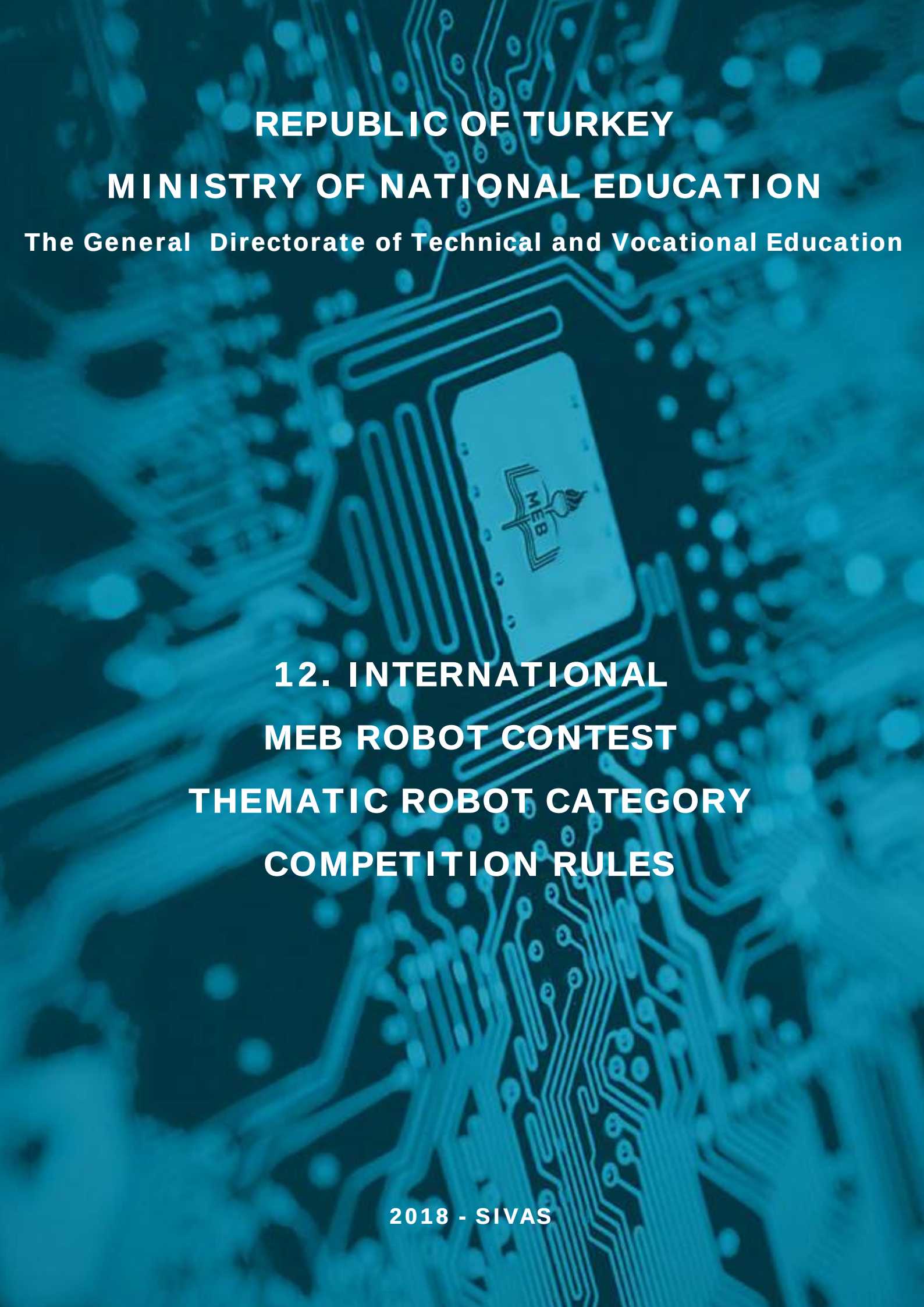
REPUBLIC OF TURKEY

MINISTRY OF NATIONAL EDUCATION

The General Directorate of Technical and Vocational Education



12. INTERNATIONAL MEB ROBOT CONTEST THEMATIC ROBOT CATEGORY COMPETITION RULES

2018 - SIVAS

THEMATIC ROBOT CATEGORY RULES

INDUSTRY 4.0 APPLICATIONS IN TURKEY

Far east countries had increased their economic power in the period of 2006-2011 years because they reached high production numbers by using their advantages of low cost human resources. On the other hand, western countries have started to use industry 4.0 concept with flexibility, low cost, quality etc. to go further in this competition. In our country, Industry 4.0 concept was used firstly in automotive sector, then it is disseminated to other sectors such as household appliances. Work processes in which IoT are used have been developing to contribute Turkey's economy and to be competitive by using high efficient production techniques. Within this scope, it is aimed that speed up thr Works about researches for IoT , trainings for programmers and IT educations.

In this scope, **Ministry of National Education**, The general directorate of Technical and Vocational Education has started to reform at vocational education systems in the year of 2000 and **the departments of Industrial Automation Technologies** were established by the cooperation of **JICA** (Japan International Cooperation Agency)

In the academic year of 2017-2018, **Thematic vocational schools for 16 different fields in 12 regions** were established. These fields are IT Technology, Transportation Services, Machine Technologies, Medial devices Technology, Electric&Electronics Technology, Plastic Technology, Shoe-Making and Leathercraft Technology, Ceramic&Glass Technology, Marketing&Retail, Welding Technology, Chemical Technology, Marine Technology, Goldsmith Technology, Furniture&woodwork Technology, Aircraft Maintenance Technology, Motor Vehicles Technology. Works for other 52 fields are still continuing.

Cezeri Green Technology Technical and Vocational High School is the first school in Turkey which giving education about renewable energy was opened in 2017-2018 academic year. It is a good sample showing Industry 4.0 and renewable energy concepts in our education system.

A SHORT JOURNEY TO HISTORY OF INDUSTRY

Industry 4.0 or 4th industrial revolution is a term which consists of lots of modern automation systems, data communications and manufacturing Technologies. This revolution is combination of IoTs, internet services and cyber-physical systems. It takes a big role to establish smart factory systems. This revolution will unveil more effective work models by providing perfect anlysis with supervising and acquising of data in manufacturing enviroment.

The first industrial revolution (1.0) was the mechanization of production using water and steam power. The second industrial revolution (2.0) then introduced mass production with the help of electric power, followed by the third industrial revolution (3.0) digital revolutionand the use of electronics and IT to further automate production. Now Fourth industrial revolution (4.0):

From Industry 1.0 to 4.0

► Mechanical manufacturing (18.century)

1712 Invention of Steam Machine

► Mass production based on electricity and job sharing

(19. century) Inventions of Telgraf 1840 and telephone 1880

1920 Taylorism (scientific management)

► Automation of production processes 20. century)

1971 First micro computer (Altair 8800)

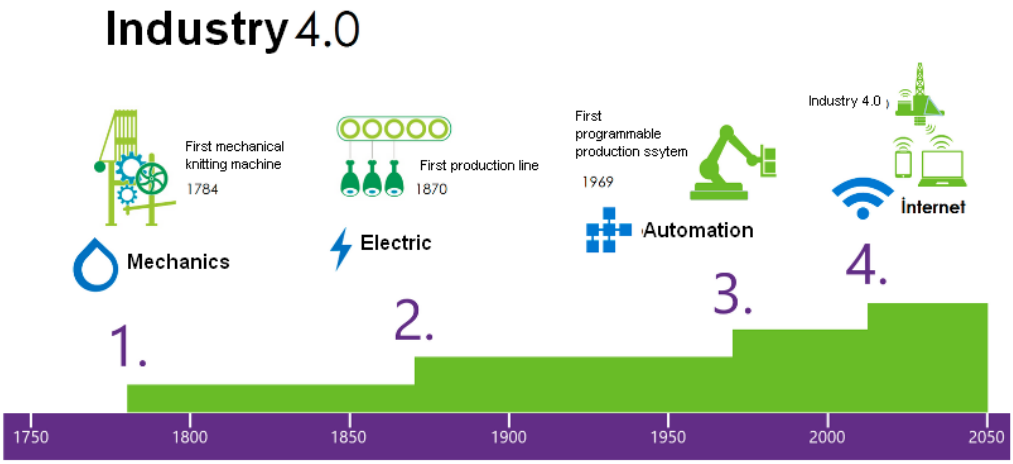
1976 Apple I (S. Jobs ve S. Wozniak)

► Autonomous machines and Virtual enviroments (21. century)

1988 AutoIDLab. (MIT)

2000 Internet of Things

2010 Cellular transport systems



Historical development of Industry

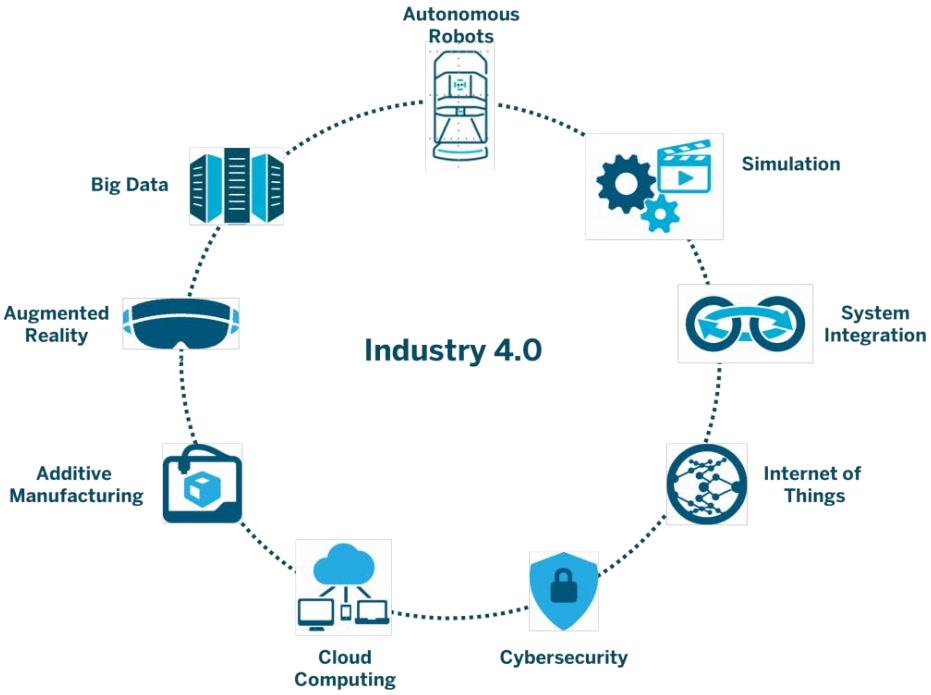
INDUSTRY 4.0 STRUCTURE

Industry 4.0 is a collective term for technologies and concepts of value chain organization. Based on the technological concepts of cyber-physical systems, the Internet of Things and the Internet of Services. It facilitates the vision of the Smart Factory.

Industry 4.0 is generally the combination of 3 following structures.

- ► Internet of Things
- ► Internet of Services
- ► Cyber-physical systems

Within the modular structured Smart Factories of Industry 4.0, cyber-physical systems monitor physical processes, create a virtual copy of the physical world and make decentralized decisions. Over the Internet of Things, Cyber-physical systems communicate and cooperate with each other and humans in real time. Via the Internet of Services, both internal and cross-organizational services are offered and utilized by participants of the value chain.



Industry 4.0 structure

INDUSTRY 4.0 PRINCIPLES

Industry 4.0 is based on six design principles.

1) Interoperability: the ability of cyber-physical systems (i.e. work piece carriers, assembly stations and products), humans and Smart Factories to connect and communicate with each other via the Internet of Things and the Internet of Services

2) Virtualization: a virtual copy of the Smart Factory which is created by linking sensor data (from monitoring physical processes) with virtual plant models and simulation models

3) Decentralization: the ability of cyber-physical systems within Smart Factories to make decisions on their own

4) Real-Time Capability: the capability to collect and analyze data and provide the insights immediately

5) Service Orientation: offering of services (of cyber-physical systems, humans and Smart Factories) via the Internet of Services

6) Modularity: flexible adaptation of Smart Factories for changing requirements of individual modules

APPLICABILITY OF INDUSTRY 4.0 SYSTEM

Manufacturing in industry 4.0 system is a kind of system which machines share their real time data with services and products. This system is being exhibited in a small smart factory established in Kaiserslautern/Germany by contributions of German Research Centre of Artificial Intelligence (DFKI) and its industrial&research partners. Soap bottles are used in this factory to show how products and machines communicate with each other. There are RFID stickers on empty bottles and machines can recognize the colors of bottles with these stickers. Saving all production data from beginning is possible by means of this system. In this way, a cyber-physical system comes to exist.

ADVANTAGES OF INDUSTRY 4.0

► Easy monitoring systems and diagnostics
► Self-awareness of systems and components
► The system is environmentally friendly and sustainable through resource saving behaviors
► Provide higher efficiency
► Increase flexibility in manufacturing
► Decreasing costs
► Develop new work models

Source: http://www.endustri40.com/endustri-tarihine-kisa-bir-yolculuk/

RENEWABLE ENERGY SOURCES

It is possible to solve the needs of energy that became the most important problem of the world in 21.century by using both renewable energy sources and clean energy sources without any damage to enviroment.

In the World, more energy is necessary day by day because of rapid increase in consumption and growth in the production capacity of industrial companies. Nowadays, main energy sources are fossil fuels , that is “non-renewable energy sources” which are used heavily.

Many problems such as environmental, water and air pollutions are appeared together with energy needs because the importance of renewable energy sources was ignored.

We need to focus sustainable energy sources to create a livable world and able to leave more beatiful tomorrows for our children and to meet energy needs of the next generations. Sustainable energy source is necessary energy produced without risking energy supplies. Renewable energy sources take an important role to continue to supply our energy needs.

It is explained that renewable energy is a source which can generate energy by using natural processes and can renew itself faster than exhausting.

Renewable energy sources;

1) Wind power,
2) Solar Energy,
3) Hydroelectric Energy,
4) Geothermal Energy,
5) Biomass Energy.

1. WHAT IS WIND ENERGY?

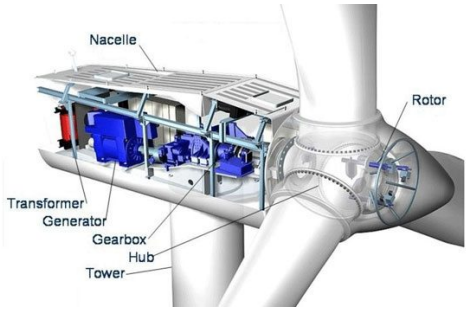
Wind energy is a natural, renewable , clean and endless power. Its source is the sun. Only small amount of energy (1-2%)which is sent from the sun transforms into wind power. Air flow occurs due to the differences in temperature and pressure because the sun cannot heat homogenously the atmosphere and ground of earth. Heating. If an air muss is heated by the sun, it moves horizontally up and another cold air muss which has same size comes and fills the empty space. This air in motion called wind. Beside the disadvantages of wind power plants such as high initial investment cost, low capacity and variable energy production, its advantages can be listed generally as the followings;

1. Many winds occur in the atmosphere.
2. It is a clean, renewable and enviroment friendly energy source.
3. Trustable source and no risk for exhausting
4. It has competitive initial construction cost.

5. Maintenance and operational costs are low.
6. creates employement.
7. Raw material is local. No need import.
8. Its technology and operation is relatively simple.
9. It takes short time to activate.

Wind Turbine Technology

Wind turbine is a machine that is main part of wind power plants and converts the wind's kinetic energy into electrical energy. There are two kinds of wind turbines : vertical or horizontal axis according to rotate axis. Most common type is horizontal axis wind turbines. Rotate axis is parallel but wings are perpendicular to wind direction. This type of turbine is produced as it has one, two , three or more wings.



(Picture; https://www.quora.com/What-is-the-working-principle-of-a-wind-turbine)

Todays, horizontal axis wind turbines have 1,0-6,0 MW powers are used. A wind turbine consists of a tower, body and rotor. Wings and hub are called rotor. Wings are made with polyster, fibre carbon and epoxy strenghed with steel backbone. Wing diameter of new generation wind turbines reaches 100m. Tower height of modern wind turbines is between 60-100m. Energy produced in a wind turbine depends on wind speed at altitute of hub placed on top of tower. We can use maximum power of winds if height of tower is increased.

(Picture: http://www.enerjimag.com/turkiyede-ruzgar-enerjisi-santrali-nasil-kuruluyor/)

2. SOLAR ENGERY TECHNOLOGIES

The energy from the Sun is light energy originates from a nuclear fusion process (transforming hydrogen gas to helium) that is occurring inside the core of the Sun. The energy of sun at outside of earth is 1370W/m^2 but when it arrives to ground of earth, its value decreases to 0-1100 W/m2 because of atmosphere. Small amount of this energy which arrives to earth is even much more than current energy consumption of humanity. Studies about solar energy had increased especially after 1970. Solar energy systems are accepted as a clean energy source.

Distance between the earth and the sun is 150 million km. The energy comes from the sun is 20.000 times more than energy consumption in a year. All solar radiations cannot reach to the earth, 30% of them reflect back from atmosphere. 50% of them can pass through the atmosphere and reach to the earth. World temperature increases and life becomes possible because of this energy. This energy also causes winds in air and waves in oceans. 20% of solar energy are kept in atmosphere and clouds. Less than 1% of solar energy are used for photosynthesis by plants. Plants generate oxygen and sugar by using water,carbon dioxide and sun lights. Photosynthesis is life source for plants. The sun is directly or undirectly source of all kinds of energies except nuclear energy.

Solar energy Technologies can be divided into two main parts in terms of material, method and technology:

Photovoltaic Solar Technology: Semi conductor materials called photovoltaic cells convert sunlights directly to electricity.

(Picture: https://www.pv-tech.org/news/nv-energy-and-apple-lock-in-lowest-cost-ppa-prices-as-section-201-decision)

Thermal Solar Technologies: Main purpose of these systems is to get heat from solar energy. This heat can be used for heating and producing electricity as well.

3. WHAT IS HYDROELECTRIC ENERGY?

Hydroelectric power plants converts the kinetic energy contained in flowing water into electricity. The energy in flowing water depends on flowing or falling velocity. A big river stores a big energy , or if water falls from very high level, we can get very high energy. In both ways, water passes through channel or pipes , flows to turbine and makes propellers of turbine rotate. Turbines are connected to generators and they transform the mechanical energy to electric energy.

Hydroelectric power plants advantages;

a. Generating energy from water ,
b. Zero greenhouse gas emmision,
c. Constracting with domestic facilities,
d. Long life and no fuel expenses,
e. Low cost of operation and maintenance expenses,
f. Create employment,

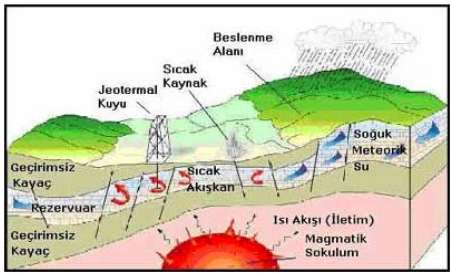
4. WHAT IS GEOTHERMAL ENERGY?

Geothermal energy is inner heat of eart. This heat spreads from inner core of earth to its surface. Geothermal resources have 3 important components :

1. Heat sources,
2. Flow carrying heat from underground to surface ,
3. Rock transparency which allows water circulations,

In geothermal areas, hot rocks and hot groundwater are found in places closer to surface. It is because of:

• Magma rises to surface and carries heat
• Heat flow occuring due to difference in temparature at thin layers of surface
• Groundwater goes down a few kilometer deep and heats up an then it comes to surface again.

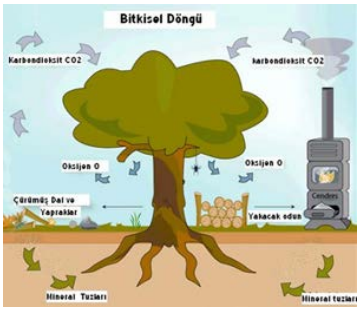


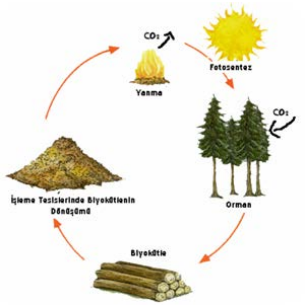
5. WHAT IS BIOMASS ENERGY?

Since biomass energy is endless, it can be obtained from everywhere and helps the socio-economic developments in especially rural areas, it is considered as a convinient and important energy source.

Biomass engery can be generated from organic materials in industrial and urban wastes, plants especially corn and wheat, animals matters, algae. It is getting important because of limited energy sources such as petrol, coil, natural gas and enviromental pollutions

Biomass which is root of living organisms is called plantal organisms storing solar energy by helping photosynthesis. Biomass can be also explained as total mass of living organisms combined from one or different species at a specific time period.





Plants synthesise organic substances which are energy sources fo them and release oxygen which is necessary for respiration of all living creatures to the atmosphere. While producing energy from biomass, enviroment is protected from CO2 which is produced as a result of combustion of the produced organic substances since it was previously taken from the atmosphere during the formation of these substances. Plants are not only nutritional source but also endless energy sources.

Even fossile fuels which are formed with dead plants remained under the ground during millions of years have same properties with biomass mentioned above , they release many harmful substances to the air when they are burned because of their changes in temp and pressure of underground.

References:

Data and information given above are quoted from the following web links of Ministry of Energy and Natural Resources, The General Directorate of Renewable Energy.

1) http://www.eie.gov.tr/yenilenebilir/ruzgar-ruzgar_enerjisi.aspx
2) http://www.eie.gov.tr/yenilenebilir/g_enj_tekno.aspx
3) http://www.eie.gov.tr/yenilenebilir/h_hidrolik_nedir.aspx
4) http://www.eie.gov.tr/yenilenebilir/jeo_enerji_nedir.aspx
5) http://www.eie.gov.tr/yenilenebilir/biyokutle_enerjisi.aspx

THEMATICROBOT CATEGORY RULES
“RENEWABLE ENGERY SOURCES BASED ON INDUSTRY 4.0”

Thematic robot competition consists of a platform and a course.

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

Course; It represents producing energy by using renewable energy sources. Course is formed by five stage tasks which are themed with wind, sun and nature.

Two teams will race on the platform at the same time with two robots.

Before racing, robots will be placed starting points of both course A and B and one operator of each team will be ready for racing.

There are one box and three cylinder in blue field, six globes in yellow field, one cube in green field at starting points of both course A and B. Blue items represent wind energy, Yellow items represent solar energy and green item represents the nature. Timing of both teams will start when the conveyor belts run and race starts.

Robots complete the following tasks respectively.

Tasks;

Task 1. Robot picks up blue cylinders and brings them to the place which represents production plant produces electric energy by using wind power and put them into the blue holes,

Task 2. Robot picks up the blue cube and brings it to the RF place , shows it to RF reader, after RF reader reads the code , robot leaves the cube down to blue place,

Task 3. Robot picks up yellow globes and brings them to the place which represents production plant produces electric energy by using solar power and put them into the yellow holes,

Task 4. Robot picks up the yellow cube and brings it to the RF place , shows it to RF reader, after RF reader reads the code , robot leaves the cube down to yellow place,

Task 5. Robot picks up the green cube and brings it to the RF place , shows it to RF reader, after RF reader reads the code , Sivas Congress Building will be enlightened.

It is assumed that game is over if team completes all tasks and lights up Sivas Congress Building. Its chronometer will stop.

Team that gets best score in shortest time will go next race. Total score and time will be considered while listing teams.

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

COMPETITION PLATFORM

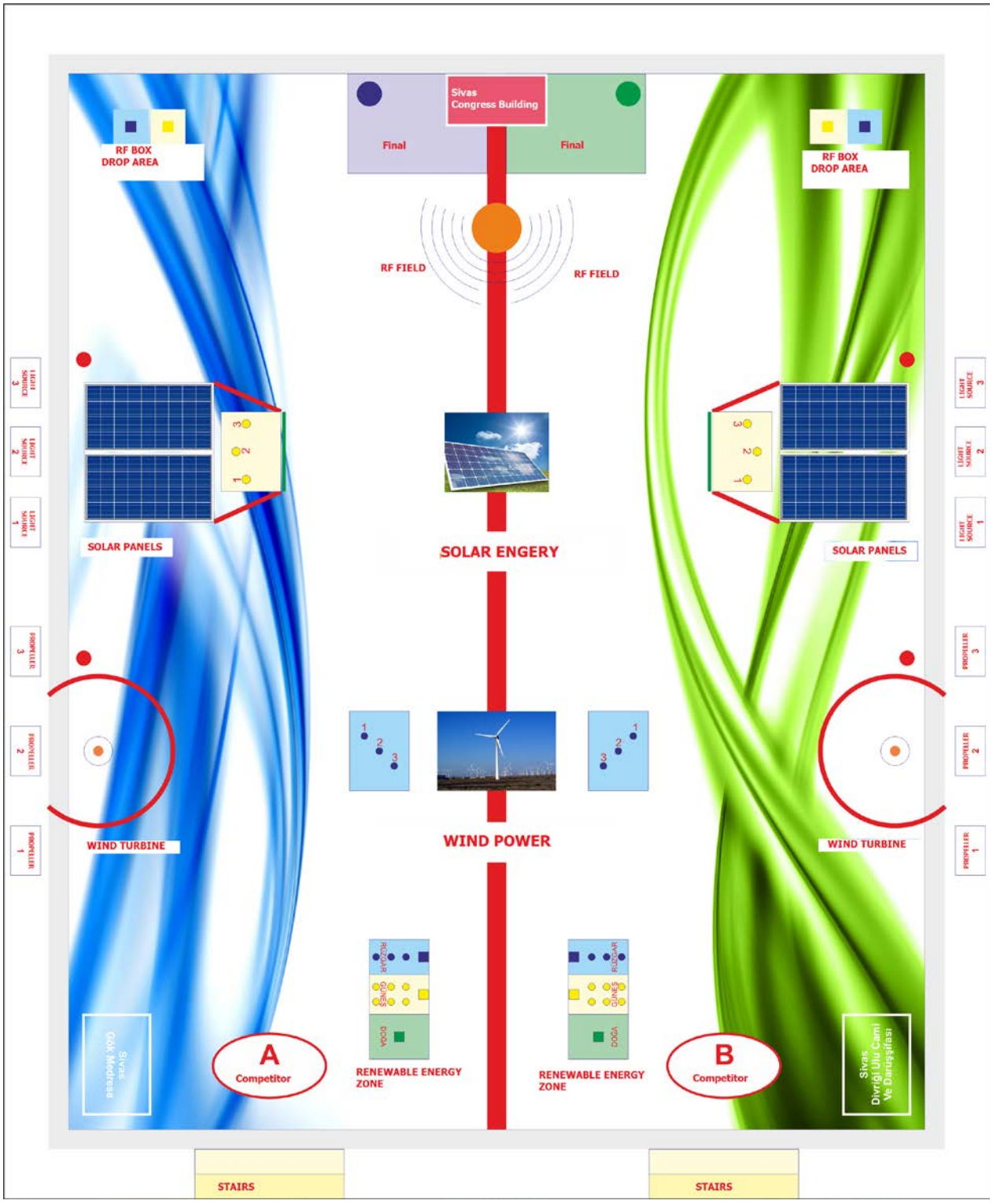


Figure -1 Top view of platform

Platform : It is covered by colorful printed foil.

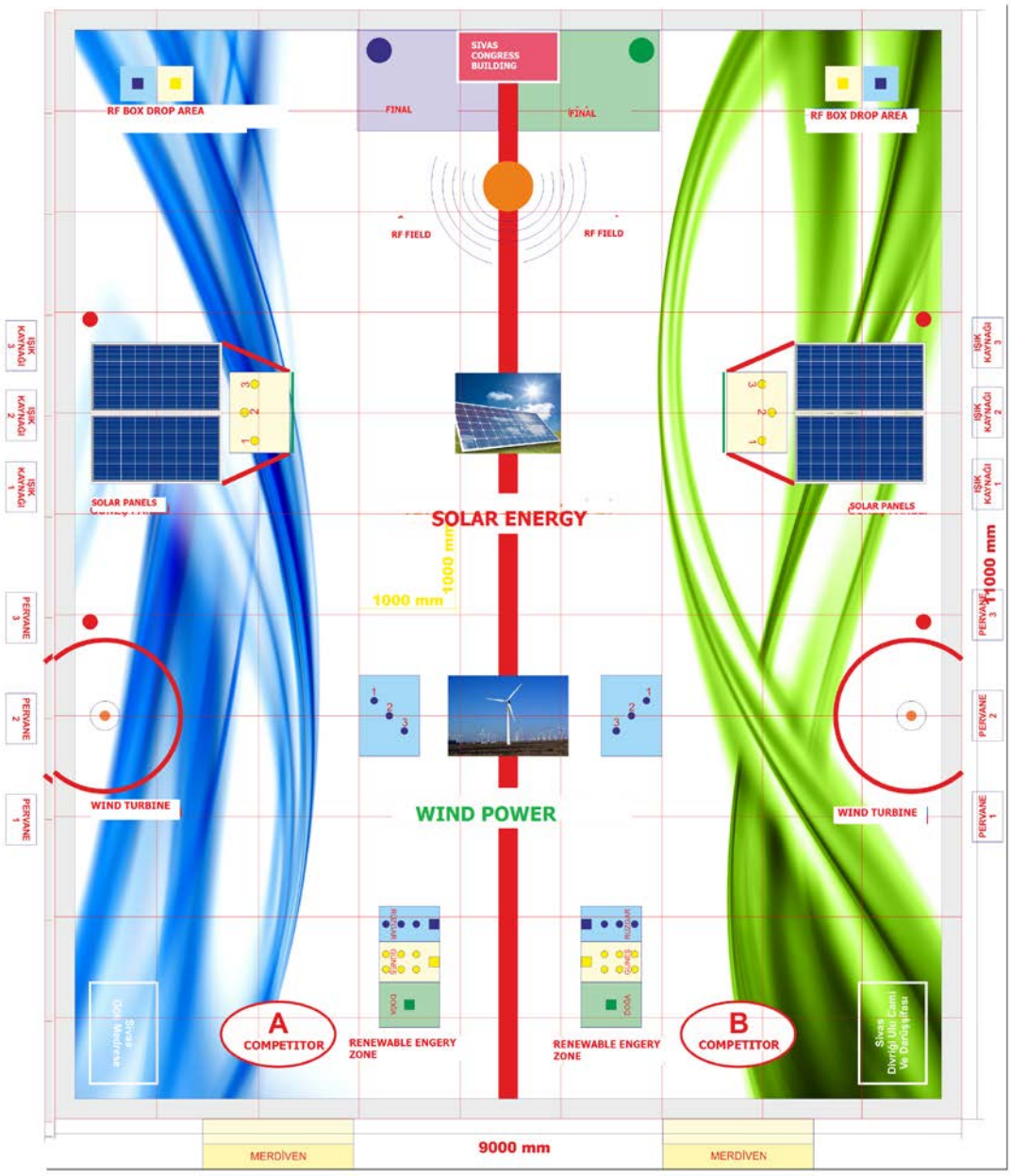


Figure-2 Grid view of Platform.

COMPETITION COURSE

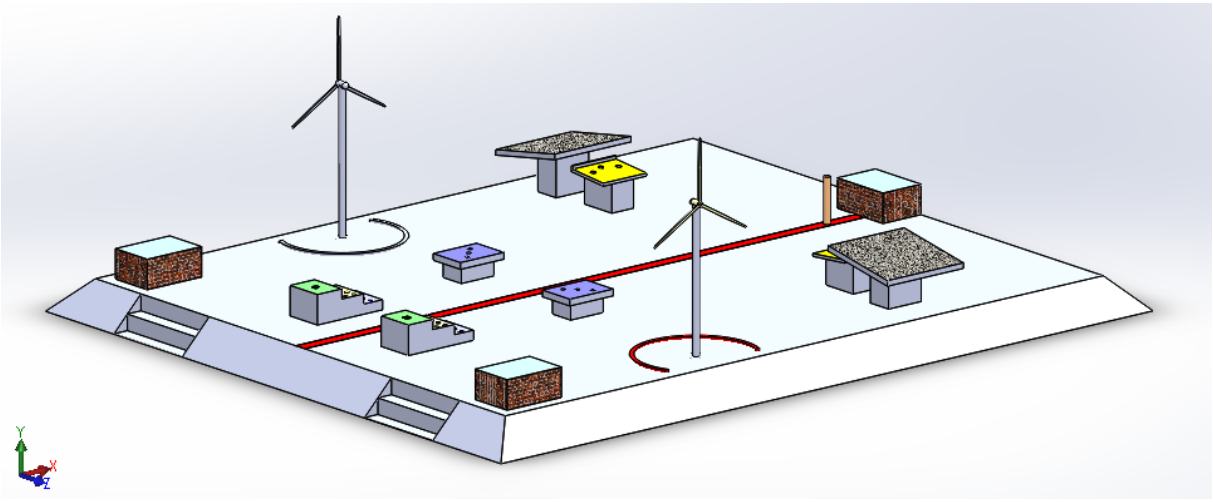


Figure-3 3D view of course A and course B

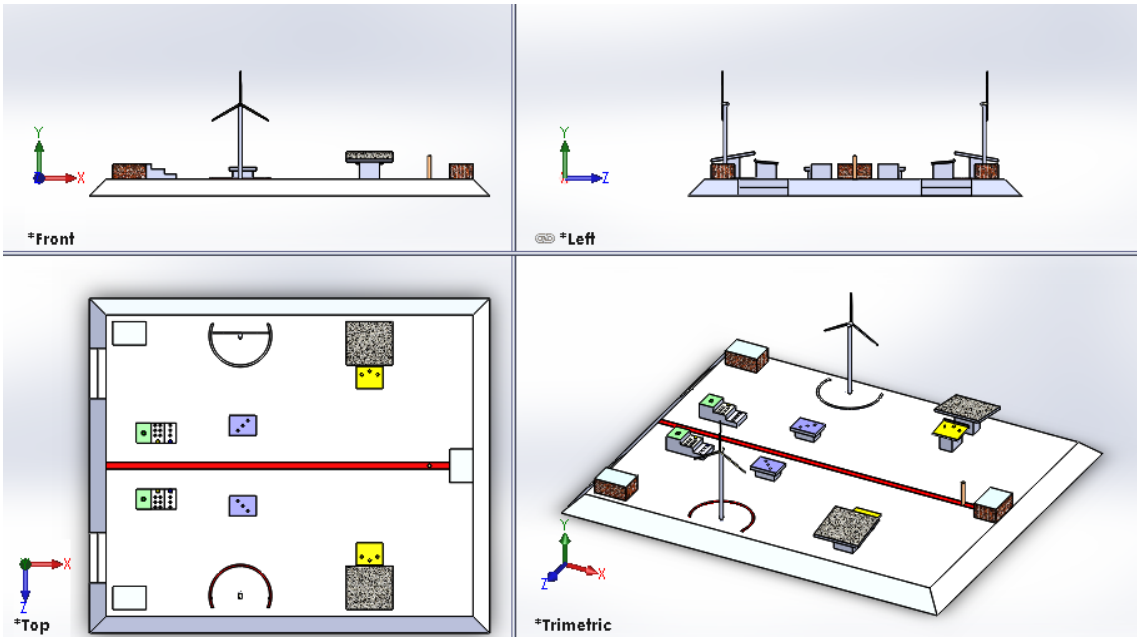


Figure -4 Perspective view of course A and course B

Course: There are two courses symetrical each other. It is prepared as A and B to allow racing two teams at the same time.

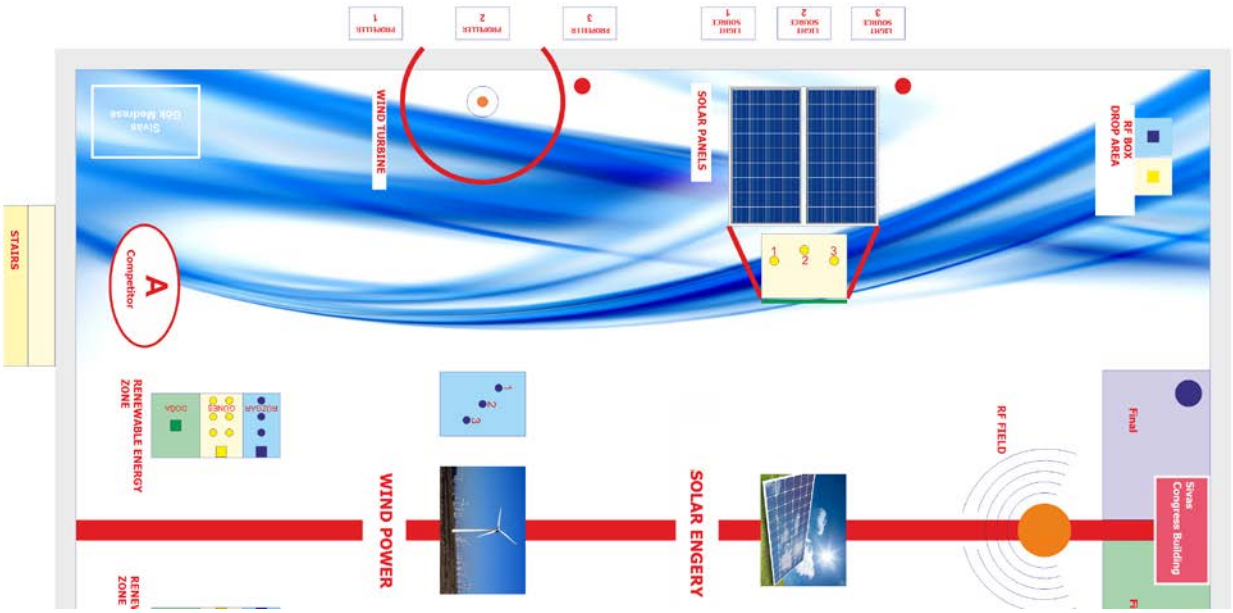


Figure -5 Task positions

Before racing, robots will be placed starting points of both course A and B and one operator of each team will be ready for racing. Timing of both teams will start at the same time by judge's command and race will starts.

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

Tasks:

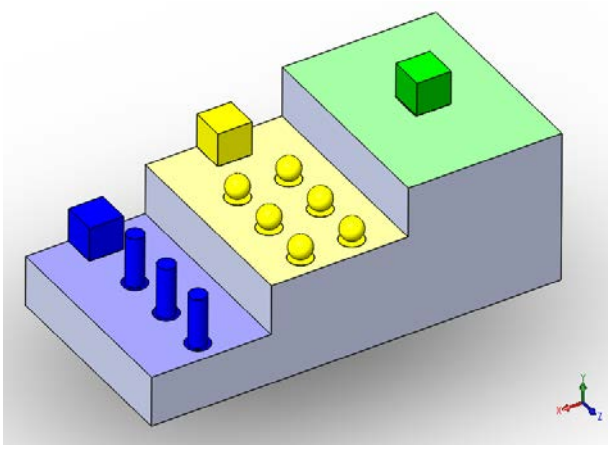


Figure -6 Renewable Engery Zone , task materials

Task 1. Robot moves from start point and picks up blue cylinders

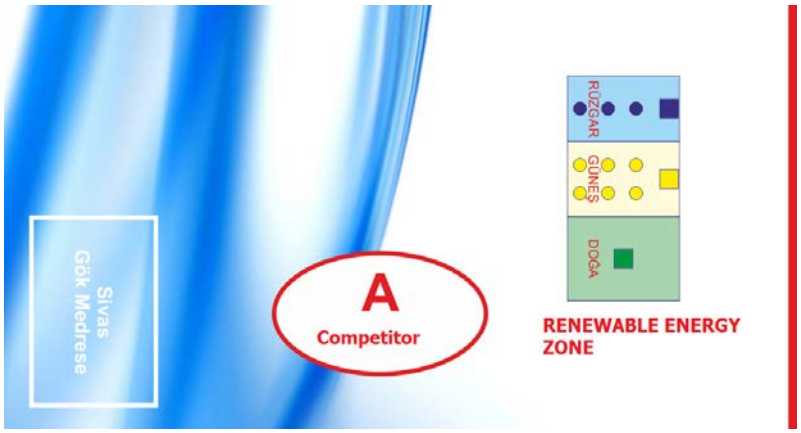


Figure -7 Starting point

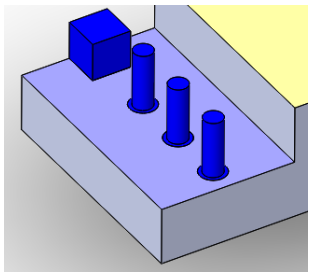


Figure -8 Wind power materials

and brings them to the place which represents production plant produces electric energy by using wind power and put them into the blue holes,

Cylinder: It has 50mm radius and 150mm height. It is made from PVC waste water pipe , filled with styrofoam and covered with blue foil. Both sides of cylinder are closed.

Figure -9 Dimensions of cylinder

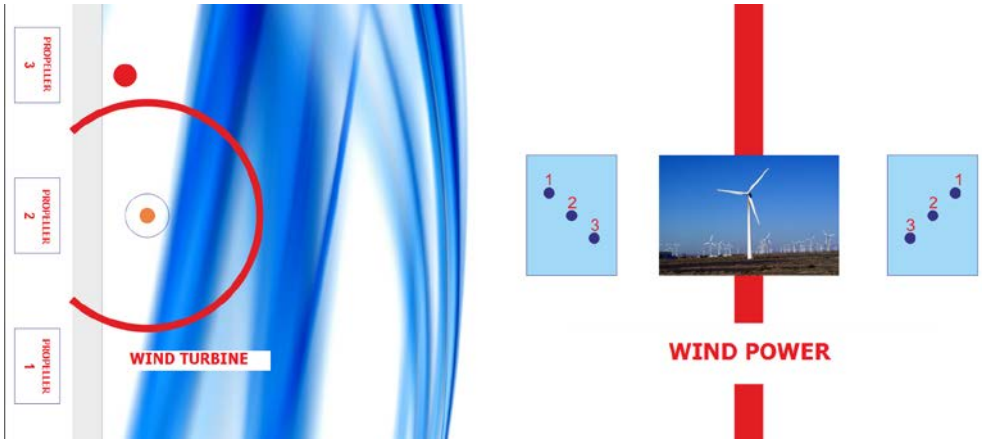


Figure -10 Wind Power area

Each of propellers will start to run when each of cylinder placed to its seat. Propeller generate electric power and one layer of tower light in red circle near the wind turbine will be turn on. It is assumed that task is done if robot runs wind turbines by placing 3 cylinders and turns on all layers of the tower light.

Tower light

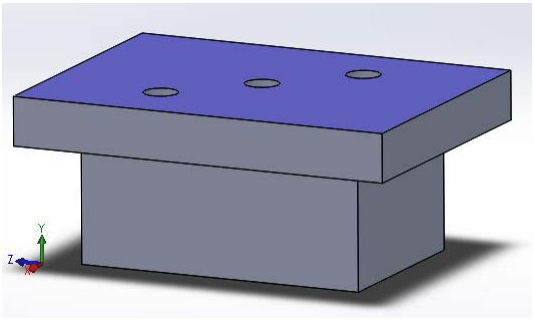


Figure -11 3D view of stand for Cylinders

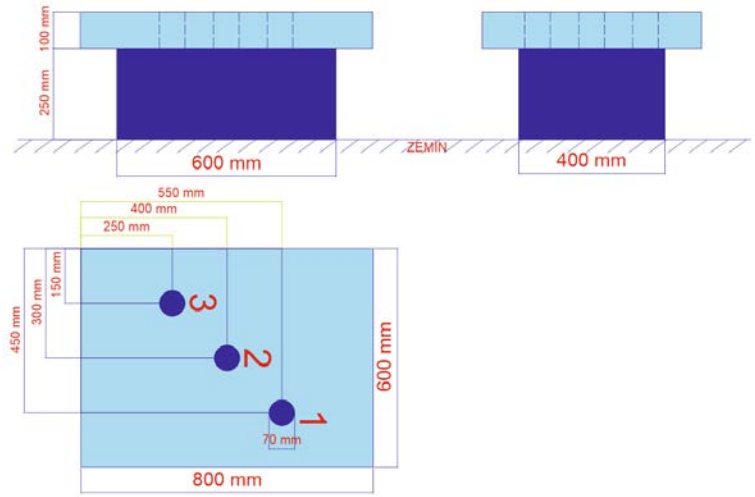


Figure -12 Perspective view of cylinders positions

Task 2. Robot picks up the blue cube and brings it to the RF place , shows it to RF reader, after RF reader reads the code , robot leaves the cube down to blue place,

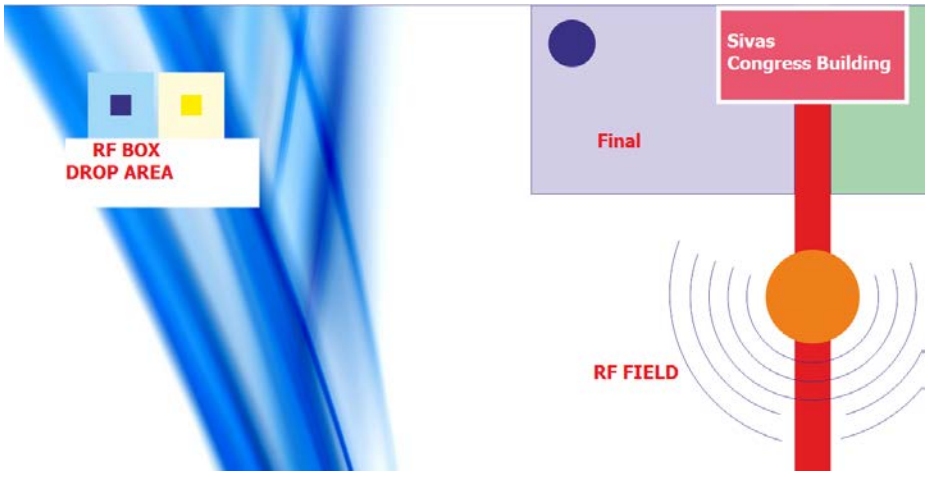


Figure-13 RF field and RF box droping area.

Box: It's dimensions are 50x150x50mm and made by poplar tree. It is covered by blue foil. There will be RFID tag on each box to register box's data. Thus, information about the boxes such as which locations they are can be collected by the system.

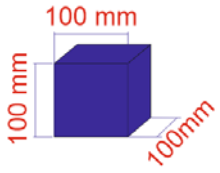


Figure-14 Blue box dimensions

Task 3. Robot picks up yellow globes ,

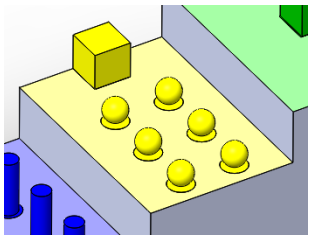


Figure-15 Solar Energy materials.

and brings them to the place which represents production plant produces electric energy by using solar power and put them into the yellow holes,

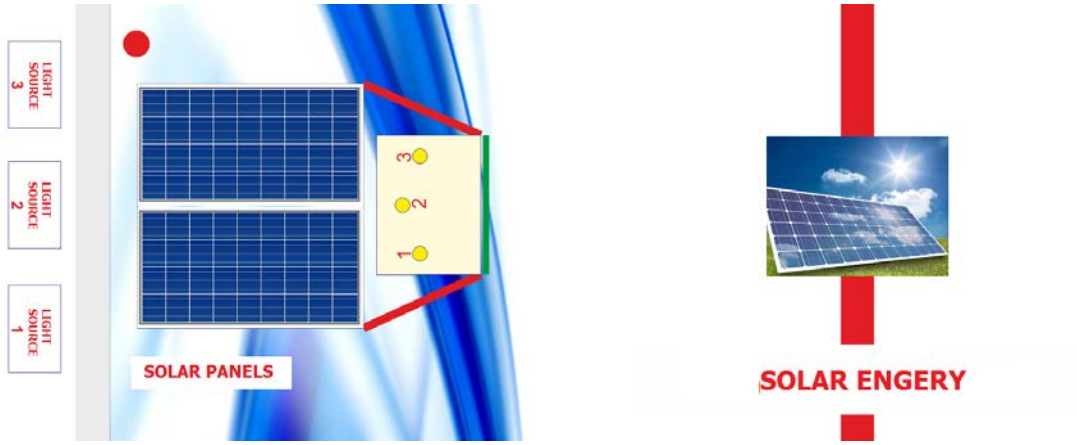


Figure-16 Solar Engery section

When each of globe placed to its seat, each solar panel generates electric power and one layer of tower light in red circle near the solar panel will be turn on. It is assumed that task is done if robot placing 3 globes and turns on all layers of the tower light.

Tower Light

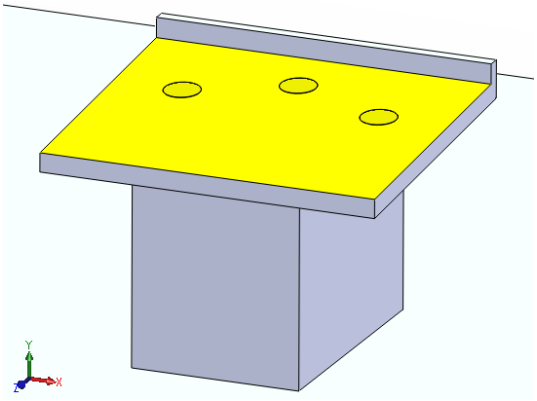


Figure-17 3D view of stand for globes

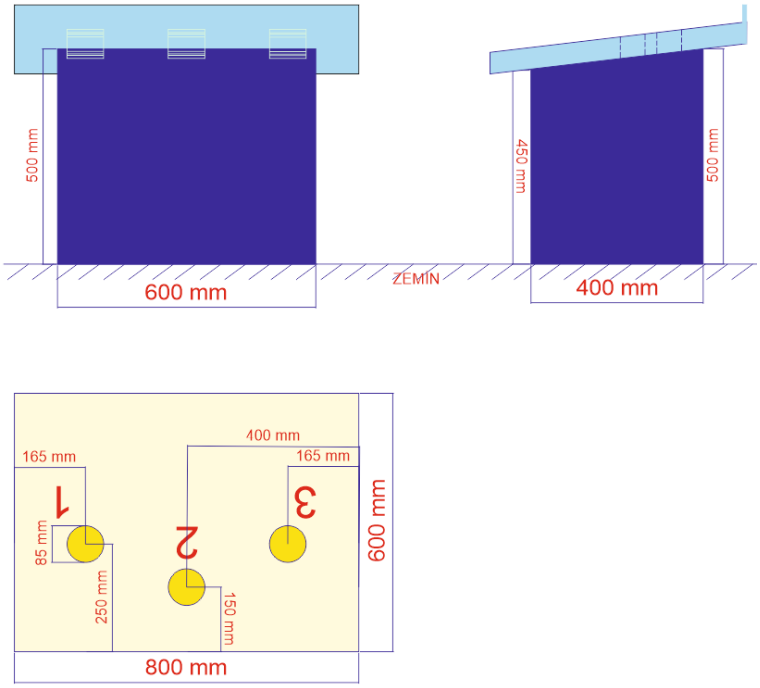


Figure-18 Perspective view of stand for globes

Globe: It is represented with table tenis ball. (weight:56,70 -58,47 gr , and radius: 6,35cm-6,67cm)

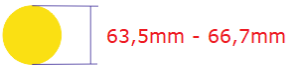


Figure-19 globe dimensions

Task 4. Robot picks up the yellow cube and brings it to the RF place , shows it to RF reader, after RF reader reads the code , robot leaves the cube down to yellow place,

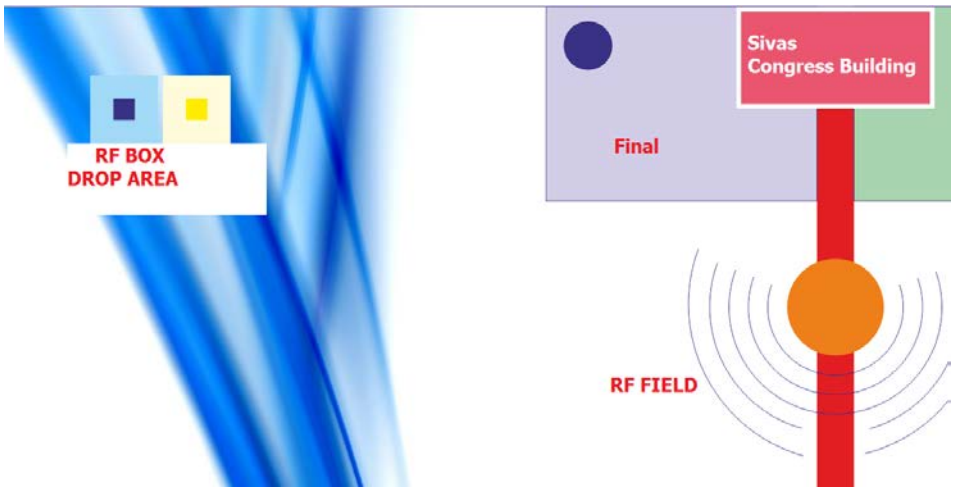


Figure-20 RF field and RF box dropping area.

Box: It's dimensions are 50x150x50mm and made by poplar tree. It is covered by yellow foil. There will be RFID tag on each box to register box's data. Thus, information about the boxes such as which locations they are can be collected by the system.

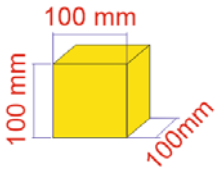


Figure-21 Yellow box dimensions

Task 5. Robot picks up the green cube ,

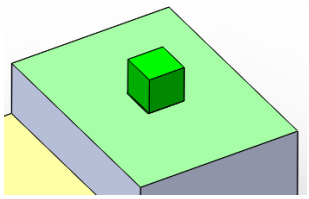


Figure-22 Nature material

and brings it to the RF place , shows it to RF reader,

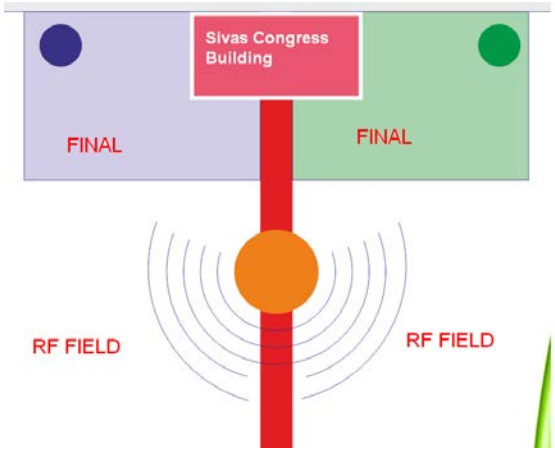


Figure-23 Final zone

after RF reader reads the code , Gök Medrese, Divriği Ulu mosque and compex , Sivas Congress Building will be enlightened.

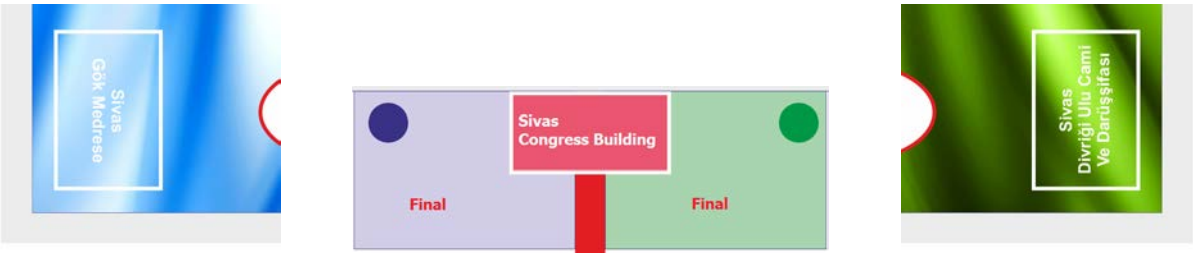


Figure-24 Places where will be enlightened.

There are warning lights (tower lights) both sides of Sivas congress building in final zone. When one of robots enters the RF field, warning light will turn on and its game will be over , its chronometer will be stopped.

When another competitor arrives to RF field within the task time and turns its warning light on , then its chronometer will be stopped and game will be over.

When second robot puts down the box-2 on ground, first robot moves with box-1 and enters to Konya zone. At that time, system reads RFID tag of box-1 and lights up one of Mevlana's seven advices. After that chronometer will stop and robot finishes its game.

When other robot reaches to Konya zone with carrying box-1 and lights up Mevlana's advice , timing will stop and competition will be over.

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. Robot will be autonomous or hand-operated.

6. It is not allowed that any intervention to robots by wired, wireless or infrared etc. until it finishs the tasks.

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

7. Competitor has to be ready inside the competition area within **3 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 semi final, final competitions.**

8. Team A and B will start racing at the same time.

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

10. Robot will take the blue cylindrical material from renewable wind power area with its own mechanism.

11. Robot will bring the blue cylindrical materials to the wind power location and place them into blue holes with its own mechanism.

12. Robot will take the blue cube from renewable wind power area with its own mechanism.

13. Robot will arrive to RF zone and system will read the code. After that robot will drop the blue cube down to blue place in RF dropping area.

14. Robot will take the yellow globe from renewable solar energy area with its own mechanism.

15. Robot will bring the yellow globe materials to the solar energy location and place them into yellow holes with its own mechanism. (It is enough to finish task if robot puts one globe for each hole).

16. Robot will take the yellow cube from renewable solar power area with its own mechanism.

17. Robot will arrive to RF zone and system will read the code. After that, robot will drop the yellow cube down to yellow place in RF dropping area.

18. Robot will take the yellow cube from renewable natural area with its own mechanism.

19. Robot will arrive to RF field and present the material to RF reader. After that tower light in finish area will turn on.

20. When robot completes all task , timing will stop and game will be over.

21. Time: It is **10 minutes**. In this time:

a. When robots cannot complete any task because of any reason, this task will be skipped by request of competitor and acceptance of judge. Then, competitors will continue to do next task. Time penalty (2 min) will be added to team's total time for each task which is failed.

22. If robot drops the box, it must take the box again then continue the race. If robot cannot take the box again, second competitor will take the box and leave it to renewable engery zone by order of judge. Robot will take the box from this location and continue the racing.

23. 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.

24. It is assumed that task is done if robot comes to RF field with green box and turns on the tower light in finish area.

25. If one of team completes all tasks and gets full score, its chronometer will be stopped and judge will finish the game without waiting other robot's tasks.

26. Team that gets best score in shortest time will go next. Ranking list will created by regarding total scores and timing

27. There may be some differences in the competition rules between first day and second day.

SCORING

TOTAL SCORES FOR TASKS: 280 Puan

SCORES:

Robot picks up 1.blue cylinder	10 score
Robot picks up 2.blue cylinder	10 score
Robot picks up 3.blue cylinder	10 score
Robot puts 1.blue cylinder into the hole	10 score
Robot puts 2.blue cylinder into the hole	10 score
Robot puts 3.blue cylinder into the hole	10 score
Robot picks up blue cube	20 score
Robot presents blue cube to RF reader	10 score
Robot leaves blue cube to RF box drop area	20 score
Robot picks up 1.yellow cylinder	10 score
Robot picks up 2. yellow cylinder	10 score
Robot picks up 3. yellow cylinder	10 score
Robot puts 1. yellow cylinder into the hole	10 score
Robot puts 2. yellow cylinder into the hole	10 score
Robot puts 3. yellow cylinder into the hole	10 score
Robot picks up yellow cube	30 score
Robot presents yellow cube to RF reader	10 score
Robot leaves yellow cube to RF box drop area	20 score
Robot picks up green cube	40 score
RF reader reads the code of green cube	10 score

PENALTIES

In each case that box are dropped	-5 score
Manually intervention	-30 score
No finish in 10 minutes (for each additional minute)	-20 score

(when stopwatch shows up 12:00:00, judge terminates the competition and declares the time and total marks of team.)

DISQUALIFICATION REASONS

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

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.)

Thematic contest will continue during 2 days. Elimination competition on first day . Quarter final, Semi final and Final cometitions 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 (QUARTER FINAL, SEMI FINAL AND FINAL)

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: 280)
- Total scores.
- Total finish time in case of equality.
- Lighter one in total weight, if their scores are still equal.