

REPUBLIC OF TURKEY

THE MINISTRY OF NATIONAL EDUCATION

**The General Directorate of Technical and Vocational
Education**

**14. INTERNATIONAL MEB ROBOT CONTEST
TOZKOPARAN (ARCHER)
RULES**

2020-ŞANLIURFA

RULES

THEME

There were very strong archers (means *Kemankeş* which is old Turkish word , *keman*=bow and *keş*=a person pulls something) in Ottoman era. Sometimes when they would pull the bows so strongly that bow ends (means "toz" in Turkish) would be broken. Therefore these archers called as "Tozkoparan" which means a person who breaks tips of bow. Theme of this category was inspired by these strong archers called Tozkoparan.

This competition is carried on with robots that are built by using mechanic, software and sensor technologies. Competition frame consist of following a route , shooting a target and finishing the rouse as soon as possible. Robots will get scores according to successful levels and target scores.

1. OBJECTIVE

In this category, archer robots try to follow white lines on black colored platform and detect the colors, shoot to target board and return to finish gate in shortest time without mistake.

In elimination tours, robots try to complete tasks as soon as possible with highest scores. All actions are evaluated with points. Top 64 robots in ranking list get right to go final tours. Number of robots for final tours can be changed depends on the number of robots participating this category.

Final tours will be carried on between two robots as elimination method. Robot which gets better score and complete the game without error in better time beats its opponent. In case of equality, robot that finish tasks in shorter time goes to next tour.

2. ROBOT

Robots will move autonomously and shoot arrows. There is no limit for robot size. But its size (include shooting mechanism) should be designed as pass through start/finish gates. Robots that can't pass the gates will be disqualified.

3. ARROW

Arrow consists of 4 parts (figure 1). These parts are wooden body, arrowhead printed PLA in 3d printer, polythelen foam and velcro tape. Arrow body is made from circular shape wooden with 9mm diameter, 180mm length. Arrowhead is printed PLA material with 28mm diameter, 14.75mm length, conic shape by 3D printer. Polythelen foam (28-20,5 mm diameter, 12mm thickness, conic shape) is stucked to make it flex. Velcro tape (36mm diameter, female side) is stucked on this foam. To make easy sticking , tape is attached to the holes of PLA material on the arrowhead with rope. Weight of arrow is $8 \pm 0,5$ gr and it is given by judge right before starting game and placed to shoot mechanism. Each robot will shoot it autonomously. When arrow sticks to target circles, it gets score. If it is not stick on target board and drops down, score will be determined by video camera.

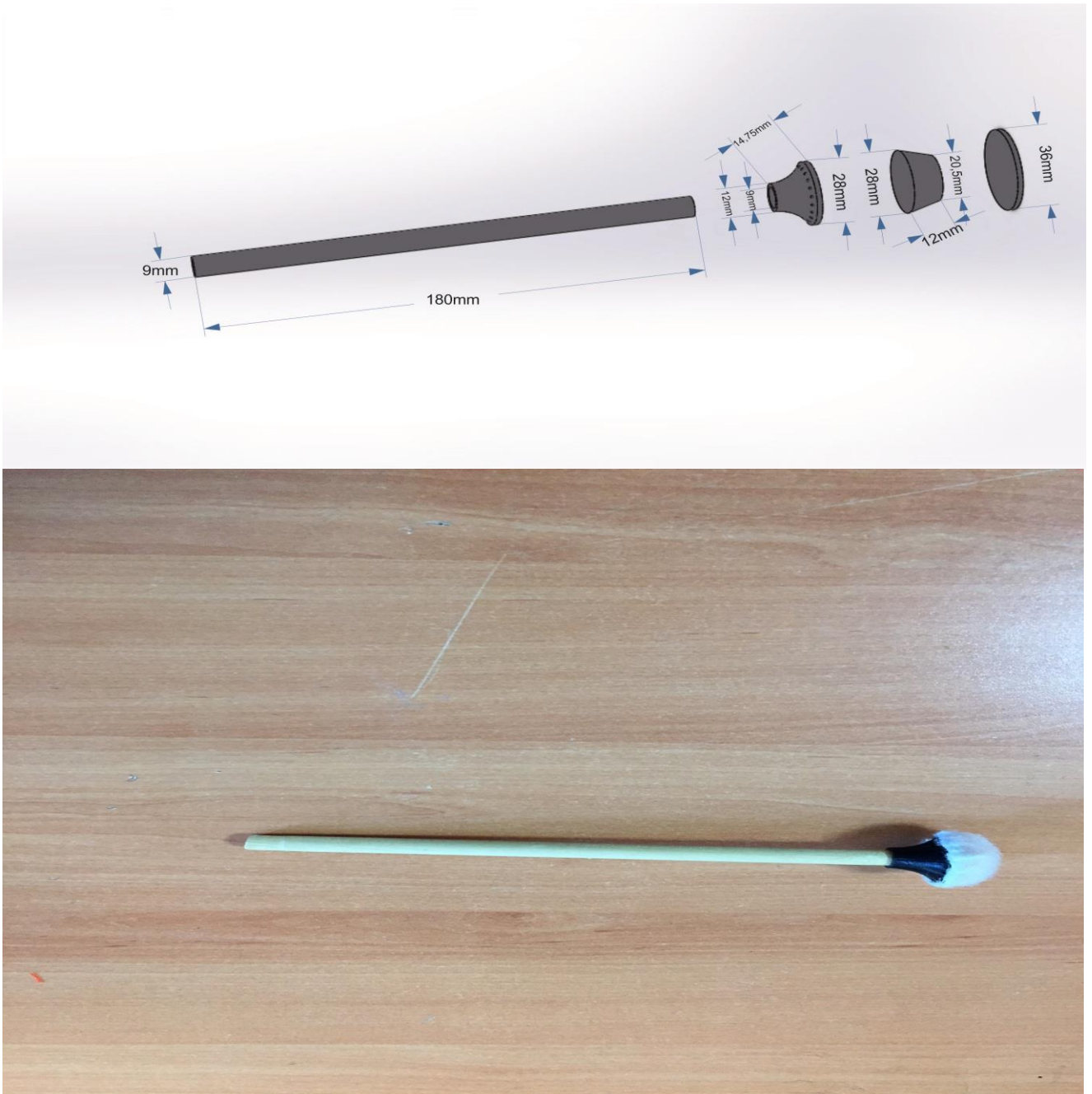


Figure-1 Arrow dimensions and photo

4. INFORMATION ABOUT SHOOTING MECHANISM :

Arrow dimensions are shown at figure-1. Competitors will design a shooting mechanism that able to throw such arrow from a certain distance and height to target board. Competitors can design it as they wish and they will assemble this mechanism on robot (robot needs to pass through start and finish gates.)

5. TARGET BOARD

Target board (700x700mm) will be made by chipboard, its surface will be covered with polythene foam 12mm thickness to provide flexibility. Foam surface will be covered with velcro tapes (male side) . Target board will be placed 400mm high to facilitate shooting process and provide good view for spectators. To do this, it will has legs. Target surface is combination of 5 nested circles (biggest one has 600mm diameter) with different colors drawn on target board to able to scoring. On the target board.

These colors are yellow, red, blue, black and white from center to outer. If arrow hits on the lines separating circles, it is assumed that hits circle which has higher score. Colors and scores are shown below:

Colours and scores :

Score	Colour
100	Yellow
80	Red
60	Blue
40	Black
20	White

Target board dimensions:

Target dimensions are calculated by using diameters of 5 circles which represent scores. Tolerances of each diameter is $\pm 3\text{mm}$.

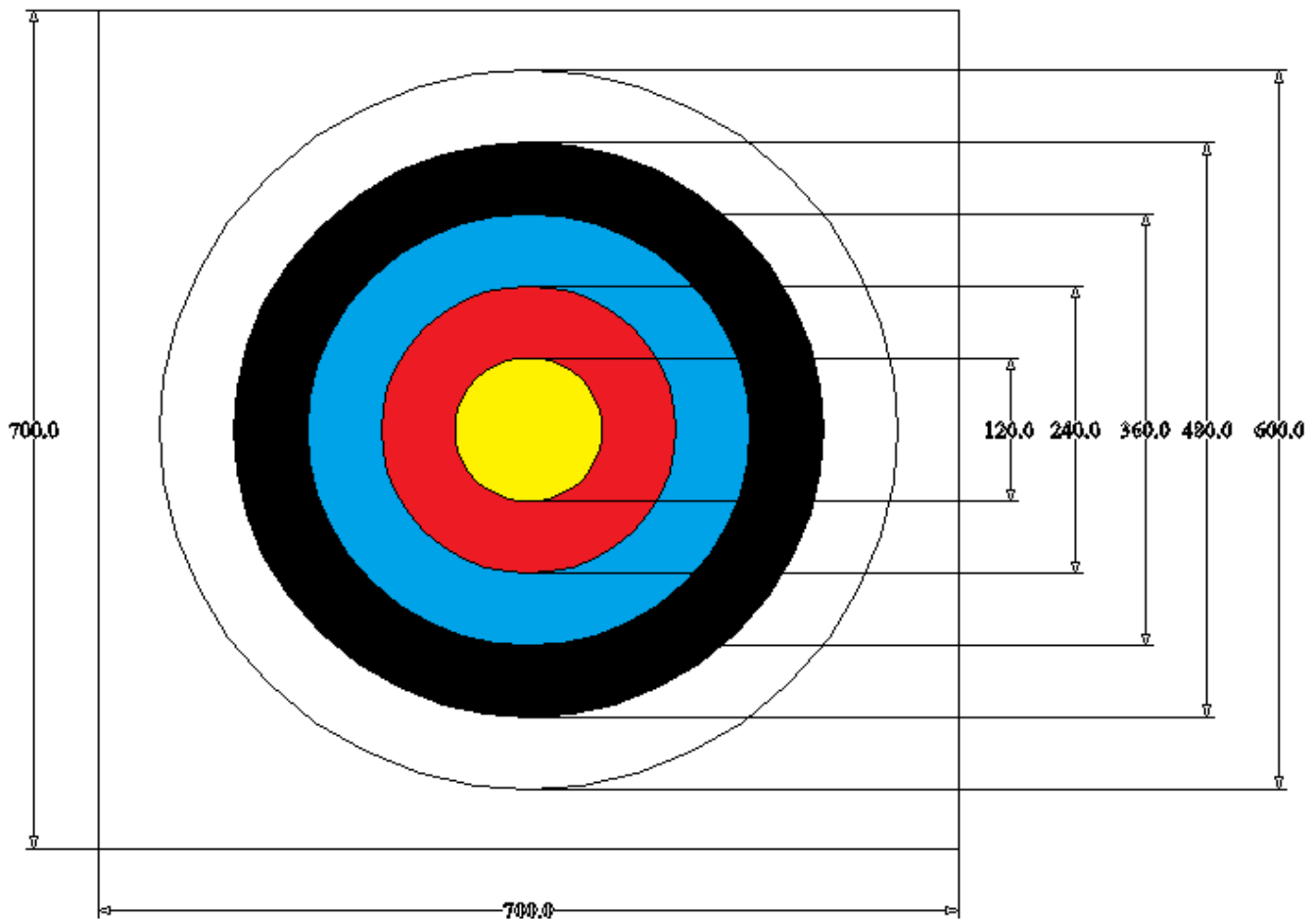


Figure 2- Target board

6.ELIMINATION TRACK

Informations

- Tracks on platform are formed with white lines on black opaque PVC foam.
- a. Platform (2700x2150mm, 5mm thickness), will be made from black opaque PVC foam on chipboard (2700x2700mm). Start and finish areas are made from two pieces (600x400mm) of black opaque PVC foam. Joints between parts that made up lines are covered with black opaque foil . **Figure 3, Figure-4**
- Lines on the platform are made from white opaque PVC foam with 20 ± 2 mm
- Colored zone has three different colour (red,green,blue).Robot follows lines and detects blue zone and lights its blue led. After that robot moves to red zone and detects red zone and lights its red led. Robot shoots arrow to target and return to green zone. It lights its green led when it detects green zone.
- Colored zone is formed as square(800 mm x 800 mm) form. Blue zone has dimensions

600mm x 600 mm , red zone has dimensions 600mm x 200 mm and green zone has dimensions 800mm x 200 mm.

- There will be two elimination routes on the platform as to be symmetrical to each other. So they are called route-A and route-B. Total area include location of target board is 5600*6400 mm dir. **Figure-3, Figure-4**
- There is one start gate with white colour for each route. Gate will be opened by pressing start button and stopwatch runs for counting time. Height from its top is 250mm at opened position of gate and height from its bottom is 15mm at closed position of gate and width of gate is 600 ± 3 mm.
- Stopwatch will start counting when judges pressed start button and the gate opened. It will stop counting when robot arrives finish gate by sensor's detection. Finish sensor which is transceiver is placed between gate towers and 15mm high.
- Target board is located directly opposite of red zone. It is 2500 ± 5 mm far from red zone . Bottom edge of target board is 400 ± 3 high from ground.
- Judges will determined which route that robot will use will by using draw lot method.

Elimination game and scoring

- Each robot races in turn, this order is determined by the draw. So which route that robot will race is determined. (route A or route B)
- After controlling robots on check-desk, judge gives one arrow to both robots. Competitor installs arrow into shoot mechanisms of robots and put robot on start place . Game start with judge's order. After starting, if arrow drops down from mechanism or robot shoots arrow from out of shooting zone, it will be assumed as "failure" and permission for manual intervention will be given. Then, arrow will be put again into mechanism.
- Robots reach blue zone by following white lines , detect blue colour and turn on blue led. After that, they continue until red zone and detect red color and turn on red led, wait inside red zone. After shooting arrow to the target board, robots return to green zone and detect green colour and turn on green led. Later, they go to finish gate by following white lines. When they reach finish gate, game will be over.
- Time will be recorded by stopwatch. Stopwatch starts by pressing start button and opening automated gate by judge and stops when robot arrives finish gate by sensor's detection.
- Each robot has to finish game in 180sec. If robot cannot finish in this time, stopwatch stops counting and robots take place in ranking list according to its score so far.

Scoring:

- Robots have to move right directions. At the beginning , 100 base points is given to robot. Robot will be evaluated for 7 steps from start to finish. Points given for shooting arrow will be added to base point. Best score on target board is 100point so the highest score which can be given is 300 points. Robots which are disqualified gets 0 point.
- Competitor has 5 rights to make intervention. After 5th intervention, if robot can't do the task , it will be disqualified. These robots are also placed on the ranking list and their times are assumed as 180sec.
- If robot makes mistakes during the game , -5 failure point is given for each manual intervention and other failures (such as no shoot, not led light up etc). In any stage, only one failure point for manual intervention is given (no matter how many times(max. 5 times))
- In case of robot doesn't do its 7 tasks in order of given order , make short cut, doesn't move at start point, drops arrow from mechanism, shooting arrow from outside of red

zone , judge gives permission for manual intervention and robot continues from failure location. -5 point is given (if it not given so far) in this moment.

Competition Steps:

1. step- Start gate;

Robot which can start gets 10 points. If it cannot start, competitor makes manual intervention by order of judge. In this case, robot takes -5 failure points.

2. step – white line;

When robot follows line and arrives blue zone, it gets 15 points. If it loses the line and can't find again, it is placed again at leaving location (time counter doesn't stop) . Robot takes -5 failure point because of manual intervention.

3. step –Blue zone;

When robot reaches blue zone, blue led goes "ON". After passing blue zone, robot arrives border of red zone and it takes 15 points. If blue led doesn't light up , 15 failure point is given to robot. If robot cannot reach red zone, competitor makes manual intervention by order of judge. In this case, robot takes -5 failure points.

4. step –Red Zone;

When robot reaches red zone, red led goes "ON" and robot stands still. Robot takes 15 points. If red led doesn't light up , -5 failure point is given to robot. If robot cannot stop inside red zone, competitor makes manual intervention by order of judge. In this case, robot takes -5 failure points.

5. step -shoot;

If robot shoots arrow inside red zone and then reaches to border of green zone, it gets 15 points. If robot cannot shoot arrow, -5 failure point is given to robot. If robot cannot arrive to the border of green zone, competitor makes manual intervention by order of judge. In this case, robot takes -5 failure points.

6. step-Green zone;

When robot reaches green zone, green led goes "ON" and robot arrives on the return line, it takes 15 points. If green led doesn't light up , -5 failure point is given to robot. If robot cannot find the return line, competitor makes manual intervention by order of judge. In this case, robot takes -5 failure points.

7. step –return line and finish;

When robot passes through the finish gate, it takes 15 points. If green led doesn't light up , -5 failure point is given to robot. If it loses the line and can't find again, it is placed again at leaving location (time counter doesn't stop) . Robot takes -5 failure point because of manual intervention.

Shoot scoring;

Each robot will shoot arrow one times autonomously. It is evaluated according to scoring circles on target board. If tip of arrow touches both score circles , it is scored

to be bigger one. If arrow hits spaces out of circles, robot gets 0 point.

Colours and scores :

score	colour
100	yellow
80	red
60	blue
40	black
20	white

- Maximum 64 robots which success to enter the ranking list of the elimination gain rights to race on final track. The number of robots can be changed depend on participation.
- In case of equal scores, the robot which finishes game in shortest time has priority. When equality occurs again, robot which has less penatlies comes first comparing the other. If they are still equal, robot which moves much more then other has priority. Finally, robot that is lighter than other will be selected.

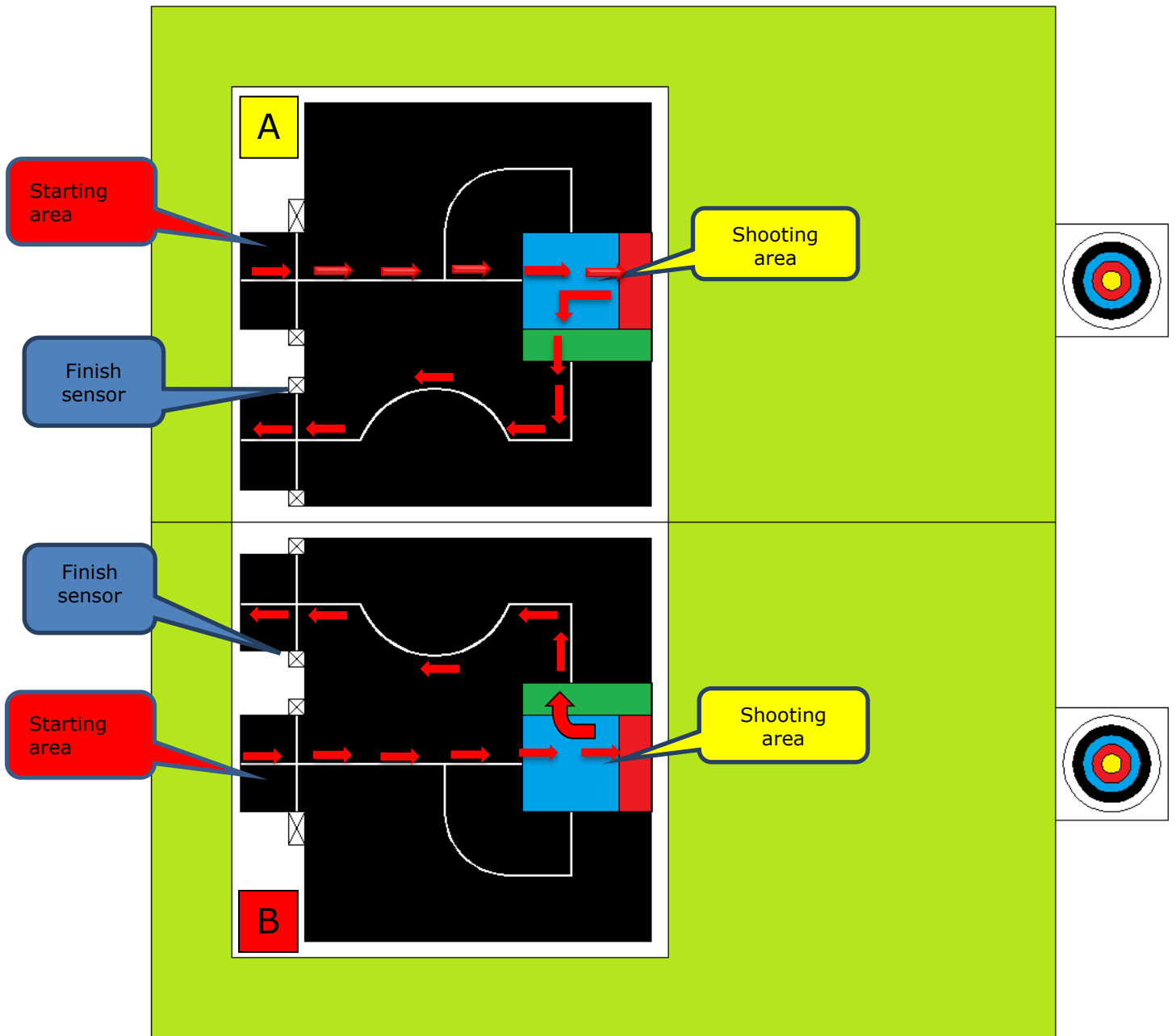


Figure-3: Elimination platform and robot movement routes

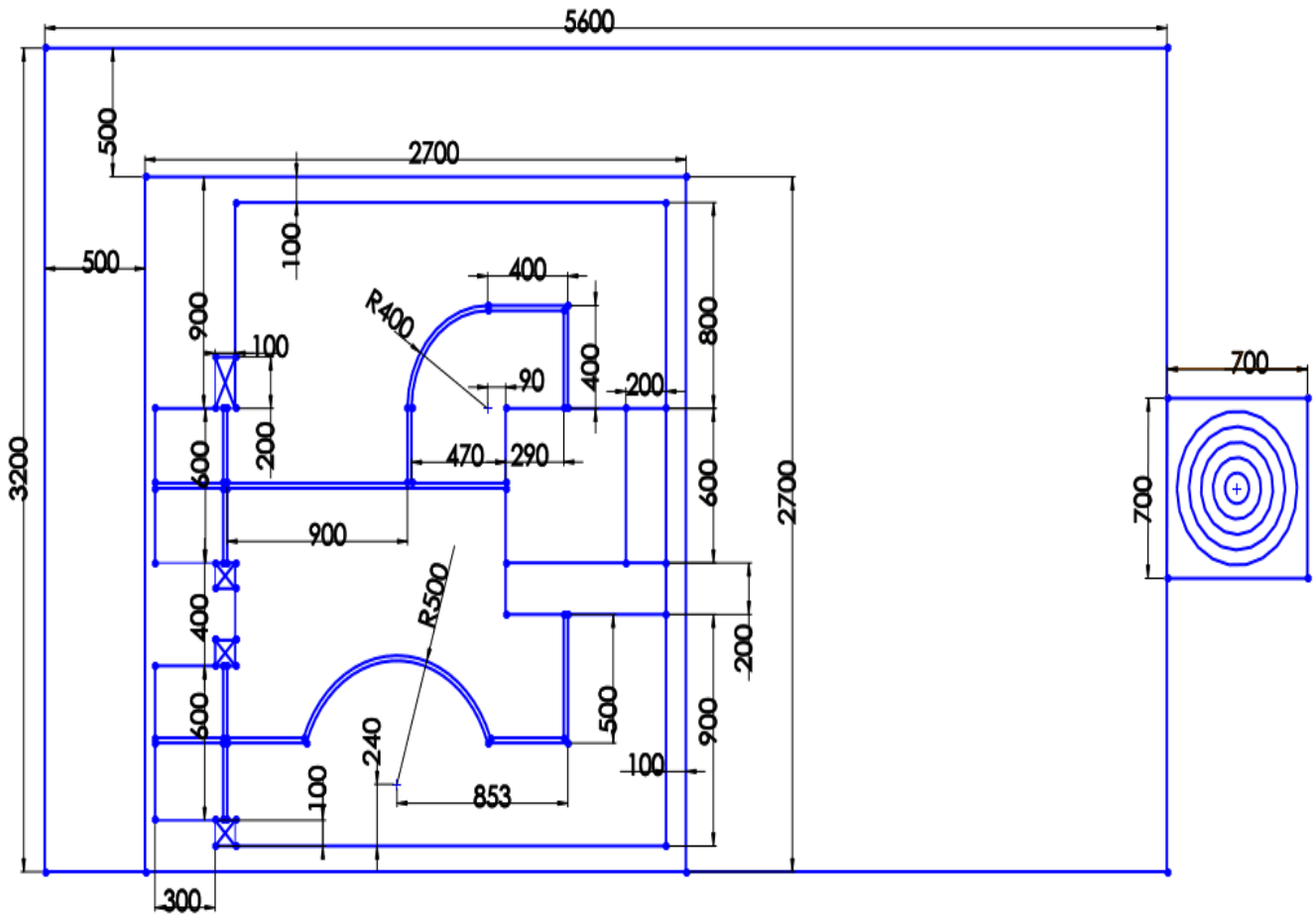


Figure-4: Elimination and Final routes dimensions

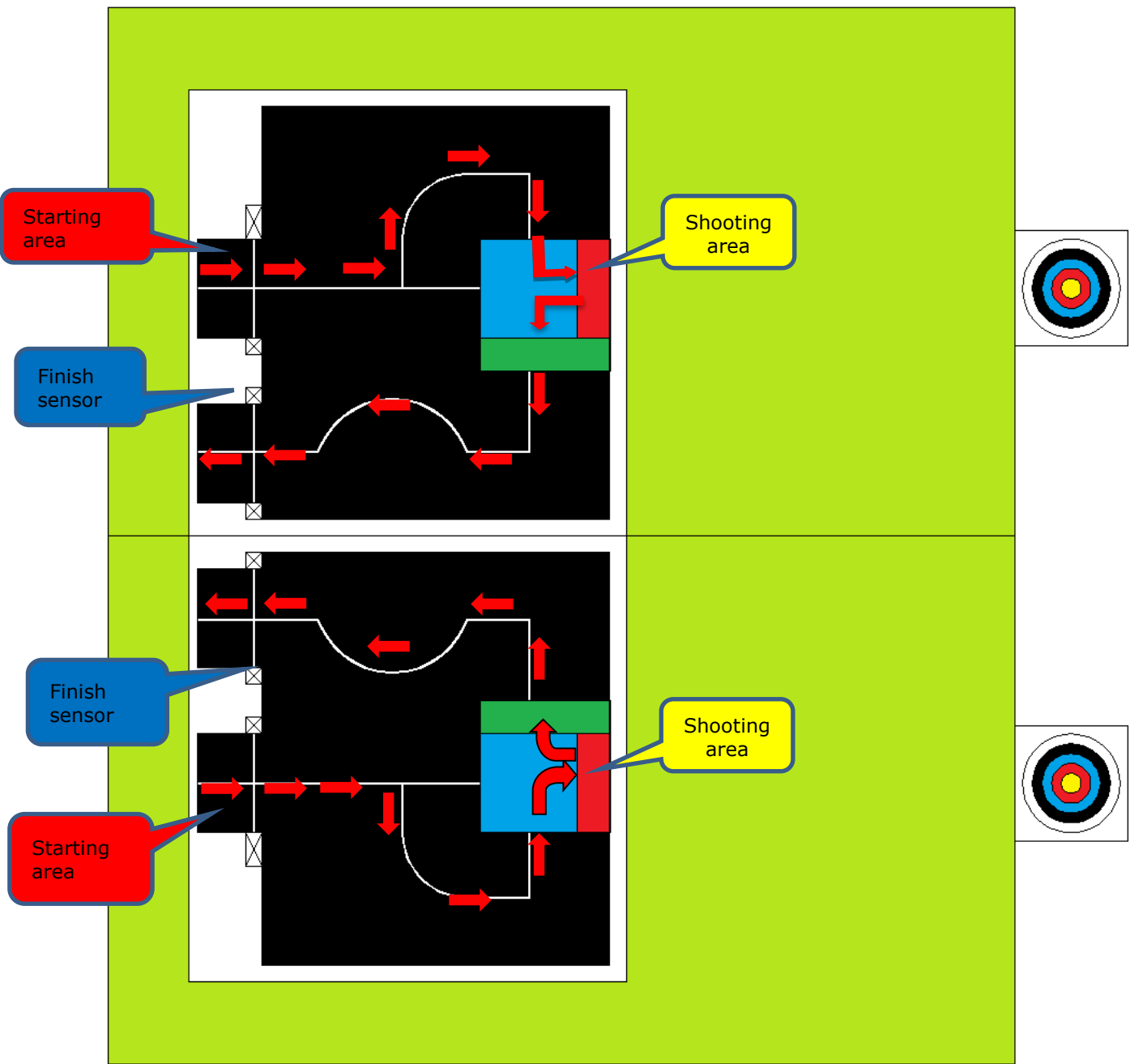


Figure-5: View of final routes and directions

6.FINAL GAME

Information

- Final route will be carried on same platform which has two routes. It has same dimensions. Some part of route will be changed. (figure 5)
- Elimination method will be used in this stage. Therefore two robots will compete at the same time. Race order is determined by drawing lot. It is also determined which route they robot will use.(route A or route B)

Final competition and scoring

- After controlling robots on check-desk, judge gives one arrow to both robots. Competitors install arrows into shoot mechanisms of robots. Game start with judge's order.
- Steps and scoring in final games will be same with elimination games.
- After the end of game, robot which gets highest score moves to next tour.
- If one of robots cannot finish the game, it is not waited until the other robot finishes the game. Opponent robot goes to next tour. If both robots can't finish , the one gets higher score goes to next tour.
- In case of equal scores, the robot which finishes game in shortest time has priority. When equality occurs again,robot which has less penalties comes first comparing the other. If they are still equal, robot which moves much more than other has priority. Finally, robot that is lighter than other will be selected.

7.Other rules

- Any time for break or maintenance will not given to the teams.
- It is not allowed to put any sign or mark permanently on the game platform or to damage it. Robots which damage platform will be disqualified.
- Robots can use any harmless energy source.
- In case of remote communication with robot, it will be disqualified.
- Red opaque foils, blue opaque foils and green opaque foils will be used for colored places.
- This elimination progress will continue like 16,8,4 etc. until remaining 2 robots. These two robots will be race for becoming winner. Their rivals will race again for third place.
- Game board dimensions can be changed slightly if it is necessary.
- Any objection related with lighting , camera or led boards will be refused.
- Competition organisation committee has rights to make all kinds of modifications about the rules of contest in case of necessities.

EVALUATION TABLE

NO	ROBOT NAME	MANUAL INTERVENTION					STARTING (BASE POINT)	1. STEP		2. STEP		3. STEP			4. STEP			5. STEP			TARGET BOARD (0-100 POINT)			6. STEP			7. STEP		STOPWATCH TIME	FAILURE POINTS	TOTAL
								START	GOING LINE	BLUE	RED	SHOOT	GREEN	RETURN	ZONE	ZONE	ZONE	ZONE	ZONE	Ç. BİTİŞ											
								10 POINT	15 POINT	15 POINT	15 POINT	15 POINT	15 POINT	15 POINT	15 POINT	15 POINT	15 POINT	15 POINT	15 POINT	15 POINT	15 POINT	15 POINT									
Manual intervention	point	Manual intervention	point	Manual intervention	No led light up	point	Manual intervention	No led light up	point	Manual intervention	No shoot	point	point	Manual intervention	No led light up	point	Manual intervention	point													
						100	-5	10	-5	15	-5	-5	15	-5	-5	15	-5	-5	15	point	-5	-5	15	-5	15						