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To all Principals

- National Polytechnics
  - Kenya Technical Trainers College
  - Technical and Vocational Colleges
  - Institute of Technologies
  - Technical Training Institutes
- All Universities (Kenya)  
Kyambogo University (Uganda)

### ROBOT CONTEST RULES 2020

The robot contest which is an annual event and has been successfully held for the last nine (9) years is one of the means by which technology and innovation is promoted within TVET institutions and universities. It is therefore, crucial that trainees and university students are fully prepared from the onset of the robot construction so that they can translate the knowledge acquired in class into practical application.

It is for this reason that the robot contest rules have been prepared to enable adequate preparations and full involvement of trainees, university students and lecturers. The competition will involve regional and national contests whose dates will be communicated later.

Attached is a copy of the robot contest rules for your further action.

**MR. TOM MULATI**  
**Ag. DIRECTOR. DTE**

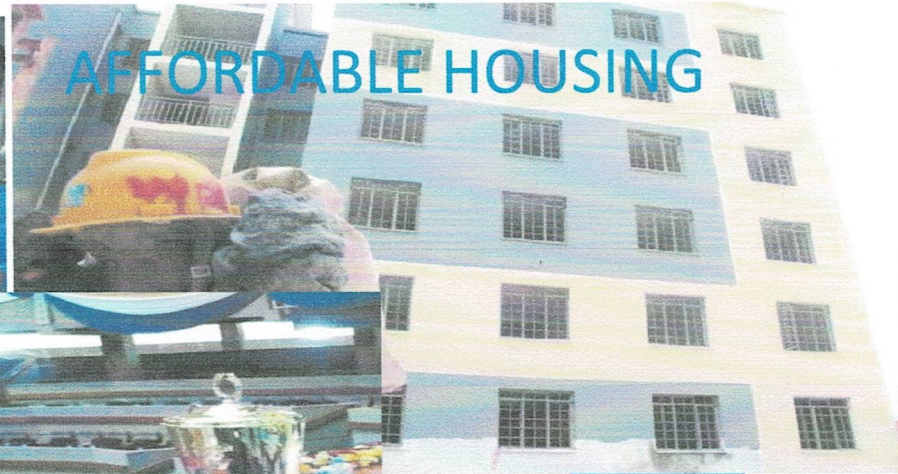


# ROBOKEN 2020 RULES

MANUFACTURING



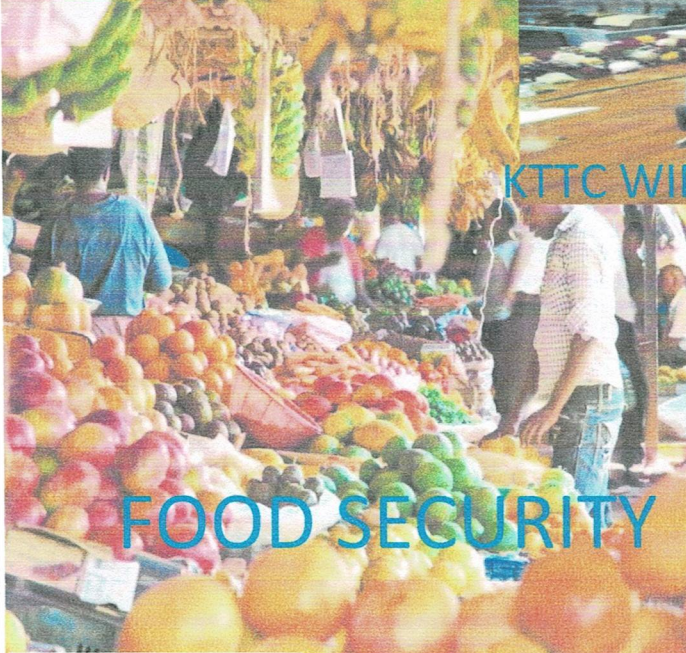
AFFORDABLE HOUSING



KTTC WINNING ROBOT 2016



FOOD SECURITY



UNIVERSAL HEALTHCARE



Ministry of Higher Education, Science and Technology



KATTI  
The Kenya Association of Technical Colleges Institutes



KENYA NATIONAL QUALIFICATIONS AUTHORITY



TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION COUNCIL

for competence certification



## 1. PREAMBLE

The Ministry of Education in collaboration with Japan International Cooperation Agency (JICA) launched the first Robotic Contest in Kenya in 2008 with the aim of promoting automation through innovation in TVET institutions. Since then, robotic contests have been successfully conducted yearly under the Ministry of Education, State Department of Vocational and Technical Training. This contest has attracted the participation of National Polytechnics, Technical Vocational Colleges, Local Universities and some institutions from East African region.

## 2. OUTLINE OF THE CONTEST

The government of Kenya has come up with the "Big Four" initiatives to drive the development agenda forward. This includes affordable housing, universal health care, food security and manufacturing.

The manufacturing sector is a key driver for economic growth and development through job creation and value addition. According to our National priorities 2018-2022 extract, the overall goal for this is to increase the sector contribution to Kenya's GDP from 9.2% to 15%.

Government ministries, State Departments, Agencies and development partners are giving priority to research which leads to:

- (i) Technologies that enhance efficiency in processing and value addition;
- (ii) Smart manufacturing processes environment, energy efficiency, effectiveness and diversification;
- (iii) Effective quality assurance and standardization of processes and products;

To achieve this, a lot of efficiency and reliability is required for best results in production processes.

To this effect, the use of robotics is required to standardize and achieve efficiency in the manufacturing processes. This year's robotics contest will be based on the use of robots to identify, sort, pack and load different sizes of flour packages.

In this game, the robot must first get to the manufacturing site ( the Start zone, team A - Blue corner and team B- Red corner), move to the picking zone represented by a circle, pick the objects which are randomly placed on the designated points within the circle. The random placement must be similar for both zones. The robots are required to correctly pack the three packets marked Blue, Red and Yellow (representing 1/2kg, 1kg and 2kg packets of flour respectively) in their respective cartons labeled Yellow, Blue and Red and then transfer them to the loading Zones labeled Yellow, Blue and Red respectively.

The game robot having accomplished all the tasks must go back to the Start zone and park correctly. The robot which clears all these tasks within or in less than three (3) minutes will be declared the winner.

NB: The order of execution of tasks is at the discretion of the team.

### 3. THE GAME FIELD STRUCTURE AND SPECIFICATION

- a) The field consists of a Game Area having the dimension of 6000mm x 6000mm and surrounded by a wooden fence with a height of 150mm and a thickness of 25mm. The game field is divided equally for two teams by a wooden fence with a height of 150mm and a thickness of 25mm.
- b) White lines with a width of 30mm made of non-shiny sticker are drawn on the floor of the Game Area as specified on the game field diagram
  
- c) The Game Area consists of a Start zone (500mm x 500mm);
  - i. The Start zones Red and Blue are 500mmx500mm
  - ii. The dimensions of the Blue  $\frac{1}{2}$  kg packet is a cylinder of diameter 40 mm and height 40mm.
  - iii. The dimensions of the Red 1 kg packet is a cylinder of diameter 40 mm and height 60mm.
  - iv. The dimensions of the Yellow 2 kg packet is a cylinder of diameter 40 mm and height 80mm.
  - v. The dimensions of the Blue  $\frac{1}{2}$  kg carton is 60 mm x 60 mm x 60 mm
  - vi. The dimensions of the Red 1 kg carton is 60 mm x 60 mm x 80 mm
  - vii. The dimensions of the Yellow 2 kg carton is 60 mm x 60 mm x 100 mm
  - viii. The dimensions of the Blue  $\frac{1}{2}$  kg loading zone platform is 70 mm x 70 mm at a height of 200 mm
  - ix. The dimensions of the Red 1 kg loading zone platform 70 mm x 90 mm at a height of 150 mm
  - x. The dimensions of the Yellow 2 kg loading zone platform 70 mm x 110 mm at a height of 100 mm
  - xi. The packets are made from sterofoms, the containers are made from carton boxes and the loading zones are wooden platforms.



#### 4. GAME PROCEDURE

- a. Each match lasts for 3 minutes.
- b. In any of the following cases, the match ends immediately (even before three minutes).
  - i. When a team is disqualified.
  - ii. When the referee and the judges direct that the game cannot continue.

#### 5. SETTING OF ROBOTS

- i. One minute is given for setting up of the robot(s) before the game starts.
- ii. At most two members of each team can engage in setting of robots.
- iii. Any team that fails to complete setting of the robots within one minute can resume the setting again once the game starts.

#### 6. DEPLOYMENT OF THE ROBOTS AND TEAM MEMBERS AT THE START OF THE GAME

- i. Game Robot must be started in the Start Zone.
- ii. When starting the game robot, the team members who perform the starting action should not be in the game field.

#### 7. COMPETITION TASKS

Once the game has begun, each team shall complete the following tasks:

- i. The Game Robot must move from the start zone to the picking zone.
- ii. The Game Robot must pick an object and move with it from the picking zone to the packaging zone.
- iii. The Game Robot must correctly place the object in the container of the corresponding colour at the packaging zone.
- iv. The Game Robot must pick the packaged container and place it on the appropriate loading zone.
- v. The Game Robot must repeat tasks (ii.) to (iv.) for the remaining two objects.
- vi. The Game Robot must park at the start zone.

**NB:** - The linesman will be responsible for placement of the objects in the picking zone in each trial/game to ensure that the objects are randomly placed. The random placement must be similar for both teams

## 8. DECIDING THE WINNER

- a. The first team whose Game Robot successfully accomplishes all the tasks as per the criteria in 7.0 shall be declared the winner.
- b. If neither team achieves the above within 3 minutes, then the winner shall be decided on marks scored and time taken. The score shall be decided as follows:
  - i. A team that moves from the Start zone (2marks)
  - ii. A team that moves from the starting to the picking zone (3 marks)
  - iii. A team that successfully picks the Yellow object (3marks)
  - iv. A team that successfully picks the Red object (3marks)
  - v. A team that successfully picks the Blue object (3marks)
  - vi. A team that successfully moves with the Yellow object to the packaging zone (5marks)
  - vii. A team that successfully moves with the Red object to the packaging zone (5marks)
  - viii. A team that successfully moves with the Blue object to the packaging zone (5marks)
  - ix. A team that successfully identifies the Yellow container i.e moves the Yellow object to the Yellow container (3 marks)
  - x. A team that successfully identifies the Red container i.e moves the Red object to the Red container (7 marks)
  - xi. A team that successfully identifies the Blue container i.e moves the Blue object to the Blue container (3 marks)
  - xii. A team that correctly places the Yellow object in the Yellow container (4 marks)
  - xiii. A team that correctly places the Red object in the Red container (4 marks)
  - xiv. A team that correctly places the Blue object in the Blue container (4 marks)
  - xv. A team that successfully picks the Yellow packaged container (4marks)
  - xvi. A team that successfully picks the Red packaged container (4marks)
  - xvii. A team that successfully picks the Blue packaged container (4marks)
  - xviii. A team that successfully moves with the Yellow packaged container to the loading zone (3 marks)
  - xix. A team that successfully moves with the Red packaged container to the loading zone (7 marks)
  - xx. A team that successfully moves with the Blue packaged container to the loading zone (7 marks)
  - xxi. A team that correctly places the Yellow packaged container on the appropriate (100mm height) loading platform (4 marks)
  - xxii. A team that correctly places the Red packaged container on the appropriate (150mm height) loading platform (4 marks)
  - xxiii. A team that correctly places the Blue packaged container on the appropriate (200mm height) loading platform (4 marks)



- xxiv. A team that successfully parks at the Start zone after completing all the tasks (5marks)

## 9. RETRIES

- i. A retry can be made only after the referees' permission
- ii. Team members are allowed to touch the robots while preparing for a retry
- iii. Retries of a robot or several robots at the same time can be made as many times as necessary
- iv. A retry of the robot is made at the start zone only
- v. During a retry, a team can bring objects which are held by the robot back to the picking zones

## 10. SPECIFICATIONS OF CONTEST TOOLS

The game field, the bricks, joint brick and the mortar shall be provided by the organizers

## 11. CAUTIONS IN ROBOT DESIGN AND DEVELOPMENT

- i. Each team is recommended to build 2 robots: 1 Game Robot and 1 Spare Robot.
- ii. Each robot must not be split into sub-units or connected by flexible cords.
- iii. Wireless radio frequency is prohibited.
- iv. The robots in the contest must be built by the team members from the same institution.
- v. Game Robots
  - a. Each Game Robot must perform its tasks automatically after it is started by a team member.
  - b. In the Start Zone, the Game Robot must have its dimension no larger than 500mm in width, 500mm in length and 1000mm in height. There is no limitation on the dimensions of the Game Robot after the game starts.
- vi. Weights of the robots
  - a. The total weight of all robots, equipments and other devices used in the entire contest must not exceed 50 kg. However, the back-up set of batteries of the same type, weight and voltage as the primary set of batteries, is exempted.
- vii. Power sources of the robots
  - a. Each team must prepare its own power sources.
  - b. The voltage of the power sources used by each robot must not exceed DC 24V.
  - c. The pressure of the compressed air power must be less than 6 bars.
  - d. The organizer has the right to declare and prohibit any dangerous and inappropriate power sources.
- viii. Safety rules
  - a. The use of explosives, fire or dangerous chemicals is prohibited.



- b. If a laser is used, it must be of class 2 or less. In designing and preparing the laser, full care must be taken to protect all persons at the venue from harm during all procedures. In particular, the beams must be so oriented that they cannot shine into the eyes of the spectators.

## 12. VIOLATIONS

If a violation occurs, 5 points will be immediately deducted and if the violation still continues, 5 points will be deducted for every 3 seconds.

Each time of deduction is considered as the number of violations. The team with three violations in a match will be disqualified. The violations are categorized as follows:

- i. Any parts of any robots or the objects held by any robots move out of the game field or the space above it.
- ii. Any parts of any robots or the objects held by any robots enter the opposing team area or the space above it.
- iii. Any parts of any robots or the objects held by the robots cause obstruction.
- iv. The Game Robot hinders or cause difficulty for the opponent's Game robot.

## 13. DISQUALIFICATION

A team will be disqualified if it commits any of the following actions during the match:

- i. The team damages or tries to damage the field, facilities, equipment or opponent's robots.
- ii. The team performs any acts that are not in the spirit of fair play.
- iii. The team fails to obey instructions or warnings issued by the referees.
- iv. The team has made three violations in the same match.

## 14. SAFETY ISSUES OF THE ROBOTS

- i. All robots must be designed and manufactured as to pose no danger of any kinds to any persons in the venue.
- ii. All robots must be designed and manufactured as to cause no damage to any robots of the opposing team or the field.

## 15. TEAMS

- i. Each participating Institution in the contest can be represented by at most two (2) teams only.
- ii. A team consists of at least nine students, three instructors and a technician who all belong to the same institution. Two of the nine students of the team is entitled to participate in the match.

- iii. In addition, other members of pit crews can adjust the robots in the pit area and can help to carry the robots to the field, but cannot participate in the match. The members of the pit crews must be students of the same Institution.

## 16. SPECIFICATIONS OF CONTEST TOOLS

- i. The game field and the field objects shall be provided by the organizers

## 17. CAUTIONS IN ROBOT DESIGN AND DEVELOPMENT

- i. Each team is recommended to build 2 robots: 1 Game Robot and 1 Spare Robot.
- ii. Each robot must not be split into sub-units or connected by flexible cords.
- iii. Wireless radio frequency is prohibited.
- iv. The robots in the contest must be built by the team members from the same institution.
- v. Game Robots

- a. Each Game Robot must perform its tasks automatically after it is started by a team member.

- b. In the Start Zone, the Game Robot must have its dimension no larger than 500 in width, 500 in length and 1000 in height. There is no limitation on the dimensions of the Game Robot after the game starts.

- vi. Weights of the robots

The total weight of all robots, equipments and other devices used in the entire contest must not exceed 50 kg. However, the back-up set of batteries of the same type, weight and voltage as the primary set of batteries, is exempted.

- vii. Power sources of the robots
  - a. Each team must prepare its own power sources.
  - b. The voltage of the power sources used by each robot must not exceed DC 24V.
  - c. The pressure of the compressed air power must be less than 6 bars.
  - d. The organizer has the right to declare and prohibit any dangerous and inappropriate power sources.



**viii. Safety rules**

- a. The use of explosives, fire or dangerous chemicals is prohibited.
  - b. If a laser is used, it must be of class 2 or less. In designing and preparing the laser, full care must be taken to protect all persons at the venue from harm during all procedures. In particular, the beams must be so oriented that they cannot shine into the eyes of the spectators.
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## 18. Scoring sheet



### ROBOKEN CONTEST 2019-2020 SCORE SHEET

NAME OF THE INSTITUTION	Task marks	Marks Scored-Game1	Marks Scored-Game2
A team that moves from the Start zone	2		
A team that moves from the starting to the picking zone	3		
A team that successfully picks the Yellow object	3		
A team that successfully picks the Red object	3		
A team that successfully picks the Blue object	3		
A team that successfully moves with the Yellow object to the packaging zone	5		
A team that successfully moves with the Red object to the packaging zone	5		
A team that successfully moves with the Blue object to the packaging zone	5		
A team that successfully identifies the Yellow container i.e moves the Yellow object to the Yellow container	3		
A team that successfully identifies the Red container i.e moves the Red object to the Red container	7		
A team that successfully identifies the Blue container i.e moves the Blue object to the Blue container	3		
A team that correctly places the Yellow object in the Yellow container	4		
A team that correctly places the Red object in the Red container	4		
A team that correctly places the Blue object in the Blue container	4		
A team that successfully picks the Yellow packaged container	4		
A team that successfully picks the Red packaged container	4		
A team that successfully picks the Blue packaged container	4		
A team that successfully moves with the Yellow packaged container to the loading zone	3		
A team that successfully moves with the Red packaged container to the loading zone	7		
A team that successfully moves with the Blue packaged container to the loading zone	7		
A team that correctly places the Yellow packaged container on the appropriate (100mm height) loading platform	4		
A team that correctly places the Red packaged container on the appropriate (150mm height) loading platform	4		
A team that correctly places the Blue packaged container on the appropriate (200mm height) loading platform	4		
A team that successfully parks at the Start zone after completing all the tasks	5		
<b>Total</b>	<b>100</b>		



# 19. The Game Field Diagram

