KnightBots:
Medieval Robotics Championship

Rules and Game Description

Hear ye! Hear ye!

Let it be known that on Friday, the eleventh of April in the year two thousand and twenty five the IEEE RAS/IMS/CSS Joint Lebanese Chapter, the Lebanese IFAC Chapter, the IEEE YP Lebanon, WIE Lebanon, the AUST-IEEE Student Branch and the Faculty of Engineering and Computer Science at the American University of Science & Technology with great pride and joy invite all fair ladies and noble knights to shine their armor and saddle up their robots to compete in **KnightBots: Medieval Robotic Championship***.*

Date and Location

Festivities start at 9 AM till 5 PM on Friday April 11, 2025, at AUST.

Eligibility

Teams of two to four knights or dames can be part of the challenge. All knights and dames should be enrolled as students in a university in Lebanon during the Spring 2024-2025 semester.

Awards

Fortune (cash and prizes) and fame shall be granted to winning knights and dames in target shooting, racing, tug of war, jousting, the battle of the castles, and one overall champion.

Registration

To register before April 1, 2025, scan the QR code.

General Description

The KnightBots: Medieval Robots Championship is the first of a kind robotics competition where robots compete in five different medieval-inspired games to win the title of the champion along with fame and fortune. After going through the medieval inspection, the robot shall participate in the first game of target shooting. The second game is a racing game. The third game is a tug of war game. The fourth game is a jousting game. The fifth game is the battle of the castles where guilds of three to five robots each, battle each other on the field. The tournament champion shall be announced after tallying all the gold coins assembled from the six games and the inspection.

General Rules

I.   Each team should be composed of two to four students currently registered at a university in Lebanon.

II. Registration using the online form (QR code above) is a must!

III. Each team must design and chose a coat of arm that is embedded on an escutcheon (i.e. heraldic shield). The shield **must** be printed on T-shirts all team members shall wear on the day of the tournament, as well as on the flag carried by the robot.

IV. One robot is allowed per team. Nonetheless, modules can be connected/disconnected to/from the robot when playing the different games as long as the size restrictions are met. Repairs are allowed in between the games/rounds.

V.   The robot with all of its extensions (if available) except for the jousting lance, should fit into a 30 cm x 30 cm x 30 cm cube. Any violation of the size rules will disqualify the team from the tournament!

VI. The platform used as the controller of the robot is open. Knights and dames can choose any controller for their robot (Arduino, Pi, etc.).

VII. The robot must carry a flag with the heraldic shield of the team printed on it.

VIII.   A space of 3 cm x 3 cm shall be left empty on the robot. A stick to hold a balloon will be installed in the space for games 4 and 5. The location on the robot is described hereinafter.

IX.   The robot must have a hook in its front to connect it to the cable in game 3 (tug of War).

X.   The robot must be wirelessly controlled using Bluetooth, Wi-Fi, RF, or other type of connectivity to a controller joystick, mobile, etc. Autonomous functions in the robot are acceptable provided that they can be disabled at any time.

XI.   Your robot must use some kind of propelling mechanism that can shoot arrows (wooden sticks) at targets. This shooting mechanism should be installed in the front of the robot and must not obstruct the balloon. For safety purposes, the shooting angle must not be more than 45 degrees.

XII.   Your robot cannot be interacted with by hand unless in base areas or explicitly given permission by the judges.

XIII.   Your robot must not pose as a safety hazard or damage the playing field or other robots. Intentional damage will lead to disqualification of the team.

XIV.   Final decisions regarding battles and winners shall be made by the judges.

XV.   All dimensions in the fields' drawings have a tolerance of 5%.

XVI.   Team members operating the robot must wear protective goggles during the matches.

Scoring

Teams will gather gold coins, representing the team's score, for the following games:

I.   Medieval Inspection and pitch (30 gold coins)
II.   Game 1: Target Shooting (20 gold coins + bonus)
III.   Game 2: Racing (20 gold coins)
IV.   Game 3: Tug of War (20 gold coins + bonus)
V.   Game 4: Jousting (20 gold coins + bonus)
VI.   Game 5: Battle of the Castles (40 gold coins + bonus)

The team with the highest score is crowned as the champion of the tournament and gains all the fortune and fame!

Details about the scoring in each game are explained hereinafter.

Robot Design and Specifications

You are to design a robot that should fit in a 30 cm x 30 cm x 30 cm cube. The robot should be able to move around and shoot wooden sticks as arrows. It should also be able to carry a lance for the jousting game. The robot should be driven using a wireless remote control.

You are to design one robot that should play the five different games with minor modifications (replacing the shooting mechanism with a lance, etc.). Therefore designing and building your robot taking into consideration the required specifications and the strategies in the different games may be the difference between a dead robot and a winning one!

First things first! The robot should be composed of several systems.

I. The drive system that is able to move the robot in the field.
II. The shooting mechanism that is able to shoot arrows (wooden sticks) at targets, towers, and other robots. This shooting mechanism should be altered to a jousting mechanism for game 4. The jousting mechanism should be able to direct a 60 cm long lance to hit a balloon in the opposing robot.
III. The wireless communication system to remotely control all the functions of the robot.
IV. The power supply to power the robot.
V. The flag attached to the robot with the coat of arms of the team printed on a heraldic shield.

Physical specifications of the robot should accommodate the above systems. In addition, no mechanism can obstruct the balloon. You should leave an empty 3 cm x 3 cm area in your robot to accommodate for the balloon.

The following figures show a typical robot views along with some 3D views. Dimensions are to be respected!

Side View   Front View   Top View
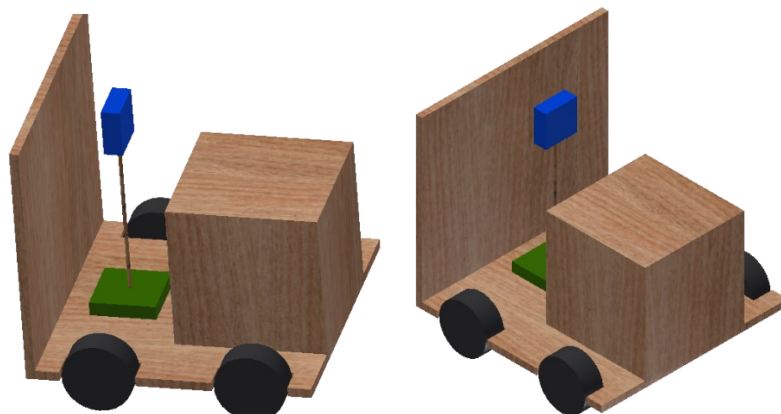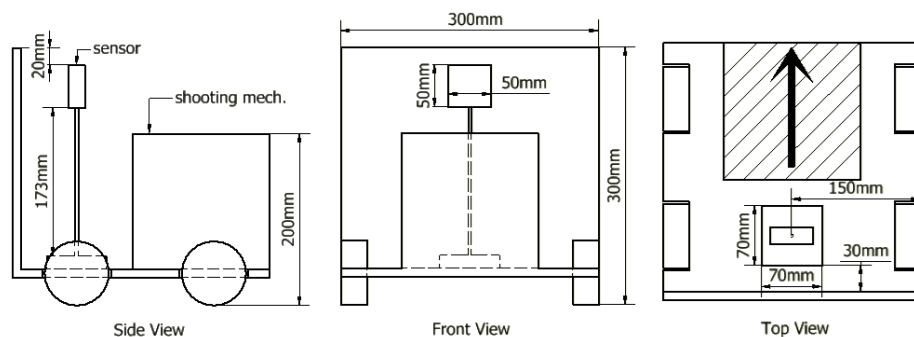
The drive system is responsible for moving your robot on the field. You can use any system you think is good for achieving this. Two, three, four wheels, or chains, with differential, Ackerman, or any other systems are allowed. The ground is either concrete, ceramic tiles, or wood.

The wireless communication system is any system (Bluetooth, Wi-Fi, RF, etc.) that is used to connect a remote controller (PS4, Xbox, Mobile Phone, etc.) to the robot. It should be used to move the robot and control the shooting/jousting mechanism. A driver should use it to control the robot during the different games.

The shooting mechanism is used in games 1 and 5. It should shoot arrows (wooden cylindrical sticks of length 10 cm and diameter of 4 to 5 mm). You should be able to aim it by either moving the whole robot or moving the mechanism as a turret (using servo motors). The following links are to videos explaining some possible shooting mechanisms:

i) https://youtu.be/w9D4GBXbMJU
ii) https://youtu.be/q3Hczhdc6yU
iii) https://youtu.be/3MsrqL70EJ4
iv) https://youtu.be/kYYT4EWn1WE
v) https://www.youtube.com/watch?v=l7O1dVTMHyA
vi) https://www.youtube.com/watch?v=iHhx3y92gK4
vii) https://www.youtube.com/watch?v=T4kRIwy4Fns

Here are some pictures of these mechanisms. Always take all safety precautions when building and testing these mechanisms!
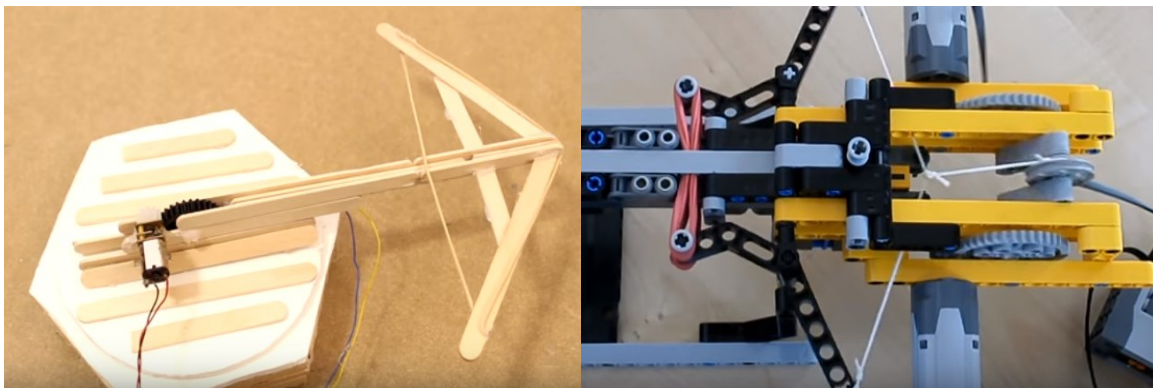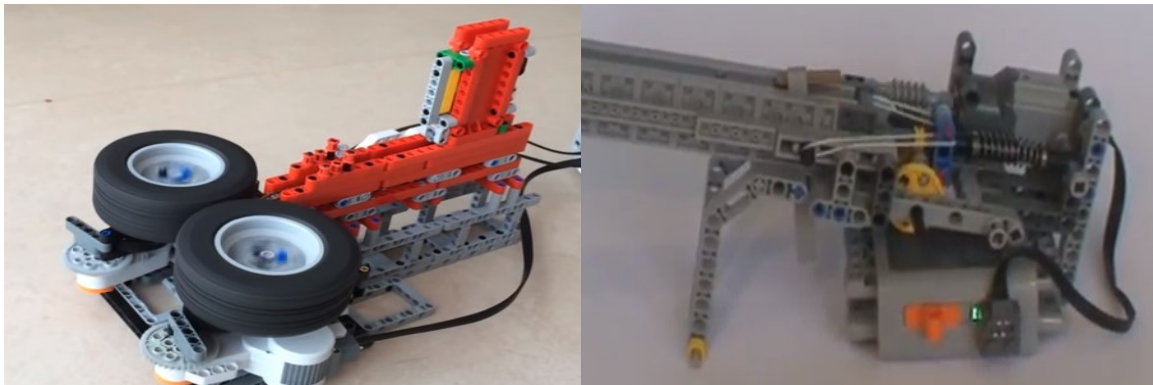
Note that the shooting mechanism cannot shoot arrows at angles higher than 45 degrees.

The robot should include an automatic reloading mechanism for the arrows in games 1 and 5. It should be able to reload up to 12 arrows automatically.

The jousting mechanism should control the azimuth (and/or elevation) angle(s) of the lance (60 cm long) which should be fixed on the robot in game 4. You should build the whole system including the lance! Make sure the tip of the lance is not wider than 1 cm in diameter. The lance should be able to pop a balloon (the use of a needle is suggested).

The power supply should be a battery, preferable rechargeable, mounted on the robot.

The controller of the robot is open. Any microcontroller or microprocessor can be used.

Each team should design a coat of arms and print it on T-shirts they should wear during the tournament. The coat of arms should also be printed on a heraldic shield and stuck on the flag on the robot.

Medieval Inspection and Pitch

Before your robot can take part of the tournament and battle for the great prize, it needs to pass through the Medieval Inspection and Pitch which is considered Game 0. The team should prepare a pitch and an oral presentation, not longer than 5 minutes followed by Q&A, to be delivered in front of the inspection jury. The team should explain their strategy and decision-making process in their design.

*The maximum score is **30 gold coins**, and is divided into as follows:*

- *The robot exists = 1 gold coin*
- *The robot can move = 1 gold coin*
- *The robot can shoot = 1 gold coin*
- *Automatic loading/reloading mechanism = 3 gold coins*
- *Coat of arms is printed on T-shirts = 2 gold coins*
- *Coat of arms is printed on the robot's flag = 2 gold coins*
- *Technical Assessment (How well does the robot perform? How professional and technical the work is?) = 5 gold coins maximum*
- *Cost effectiveness = 5 gold coins maximum*
- *Design Process = 5 gold coins maximum*
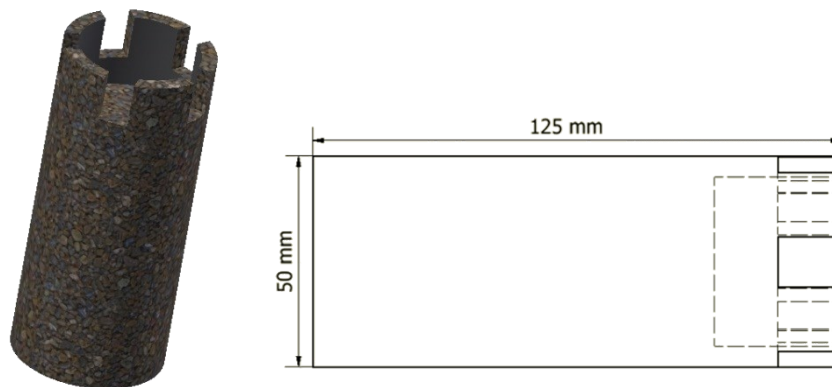- *The robot design is not fragile and well executed with creativity and originality = 5 gold coins*
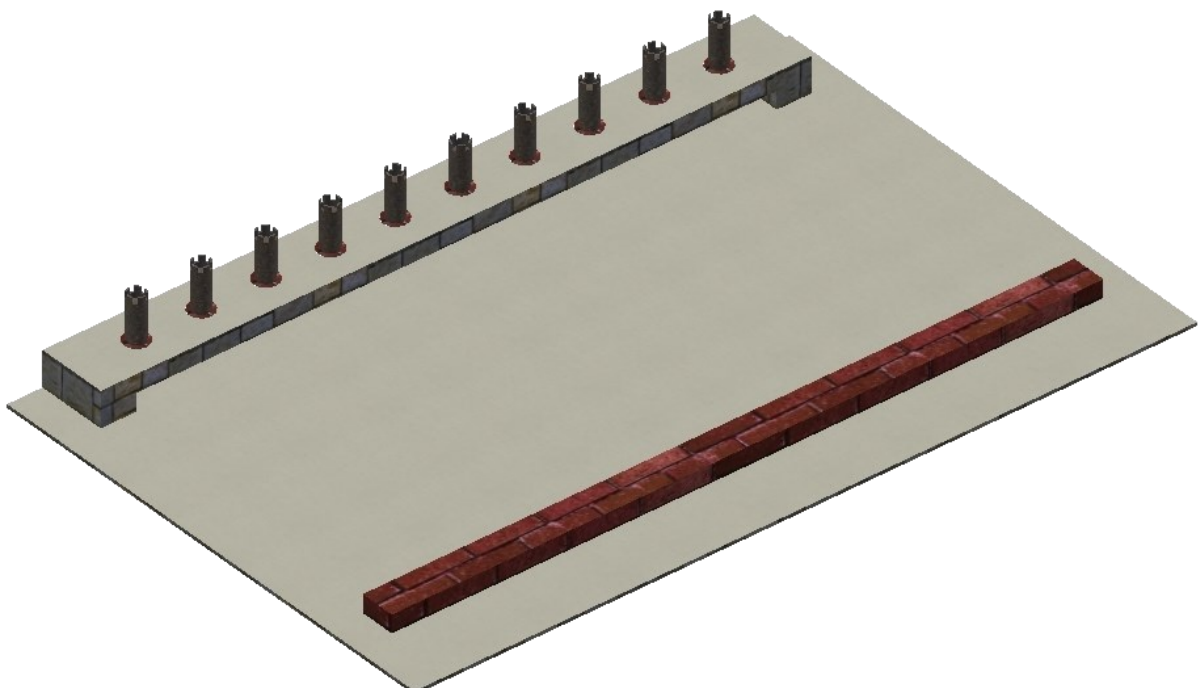
Game 1: Target Shooting

The first game in the tournament is the Target Shooting game. In this game, your robot must shoot 10 tower targets in 2 minutes.

The targets are cylindrical towers 12.5 cm high with a diameter of 5 cm as shown below.

Target Tower

There are 10 targets that are aligned about 18 to 20 cm apart, 50 cm away from the robot as shown in the figure below.

Target Shooting Field 3D View

Scoring

Every target that is knocked down is worth 2 gold coins. In case all targets are knocked down before the 2 minutes are through, the team gets 1 gold coin for each remaining 10 seconds (fractions are neglected).

*The total score is **20 gold coins plus the bonus**.*

At the end of this game, the team with the highest score will be declared the winner of the Target Shooting game.

Game 2: Racing

The second game in the Tournament is a Racing game. In this game each robot should race down a 5-meter straight track against the clock. Each robot is allowed to do 2 runs, and the fastest run is only counted. The fastest robot will be named the racing champion.

The racing field is 5 m long and 40 cm wide.

Scoring

All robots who finish the race will get 5 gold coins. The fastest robot gets 20 gold coins. The second fastest gets 15 gold coins, and the third fastest gets 10 gold coins.

The total score is **20 gold coins**.

Game 3: Tug of War

The third game in the Tournament is a Tug of War game. In this game two robots face each other in a duel. A 1-meter-long rope will be connected to both robots. The robots will pull the rope against each other. The robot that passes the middle-marked line loses. Each round has a time limit of 3 minutes. In case none of the robots was able to pull the other, both robots will lose the round. Each duel is won by winning 2 out of 3 rounds.

The tug of war field is 1 m long.

Scoring

Teams will be divided in groups of two and each two robots will face each other in the tug of war field. Each duel is won by winning 2 out of 3 rounds. Every time a robot participates in a round, the robot scores 5 gold coins. If the robot wins the duel, it scores a total of 20 points. This means that a losing robot scores either 10 points (if it loses 2 passes) or 15 points (if it wins one pass and loses 2 passes), while the winner always scores 20 points.

The scores of the first elimination round of duels will be used in the final score, along with bonus gold coins accumulated in later tug of war stages.

Elimination stages will be carried out until 2 or 3 finalists in the tug of war game are determined. During the elimination stages, a team winning a duel scores an extra 1 gold coin per win. The winner of the tug of war game scores an extra 5 gold coins, the first runner-up scores an extra 3 gold coins, and the second runner-up (if available) scores an extra 1 gold coin.

The total score is **20 gold coins plus the bonus**.

Game 4: Jousting

The fourth game in the Tournament is a Jousting game. In this game two robots face each other in a duel. Each robot should be equipped with a 60 cm lance and must hit the other robot's balloon to pop it. The two robots face each other and then move in a straight path towards the other robot. Each duel is won by winning 2 out of 3 passes. After each pass, the judges will decide the winner of the pass (the robot which pops the balloon of the other robot) or if there is a tie. In case all passes are ties, the judges will decide the winner based on the best performance (aggressively, trying to hit the other robot and not avoiding the hit, etc.).

The jousting field is 3 m long where two separate and parallel paths 40 cm wide host the two robots. The field is described in the figures below.
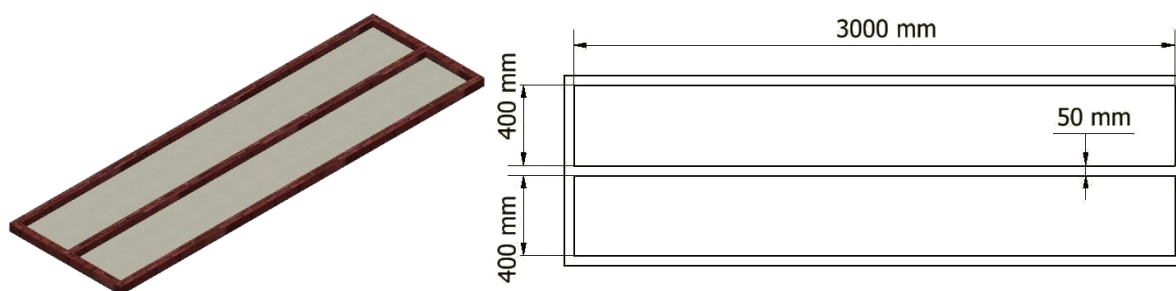
Jousting Field 3D and Top Views
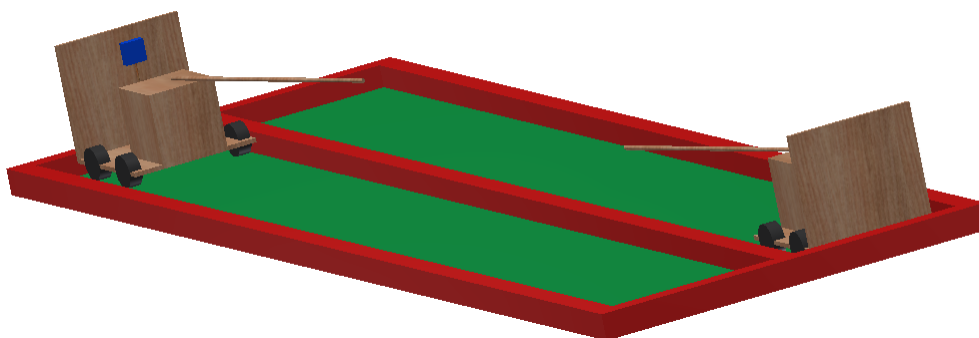
Two Robots Jousting

Scoring

Teams will be divided in groups of two and each two robots will face each other in the jousting field. Each duel is won by winning 2 out of 3 passes. Every time a robot participates in a pass, the robot scores 5 gold coins. If the robot wins the duel, it scores a total of 20 points. This means

that a losing robot scores either 10 points (if it loses 2 passes) or 15 points (if it wins one pass and loses 2 passes), while the winner always scores 20 points.

The scores of the first elimination round of duels will be used in the final score, along with bonus gold coins accumulated in later jousting stages.

Elimination stages will be carried out until 2 or 3 finalists in the jousting game are determined. During the elimination stages, a team winning a duel scores an extra 1 gold coin per win. The winner of the jousting game scores an extra 5 gold coins, the first runner-up scores an extra 3 gold coins, and the second runner-up (if available) scores an extra 1 gold coin.

*The total score is **20 gold coins plus the bonus**.*

Game 5: The Battle of the Castles

The fifth game is the Battle of the Castles. This is not an individual game, rather than a guilds game. Two guilds, each composed of three to five robots, face each other on the field. The teams composing each guild will be picked randomly and made public on the day of the tournament. The goal of each guild is to knock down the maximum number of towers and the castle of the other guild by shooting arrows, while protecting their own, in a battle that lasts 5 minutes. Robots can also knock down other robots or be knocked down during the battle.

The field is a 6 m x 4 m area which is divided into two symmetrical halves. Each half contains one big castle, 2 big heavy towers, 3 big light towers, 2 small heavy towers, and 3 small light towers placed as shown in the figures below. Each guild has a 50 cm x 4 m base area where they can handle their robots. And there is a 1 m x 4 m area in the middle of the field that is empty (considered a neutral territory).
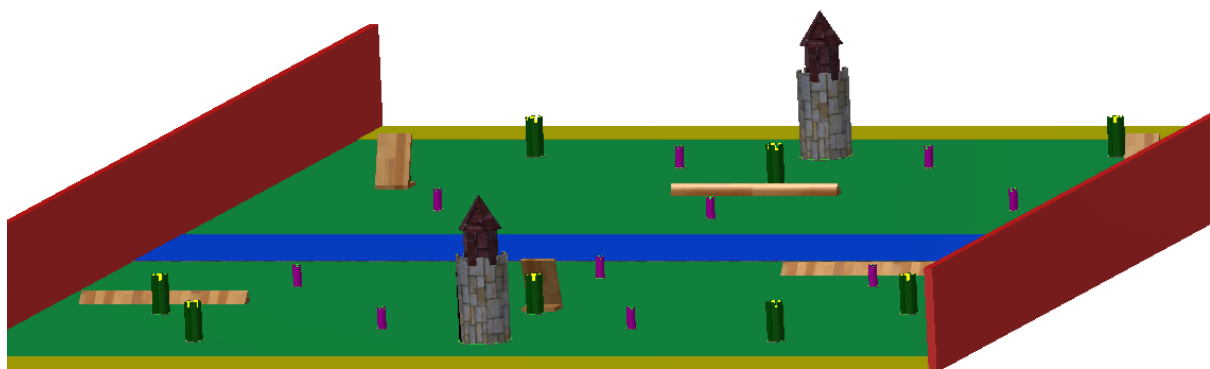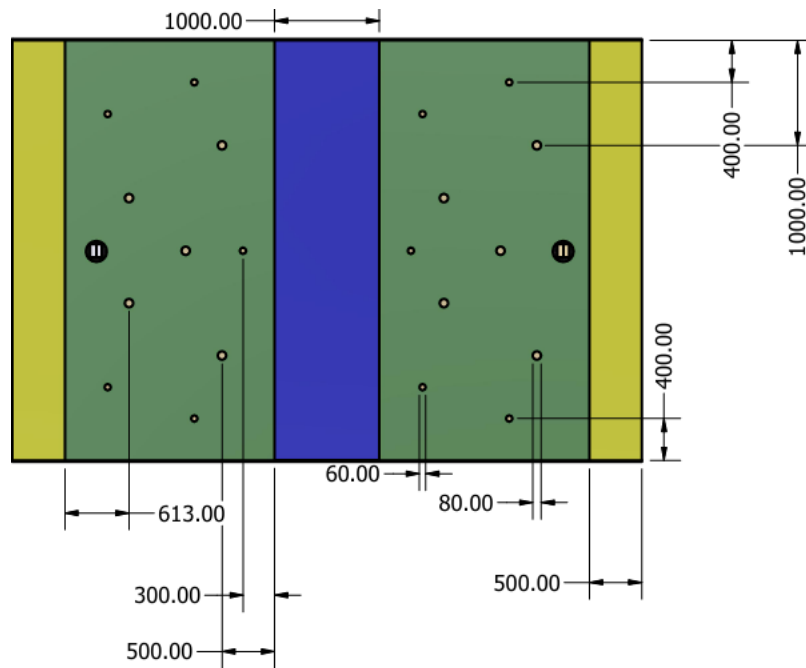

3D View of the Battle Field
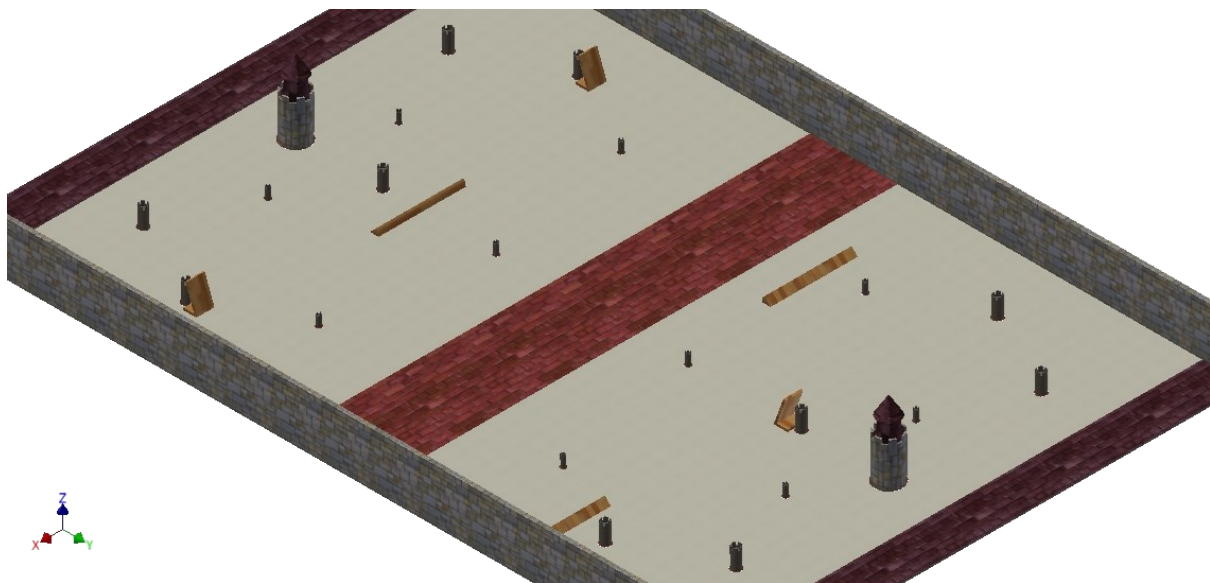
*Another 3D View of the Battle Field*

The castle is cylinder 85 cm high with a diameter of 30 cm. The 5 Big towers (2 heavy and 3 small) are 22.5 cm high with a diameter of 10 cm. And the 5 small towers (2 heavy and 3 small) are 12.5 cm high with a diameter of 5 cm. The 3D pictures and crossectional views are shown below.

On the other hand, there are two obstacles available for each guild. The first is a one-meter ramp barrier to prevent robots from passing. And
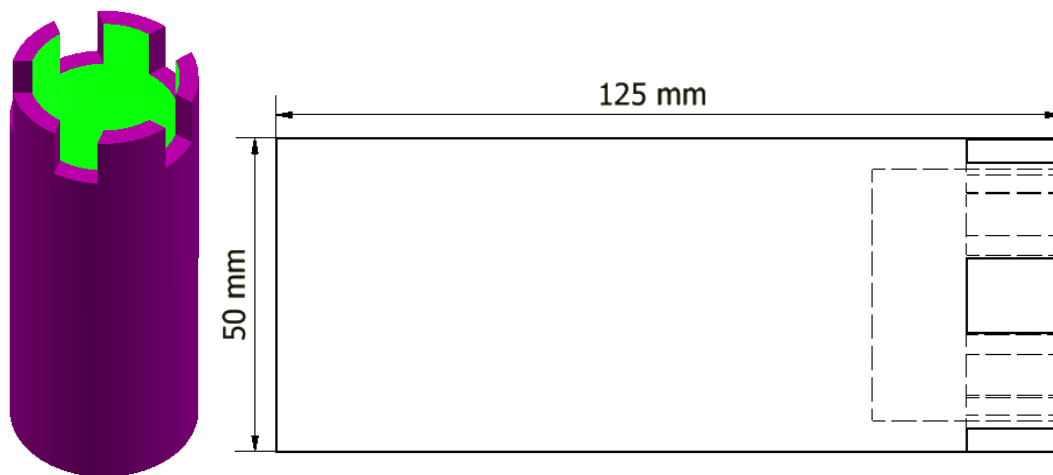
the second is a shield 30.7 cm heigh to protect a tower. Both obstacles can be placed on the field in a guild's territory before the battle starts. They are shown in the figures below.
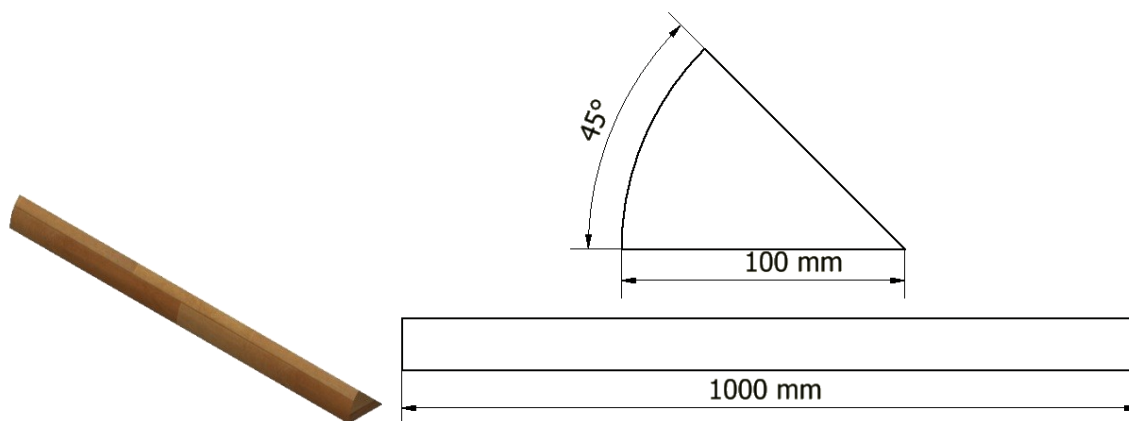

850 mm

300 mm
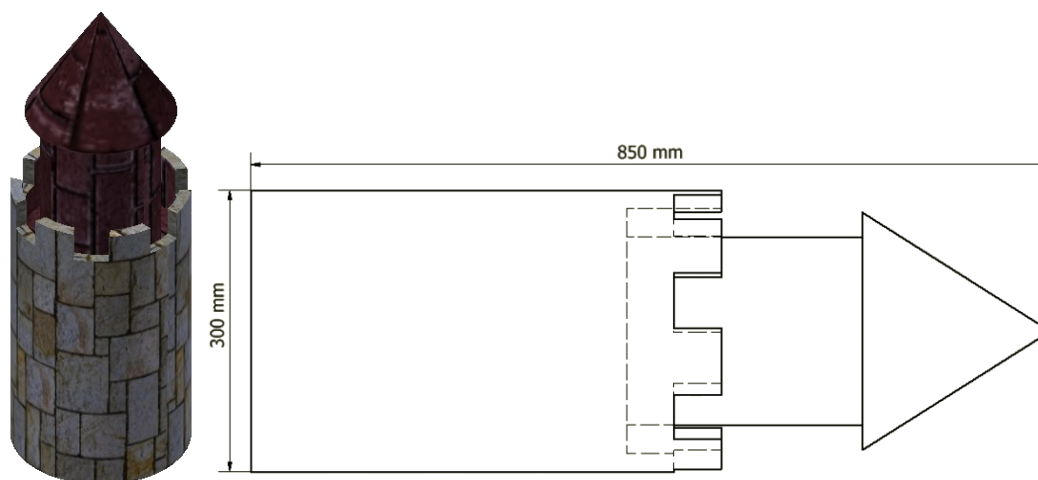
Castle 3D and Cross-sectional Views

225 mm

100 mm
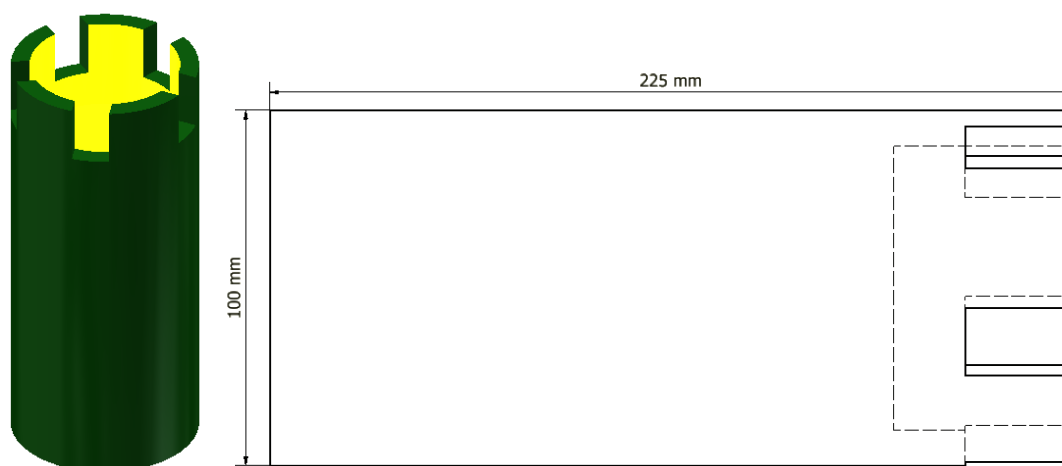
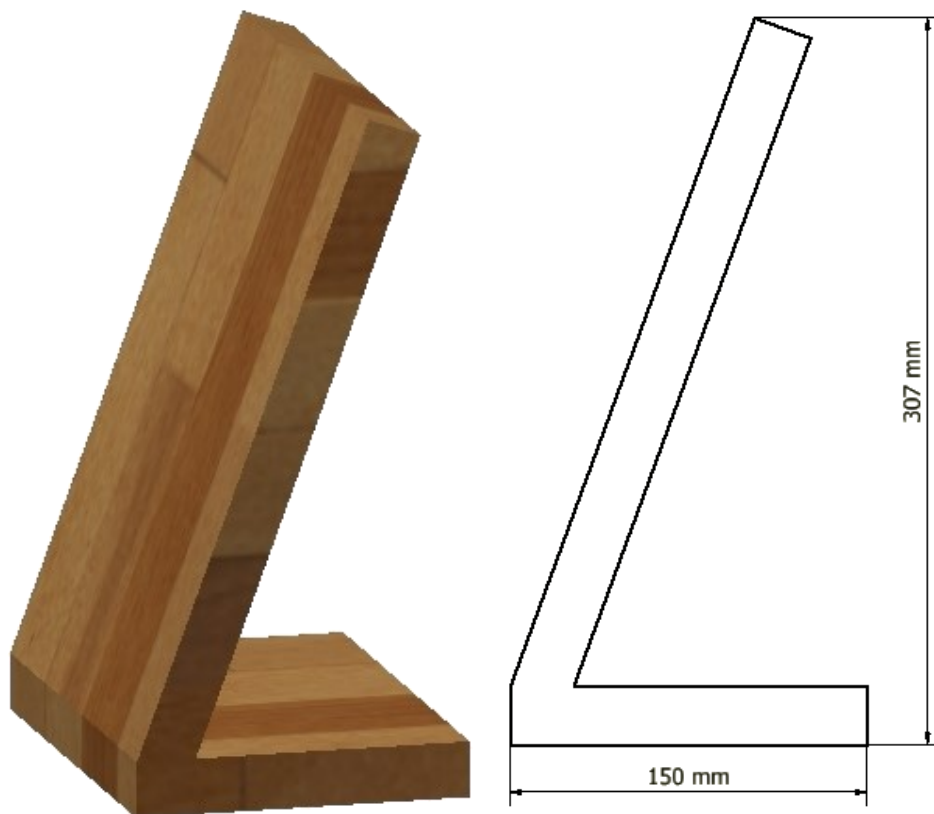*Big Tower 3D and Cross-sectional Views*

125 mm

50 mm

Small Tower 3D and Cross-sectional Views

45°

100 mm

1000 mm

Ramp Obstacle 3D and Cross-sectional Views

Shield Obstacle 3D and Cross-sectional Views

Before the beginning of each battle, each guild has a total of 150 arrows to use. These arrows can be divided among the robots, and reloading of the robots can only be done in the base area of the guild.

There will be protection around the field, and the team members are all required to wear protective goggles during the battles.

Scoring

In this game, scoring will be for the guild, i.e., the robots in the same guild will get the same score. So it is suggested that they cooperate during the battle and agree on a strategy where each robot uses its own strengths for the benefits of the guild.

When the battle begins, robots are to knock down towers and the castle by shooting them or knocking them down by driving through them. In case, a robot accidentally knocks down its own tower, the gold coins for that tower will go to the other guild.

At the end of the battle, judges will score the gold coins for each guild according to the following:

- ✹ *The Castle is shot down = 6 gold coins*
- ✹ *A Big Heavy Tower is shot down = 3 gold coins*
- ✹ *A Big Light Tower is shot down = 2 gold coins*
- ✹ *A Small Heavy Tower is shot down = 2 gold coins*
- ✹ *A Small Light Tower is shot down = 1 gold coins*
- ✹ *An enemy robot is shot down =5 gold coins*
- ✹ *Finish the battle on the enemy's territory without being killed = 3 gold coins*
- ✹ *Finish the battle 1 m away from the enemy's castle without being killed = 5 gold coins*

In total, for shooting down the castle, all the towers, and the enemy robots, the maximum number of **gold coins is 40**. Add to it bonuses for finishing on enemy territory, it can add up to **55 gold coins**.

The winning guild will qualify for the next round and have a **5 gold coins** per win as a winning bonus. This will be repeated until only one guild wins the Battle of the Castles game. All three to five teams in the winning guild are considered the winners of the Battle of the Castles game.

The total score is **40 gold coins plus the bonus**.

Organizers

- *The IEEE RAS/IMS/CSS Joint Chapter Lebanon*
- *The Lebanon IFAC Chapter*
- *The IEEE YP Lebanon*
- *The WIE Lebanon*
- *The AUST-IEEE Student Branch*
- *The Faculty of Engineering and Computer Science at the American University of Science & Technology*
  - *Michel Owayjan*
  - *Mohammad Ballouz*
  - *Mohammad Dika*
  - *Maroun Attieh*
  - *Viviane Tohme*
  - *Joe Farah*
  - *Ali Hasan*
  - *Charlie Jarjoura*
  - *Cirine Radwan*
  - *Dana Attieh*
  - *James Youna*
  - *Joe Abou Rjeily*
  - *Maria Challita*
  - *Lara Farhat*
  - *Sarah Hasan*
  - *Mounir Rizcallah*
  - *Majd Hajj Ali Sleiman*

Main Sponsor

- *Dynamics Solutions*

Change Log

- *Updated (April 6, 2025)*