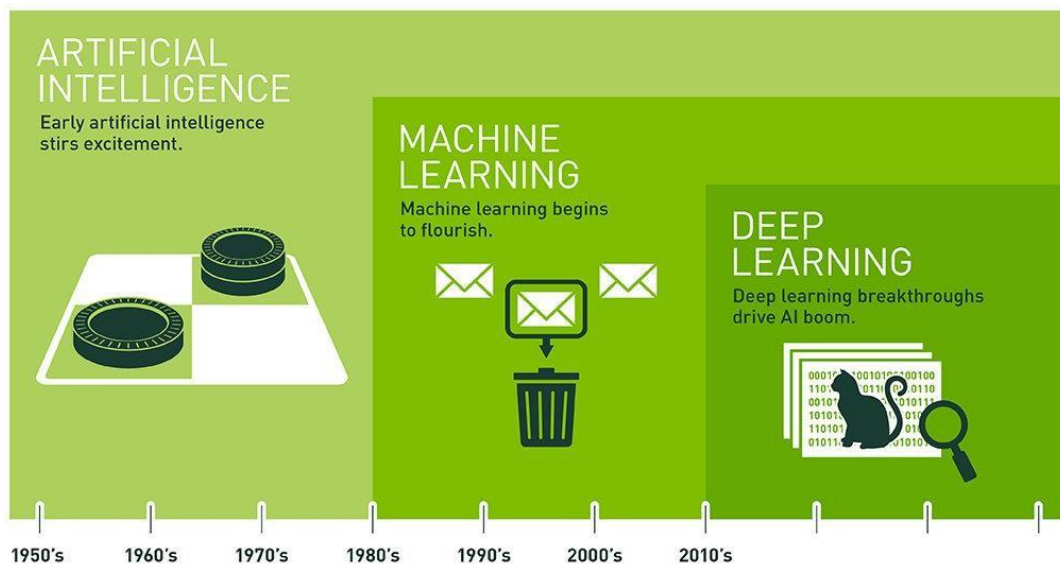
Chronology of Artificial Intelligence,Machine learning and Deep learning (source: Nvidia)

References:

Information given above were quoted from following web pages ;

http://bilimgenc.tubitak.gov.tr/makale/yapay-zeka-ve-yapay-ogrenme

https://yapayzeka.ai/endustri-4-0-ve-yapay-zeka-iliskisi/

THEMATIC ROBOT CATEGORY RULES

Thematic robot competition consists of a platform and two courses.

Platform; It is the area that all games of this competition are played.

Courses; They represent as follows

First course: See transportation (Independence way)

Second course: Land transportation

One of team members be ready at first course, another member is at second course with their robots.

The competitors will compete with an autonomous robot (able to move itself) for the first course and a robot controlled (wired or wireless) for the second course.

In this competition manual, the autonomous robot is referred to as the first robot and the controlled robot is referred to as the second robot.

Before the competition begins, both robots will be placed in the first and second courses where they will start the competition (First robot is placed in the Bosphorus of Istanbul where is filled with water in the sea area and the second robot is put in place reserved for Robot-2).

Robots complete the tasks in both courses respectively.

The first and second course will complete the tasks in order of robots.

When the second competitor moves the second robot from the starting position on the platform, the stopwatch will be run by the referee and the competition will start.

Task 1. Second robot will move from starting point and take task order from Istanbul. Afterthat it will deliver task list to first robot,

Task 2. First robot will move from starting point by own and stop when it enters area-4. Then it will wait message from Mors lighthouse. When it receive lighted mesage from Mors ligthhouse , it will decode the message then travel to point called "first step" in Samsun. When it arrives Samsun, it will stop.

Task 3. When first robot stops in area-4, second robot will send Mors message combining with 3 characters to first robot through Mors lighhouse by using G-6 telegraph machine

Task 4. Second robot will set up telegraph pole in Havza

Task 5. Second robot will fix broken parts of telegraph lines.

Task 6. Second robot will send message "OKEY" by using G-6 Telegraph machine so that Turkey map will be lighted up.

It is assumed that game is over if team completes all tasks and lights up Turkey map, then Its chronometer will stop automatically.

Teams will be listed according to total scores and times.

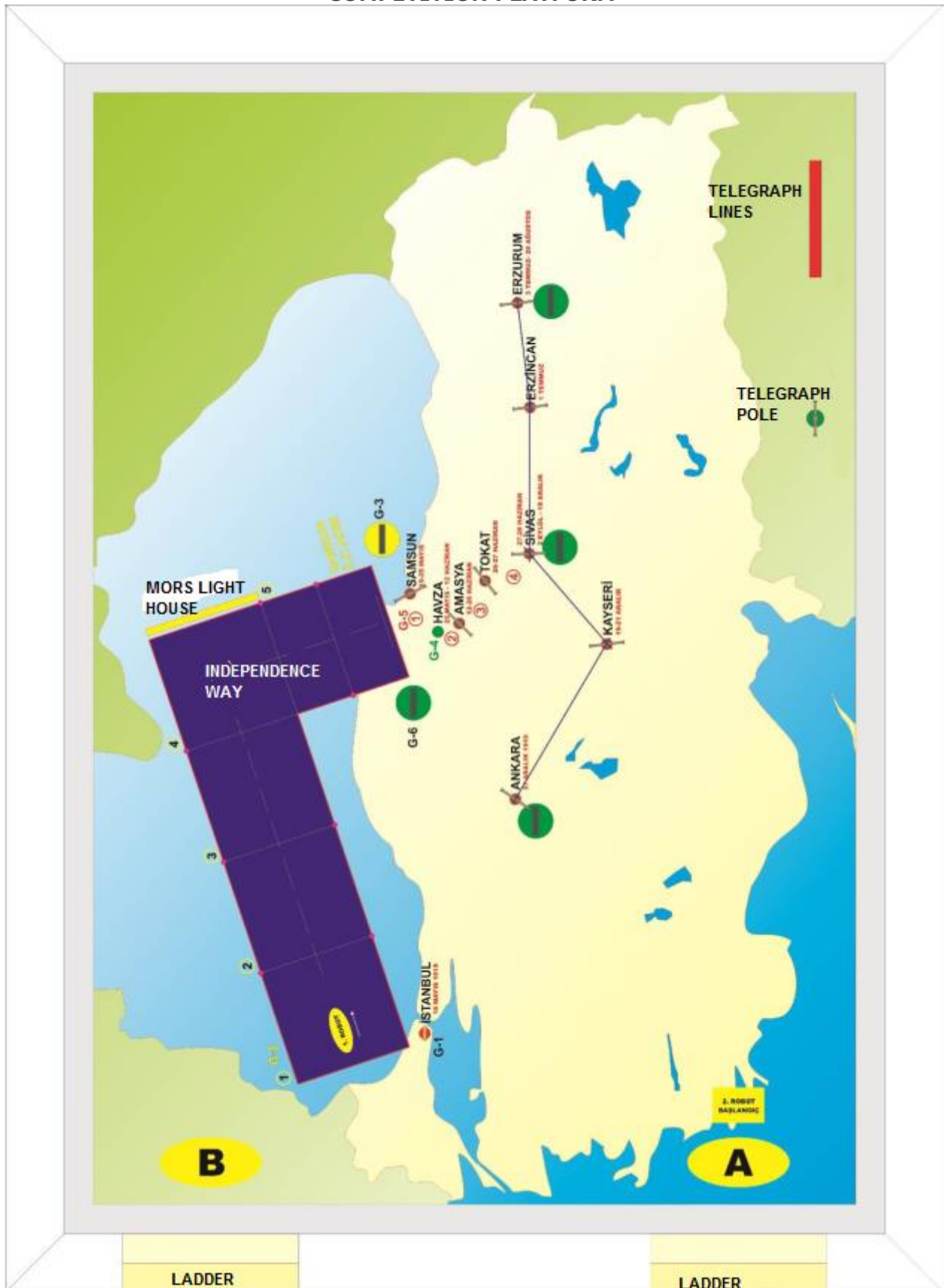**Digital Chronometer:** It is located in competition area as seen from everywhere.

Figure -1 Top view of platform
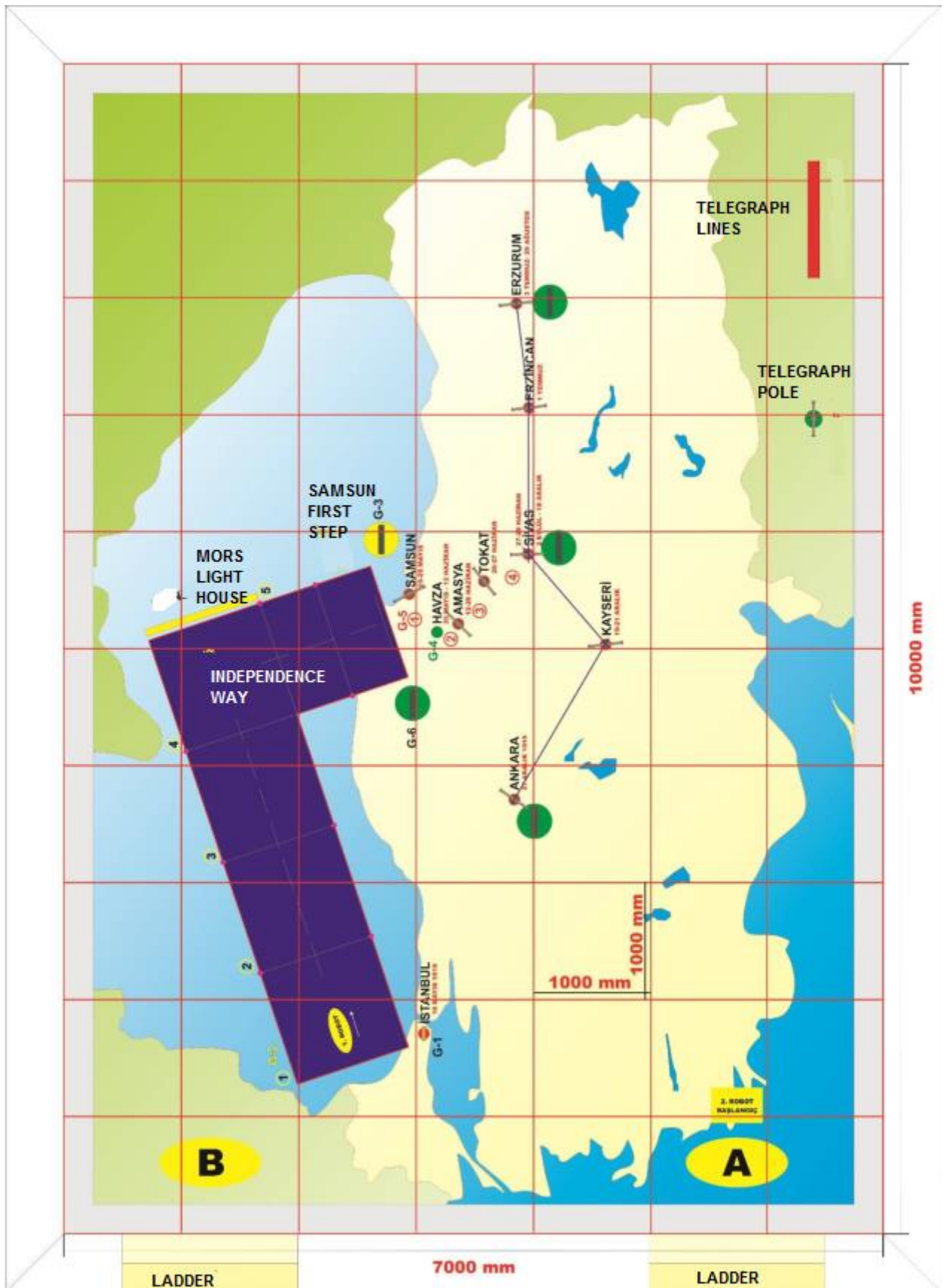
Platform : It is covered by colorful printed foil.

Figure-2 Grid view of Platform.

COMPETITION COURSE

Figure-3 3D view of course A and course B

Figure -4 Perspective view of course A and course B

Course: There are two courses which are sea and land tracks

FIRST COURSE

Figure -5 Top view of sea course

SECOND COURSE (manual control, "first step")
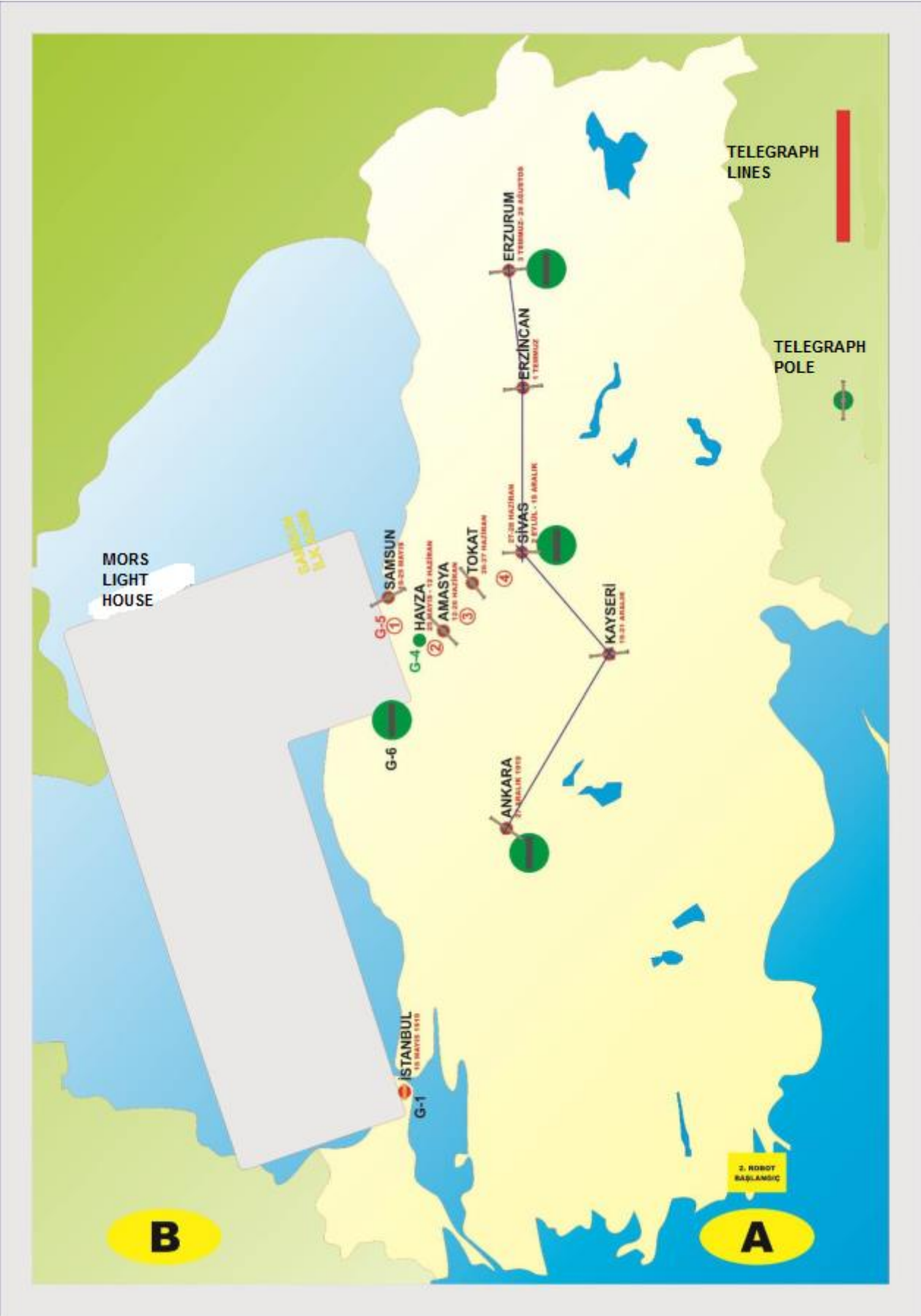
Figure-6 Top view of Land track on platform

FIRST COURSE (Indepencence Way) (AUTONOMOUS ROBOT)

Before racing, robots will be placed starting points of both course A and B and operators of team will be ready for racing. Judge will start chronometer when second robot(operator controlled) moves and race will starts.

Robots complete the following tasks with same order on the courses.

Tasks:
Task 1: This task will be explained in second track section because it will be performed by robot-2.
Tasks for first track:
Task 2: Arrive the point "First step in Samsun" by passing "Intependence Way"

Figure-7 Top view of Sea track on platform

Figure-8 3D view of Sea track on platform

First robot will run automatically and move on "Independence way" after get order from second robot. It will arrive to area-4 throughout area-1,2 and 3 without touching any walls and wait the message sending from Mors Lighthouse. First robot will decode the message when it receives the message , after that it will go to the zone called "First Step in Samsun" and stop without hitting white wall. Tasks will finish.

Mors Light house *(Aldis Lamp):Minimum two lighting fixtures (1000mm lenght,36W white led wallwasher) will be used to represent Mors light house)*
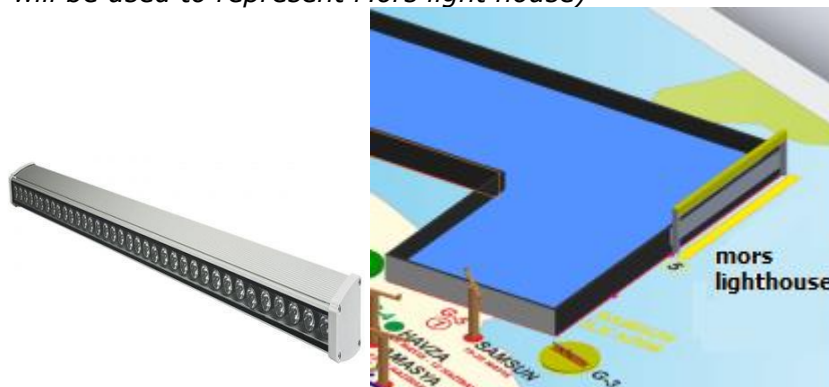

Figure-9 a- Wallwasher   b-location of Mors Lighthouse

Mors Messsage: Operator of second robot will draw lot to determine what this message is. Message consists of 3 characters. (There will be Morse code next to the characters).
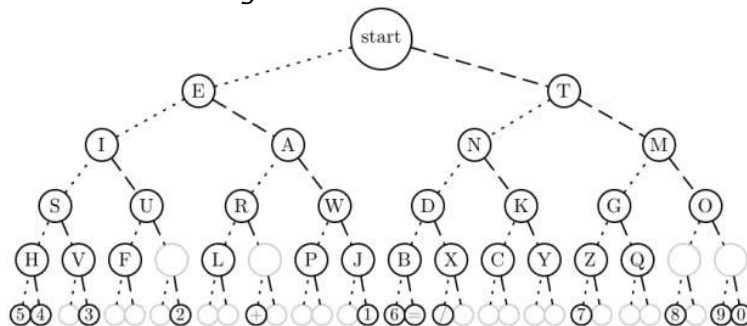

Figure-10 Mors Alfhabet

Figure-11 Mors Code tree

Dimensions of Sea: It has 350 mm height. Other dimensions given in figure-12. A pool will be produced with (3~5 mm metal sheet and placed to its location on the platform.) It will be installed as embedded into platform except the part of 150mm its height stays above the platform. Water level will be 200mm.

Figure-12 Dimensions of sea track

Walls: 150mm of part-1,2 and 3 over water level is coated with black opaque foil. Both sides of Part-4 (only the sides facing to Mors light house) and inner and outer sides of part-5 are coated with white opaque foil.
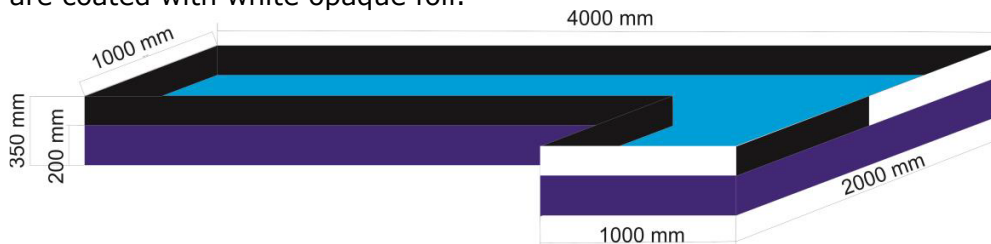

Figure-13 Coating inner and outer sides of Sea section

SECOND COURSE ("First Step") (OPERATOR CONTROLLED ROBOT)
Tasks:

Task 1: Second robot will take its tasks from Istanbul and move to starting point of first robot and deliver the task order to first robot. After that , it will goto point G-3 and wait here until first robot arrives to area-4 on Intependence way.

Task Order: It will be a box which is produced from poplar tree and it has 30x120x40mm dimensions. Its surfaces are covered with orange colored foil.
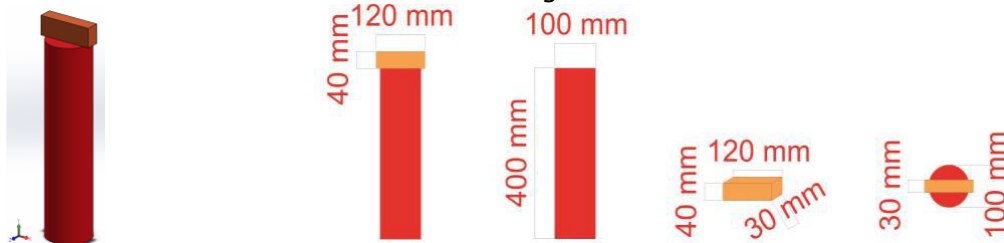

Figure-14 Task order Platform and dimensions

Task 2: It was expained in section of first course

Task 3: When first robot arrives and stops on area-4 , second robot will send mors message to it via Mors Lighthouse (with light beams) by using G-3 telegraph machine

Task 4: When first robot arrives to area"First step-Samsun" , second robot will go to location of telegraph pole and then pick it up, then place it to green zone called G-4 (Havza town)

Telegraph pole: It is a PVC pipe which has 50mm diameter and 600mm lenght. There is a metal profile (10x20x1mm and 300mm lenght) mounted to upper side of this pole.
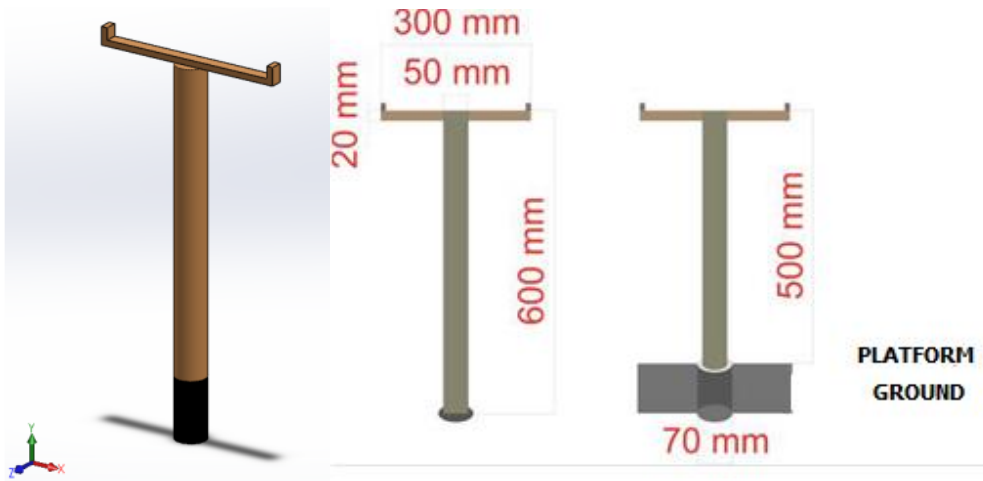
Figure-15 Telegraph Pole Dimensions

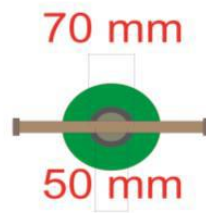**Hole for Telegraph pole:***It has 70mm diameter and 100mm depth*

Figure-16 Hole dimensions

Task 5: Second robot will pick telegraph lines from their places and put them on telegraph poles respectively between Samsun-Havza (1), Havza-Amasya (2), Amasya-Tokat (3) and Tokat-Sivas (4) so that it will fix the broken connection of telegraph lines in Anatolia.
Telegraph Lines: They are represented with empty metal profiles (10x10x1mm)

Figure-17 Telegraph Lines lenghts

Rack for Telegraph Lines: Telegraph lines are stored on vertical racks which its dimensions given below. Operator will pick these telegraph lines from rack by robot and bring to telegraph poles.
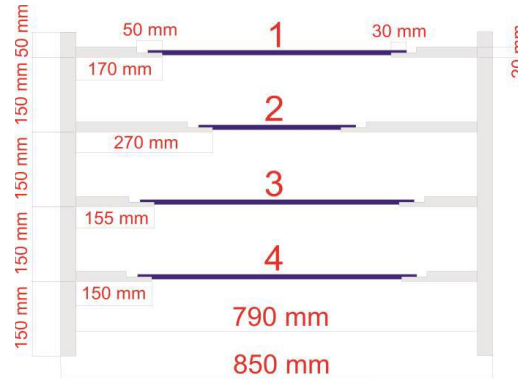

Figure-18 Dimensions of Racks for Telegraph Lines

Task 6: Second robot will send the message (TAMAM) written with Mors codes by using G-3 telegraph machine. When this message is shown on the screen which is placed on platform and lights of Turkey map and telegraph machines in Erzurum, Sivas and Ankara will turn on, choronometer will stop and competition will be over.

Telegraph Machines: They are produced with dimensions given above. One of them has yellow color , another one has green color. Yellow one placed on zone G-3 will be used for communication with Mors lighthouse and green one placed on zone G-6 will be used for communication on telegraph lines
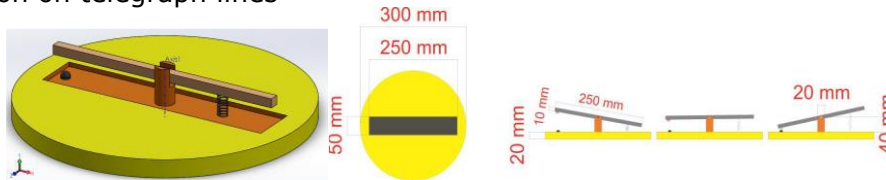
Figure-19 G-3 Telegraph Machine Dimensions for sea
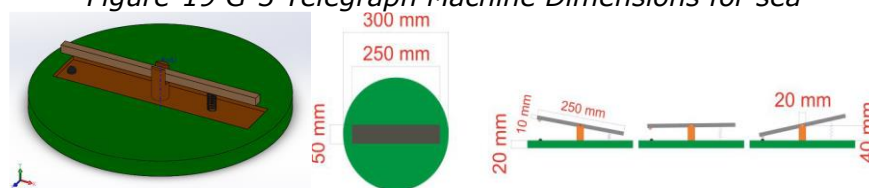
Figure-20 G-6 Telegraph Machine Dimensions for land communications

How Telegraph Machines will be used:

When robot operated by competitor arrives to location of telegraph machine and;

presses 0-2 sec. , system will understand that this was a dot (**.**) and yellow lamp of tower light will be on.

presses 2-3 sec. , system will understand that this was a dash (**-**) and yellow lamp of tower light will be off but green lamp on.

presses 4-6 sec. , both yellow and green lamp will be on at the same time and it is assumed that character is done. After that , competitor starts to create another character.

presses 4-8 sec. , only red lamp will be on while both yellow and green lamp off and it is assumed that character is invalid , so that competitor will create same character again.

presses 8-10 sec. , red, yellow and green lamp will be on at the same time and all characters written so far will be deleted. After that , competitor starts to write message again.

There will be a digital screen on the platform , so each character can be seen by competitor and spectators.

Time	Color	Mors alphabet
0~2sn	Yellow	●
2~4sn	Green	─
4~6sn	Yellow,green	Sent character
6~8sn	Red	Character Reset
8~10sn	Yellow ,green,red	Message Reset
Table-1 Time durations for character		

Figure-21 Tower light

Mors code application of message "TAMAM ":
T(─) A(.─) M(──) A(.─) M(──)

Message	T	A	M	A	M
MORS Code	─	.─	──	.─	──
Lamp colors	GREEN	YELLOW, GREEN	GREEN, GREEN	YELLOW, GREEN	GREEN, GREEN
Time interval to press telegraph	2~4sec 4~6sec	0~2sn,2~4sec 4~6sec	2~4sn,2~4sec 4~6sec	0~2sn,2~4sec 4~6sec	2~4sn,2~4sec 4~6sec

Table-2 Sample message sending

GENERAL RULES

1. Each team has two robots and two members. A Robot can not be used for more than one team.

2. Any equipment or material used on robots must not have characteristics cause to injury audience, competitors and damage to plartforms. Water, oil, inflammable liquids or gases and dangeraous chemical materials are not allowed. Robot will be disqualified if it is noticed that such a kind of materials mentioned above was used.

3. Maximum two team members can stand inside the competition area while the team competing.

4. Total weights of robots should be maximum **25kg.** (include all hardware and equipments such as power suppy etc.)

5. One of robots will be autonomous and the other one will be hand-operated.

6. It is not allowed that any intervention to robots by wired, wireless or infrared etc.

6. Power suppies of robots should be maximum **DC24 V**.

7. Competitor has to be ready inside the competition area within **5 minutes** when they are invited to race. If the competitor requests extra time because of the reason about failures on robots, extra time maximum **10 minutes** will be given to competitor just one times. In this case, next competitor will start to competition. This rule (extra 10 minutes) will be applied only in first day racing **but not in final competitions.**

13. International MEB Robot Contest / Thematic Robot Category Competition Rules

8. Game will start when team moves its robot.

9. Once the choronometer starts, it isn't stopped until the end of race.

10. Robot will take materials placed on platform with its own mechanism.

11. Second robot will take the task order (orange colored box) from second course and deliver to first robot which is waiting on the pool by its own equipments.

12. First robot will take the task order box and move without hitting any walls and base of pool. It will pass area 1,2,3,4 and 5 on independece way.

13. Second robot will send message from Samsun to first robot on the pool by using yellow telegraph machine via Mors light house

14. First robot will decode the message sending as lights via Mors light house by itself while waiting in area-4 , and then it will move to area-5

15. First robot will stop on point "First step-Samsun" without hitting white wall when it enters to area-5

16. Second robot will pick up telegraph pole with its own equipments and mount it on area in Havza town

17. Second robot will pick up telegraph lines by its own equipments and place them on telegraph poles located between Samsun-Havza (1), Havza-Amasya (2), Amasya-Tokat (3) and Tokat-Sivas (4) .

18. Second robot will send message to other cities connected with telegraph lines by using telegraph machine in Havza town.

19. When second robot finishes its tasks, timing will stop and competition will be over.

20. Competition duration: Total 13 minutes for platform. In this time:

   a. In case the first robot cannot complete any task , the task will be skipped by request of competitor and acceptance of judge. Then, competitors will continue to do next task. In this case, penalty time for each missing task will be given and 2 minutes will be added to total time.

21. If robot drops the material, it must take it again by own and then continue the race. If robot cannot take the material again, other team member will take it by hand and leave it to starting zone by order of judge. Robot will take this material from starting zone and continue the racing.

22. In case of manual intervention to robots (except judge's warning and other cases explained above), time penalty (30sec.) and penalty score will be given to team. In this case, it is assumed that it's last task was not completed and this task will be repeated.

23. It is assumed that robot finishes competition succesfully when it completed all tasks and turn the lights of Turkey map and telegraph machines in other cities.

SCORE DETAILS

TOTAL SCORES FOR TASKS: 460

SCORES:

Robot-2 takes task order	10 point
Robot-2 delivers task order to Robot-1	10 point
Robot-1 departure from harbor	10 point
Robot-1 arrives area-2	10 point
Robot-1 arrives area-3	10 point
Robot-1 arrives area-4	10 point
Robot-1 stops area-4	20 point
Robot-2 sends character-1 by using telegraph machine	10 puan
Robot-2 sends character-2 by using telegraph machine	10 point
Robot-2 sends character-3 by using telegraph machine	10 point
Robot-1 understands character-1 that came from Mors Lighthouse	30 point
Robot-1 understands character-2 that came from Mors Lighthouse	30 point
Robot-1 understands character-3 that came from Mors Lighthouse	30 point
Robot-1 arrives area-5	30 point
Robot-1 stops at point "first step" in area-5	20 point
Robot-2 takes telegraph pole	10 point
Robot-2 puts telegraph pole in Havza	30 point
Robot-2 takes 1.telegraph line from rack	10 point
Robot-2 takes 2.telegraph line from rack	10 point
Robot-2 takes 3.telegraph line from rack	10 point
Robot-2 takes 4.telegraph line from rack	10 point
Robot-2 puts 1.telegraph line to its place	20 point
Robot-2 puts 2.telegraph line to its place	20 point
Robot-2 puts 3.telegraph line to its place	20 point
Robot-2 puts 4.telegraph line to its place	20 point
Robot-2 sends 1.character by using telegraph machine	10 point
Robot-2 sends 2.character by using telegraph machine	10 point
Robot-2 sends 3.character by using telegraph machine	10 point
Robot-2 sends 4.character by using telegraph machine	10 point
Robot-2 sends 5.character by using telegraph machine	10 point

PENALTIES

In each case that material carrying are dropped	-5 score
Manually intervention to robot	-30 score
If robot-1 touches sea ground while it is moving	-100 score
If robot-1 touches sea border while it is moving	-10 score
No finish in 13 minutes (for each additional minute)	-20 score

(when stopwatch shows up 15:00:00, judge terminates the competition and declares the time and total score of team.)

DISQUALIFICATION REASONS

1. If any team tries to control robot with wireless, infrared etc. during the game

2. If the teams act behaviours which don't respect to the spirit of fair play before, after or during the comptetition

3. If the teams don't obey the rules and instructions of judges.

4.If the robots damage the platforms during the competition. (by using any kinds of liquits/gases which are inflammable or any dangerous chemical substances, etc.)

5. If same robot/robots used by different teams (Both teams will be disqualified when judges determined this scam).

Thematic contest will continue during 2 days. sorting competition on first day . Final competitions on second day.

FIRST DAY RULES

Two teams will race at the same time and winner will go next tour. First day, racing will continue until quarter finals. In case of not enough team reach quarter finals, teams from top of ranking list will be invited to quarter finals. If there are odd number of teams , team that not has opponent will go directly to next tour.

* Team's score and time are declared within 5 minutes.

Priorities;

Teams will be sorted according to following priorities.

- ➢ Teams which finished both routes and all tasks completely (with full score: 280)
- ➢ Total scores.
- ➢ Total finish time in case of equality.
- ➢ Lighter one in total weight, if their scores are still equal.

SECOND DAY RULES (FINAL DAY)

Second day, matching teams that reached quarter final will be done as top team and bottom team according to order of their score/timing ranks. Racing order will be created by draw lot.

* Team's score and time are declared within 5 minutes.

Priorities;

Teams will be sorted according to following priorities.

- ➢ Teams which finished both routes and all tasks completely (with full score: 460)
- ➢ Total scores.
- ➢ Total finish time in case of equality.
- ➢ Lighter one in total weight, if their scores are still equal.

SECOND (FINAL) DAY CLASSIFICATION RULES

According to the ranking formed at the end of the first day, the first 10 teams will remain in the finals.

On the second day, the competition order of the teams remaining in the finals **(in the order of points/Time)** will be determined by drawing lot.