2018

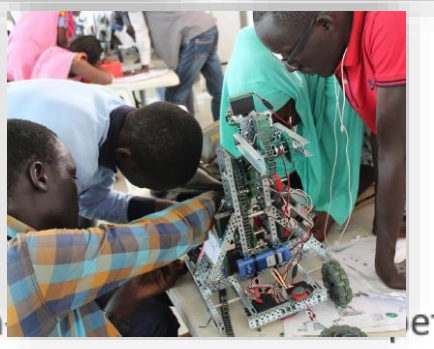
PAN-AFRICAN ROBOTICS COMPETITION

GAME CHALLENGE & RULES

PAN-AFRICAN ROBOTICS COMPETITION (PARC)

What is PARC?

The Pan-African Robotics Competition (PARC) is an All-African Robotics competition which brings together middle, high-school, and university robotics teams to participate in a competition around a challenge based on a real-world topic relevant to science and the sustainable development of Africa.



Pan-African Robotics Competition

an- petition (parcrobotics.org)

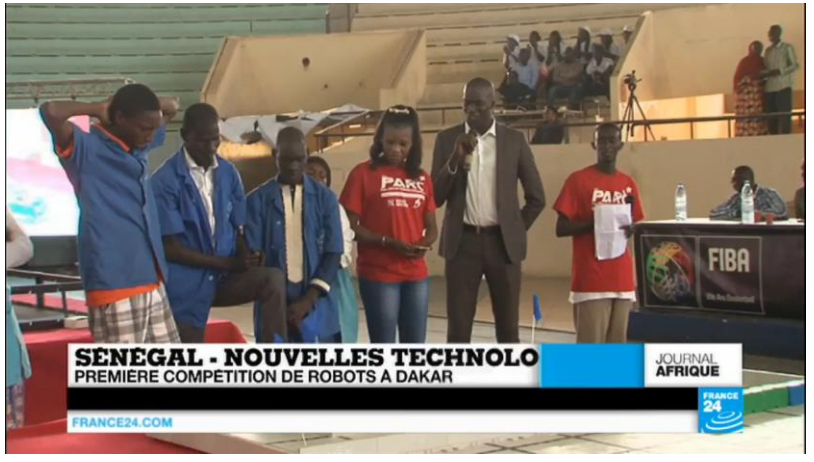
The New York Times

BBC NEWS

FRANCE 24

ALJAZEERA

PARC 2016 – Powering Agriculture



PARC 2017 – Made in Africa

MISSION OF PARC

The goal of the Pan-African Robotics Competition is to inspire young Africans while promoting STEM education within the African community

"It's more than just a Robotics Competition…"

PARC 2018

- **Theme:** One-Health Innovation
  - Africa has 6 out of 10 fastest growing economies but it also has the highest disease burden in the world. PARC 2018 challenges African students to devise solutions to provide access to quality health services using science and technology.
- **When:** TBD, 2018
- **Where:** Saly, Senegal
- **Who:** Over 20+ African countries confirmed

PARC 2018 CONT.

- **Competition Categories:**
  - **S**tars, **T**ech, **E**ngineers, & **M**akers Leagues
- **Number of Teams per Country:** 4 (with the exception of Rwanda)
  - No more than two (2) teams in the same category; ideally one team per category
- **Number of Team members: 4-8** students plus a coach/mentor
- **Competition Format:** Teams build own robots/devices and work on projects defined in published competition challenges. Teams have 3 months to prepare before competing in Kigali.
- **Registration Fees per Team:** $100

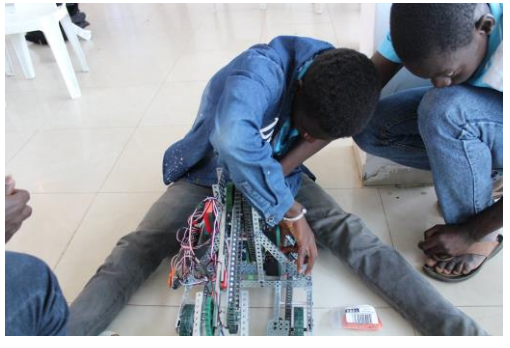
ROLE OF THE MENTOR

- The role of the mentor is to provide advice, guidance, and technical assistance as students work on the competition challenges

- The objective of the competition is for the students to work together to solve challenges and NOT for the mentor to do it him/herself.

- The goal is not only to win, it is a learning and discovery process, an adventure, it's life-changing for the students. Let's not deprive them of it.



TECH LEAGUE

Grades: 4 – 8
Age: 11 – 15 years
Robot kit: VEX IQ Super Kit

It's an Outbreak

There is an infectious disease outbreak in a remote African village; TECH League teams are tasked to send in robots to control the outbreak and rescue people.

Missions include setting up makeshift remote hospitals / labs to test & treat and investigate the outbreak, establish communication infrastructures for infection prevention control measures, and evacuate critical patients.

IT'S AN OUTBREAK

The Story:

There is an infectious disease outbreak in a remote African village; TECH League teams are tasked to send in robots to control the outbreak and rescue people. There are three important stages in managing the outbreak.

- **Diagnostics:** We need to find out who and how people are being infected. Using scientific methods and technologies such as point-of-care (POC) devices; we can identify the disease, its transmission medium, and separate the healthy from the infected people.
- **Treatment:** Infected people are treated in a treatment center where utmost care is taken to avoid transmission of the disease to staff and caretakers. Personal protective equipment are used and the most serious cases are quarantined in hot zones.
- **Communication:** To reduce the risk of transmission, standard precautions are communicated to the general public through channels such as TV, radio, and ads campaign. These precautions could include: hand hygiene, respiratory hygiene/cough etiquette, and cleanliness.

Each one of the stages represents a **LEVEL** and within each Level, there are **OBJECTIVES** team robots need to achieve. For PARC 2018, teams will compete on the **first two levels**.

Careers:

Controlling a disease outbreak is a difficult and complex challenge which requires expertise from many fields working together. Epidemiologists, doctors, nurses, laboratorians, veterinarians, translators/interpreters, computer specialists, mathematicians, entomologists, health agencies, and other public service officers, etc.

IT'S AN OUTBREAK

Goal:

Build and send in robots to town to control the outbreak and rescue people.

Objectives:

Level I

- Objective 1: Move people to designated evacuation area based on the diagnostic result.

Level II

- Objective 2: Push dispenser to release Pills from Medicine cabinet
- Objective 3: Move Pills from cabinet to sick person bed
- Objective 4: Trigger Incubation Period clock

DEFINITIONS

- Red Person – Infected individual, 10 cm tall
- Yellow Person – Individual shows some symptoms, 10 cm tall
- Green Person – Healthy individual
- Level Field – 121.9 x 243.8 cm
- Start box – Base from where robot starts
- Grey box – Elevator to next Level
- Pills – 10 cm objects
- Red Patient – Red colored bed located in hot zone
- Yellow Patient – Yellow colored bed
- Medicine Cabinet – Stores Pills

IT'S AN OUTBREAK

General Rules

- No part of the robot can extend outside the starting box before the match begins.
- Robot must be completely inside the grey area and stopped in order to move on to the next level.
- Starting robot configuration must be within a 30x30x30cm box but can extend outside of that after the start of the match.
- 10 point penalty for touching your robot outside of the starting zone or elevator and increases by 5 points for each additional touch.
- No penalty for touching robot while it is in the starting zone or on the elevator.
- You can change attachments on your robot while in starting base or elevator (grey area).
- Once on elevator, teams can pickup robots to place them on level II starting base

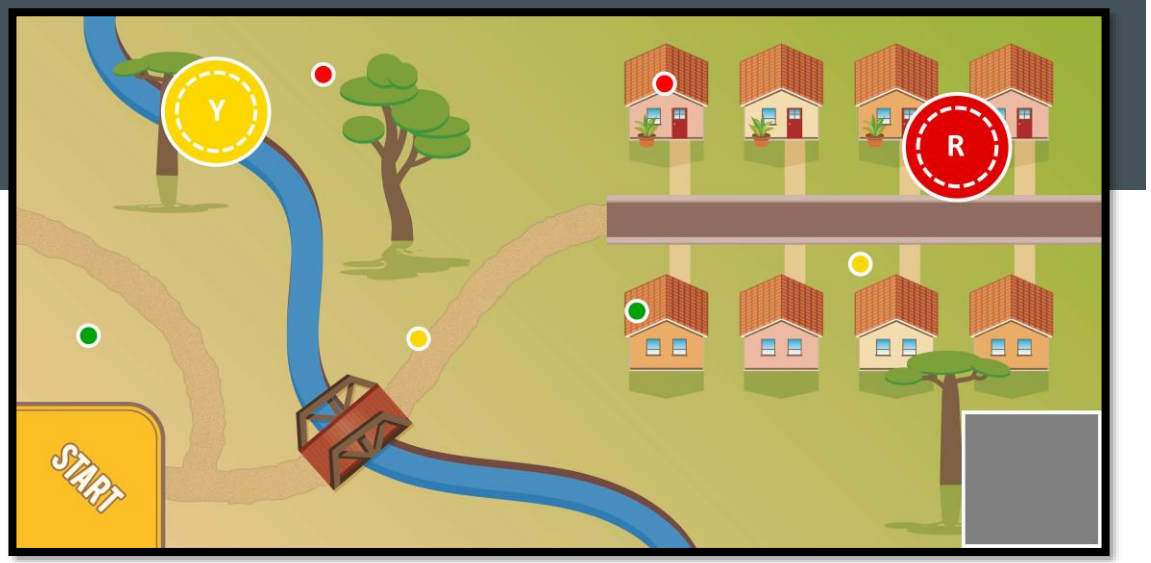
GAME PLAY

- All robots are autonomous
- Robot must start in the Start Box
- The total length (all levels combined) of the game is 3 minutes (all autonomous)
- Each team will have two trials

IT'S AN OUTBREAK

Level 1: Diagnostics

- Move at least one Red person to Red site
- Move at least one Yellow person to Yellow site
- Park Robot in Grey area to move to next level

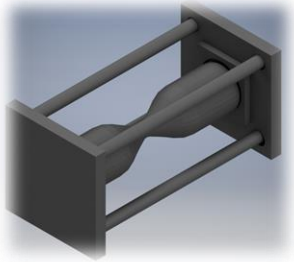


Level 1 Rules

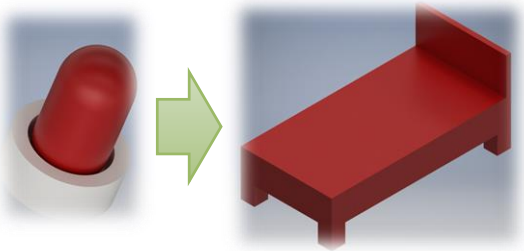
- Each person moved to evacuation site amounts to 20 points
- Enter elevator to score 10 points
- 5 points penalty for hitting a Green person

IT'S AN OUTBREAK

Level II: Treatment



- Hourglass Clock has a trigger to start Incubation Period
- Pills are kept inside Medicine Cabinet
- There are 3 Yellow Pills and 1 Red Pill to distribute to Patients



Level II Rules

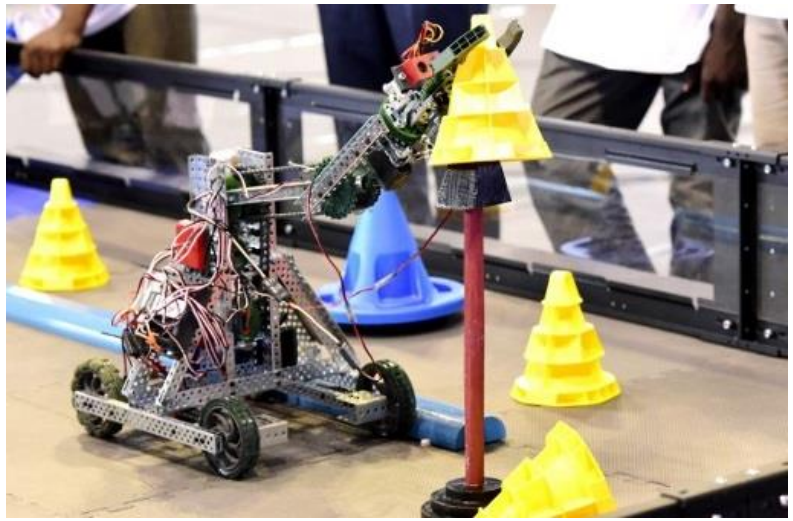
- Dispense Pills to score 10 points
- Trigger Hourglass Clock to score 30 points
- Each Pill moved to the right bed amounts to 20 points

IT'S AN OUTBREAK

Robot Kit & Fields

- VEX IQ Super Kit: $330 USD
- Level table (optional): ~ $50 USD
- Teams can make any variations of Robot however must only use pieces in the VEX IQ Super Kit
- Level Mats and all game elements are shipped to teams by PARC free of charge

STARS LEAGUE



Grades: 9 – 12
Age: 15 – 19 years
Robot Kit: VEX EDR Competition Super Kit with additional accessories

Manufacturing Medicine

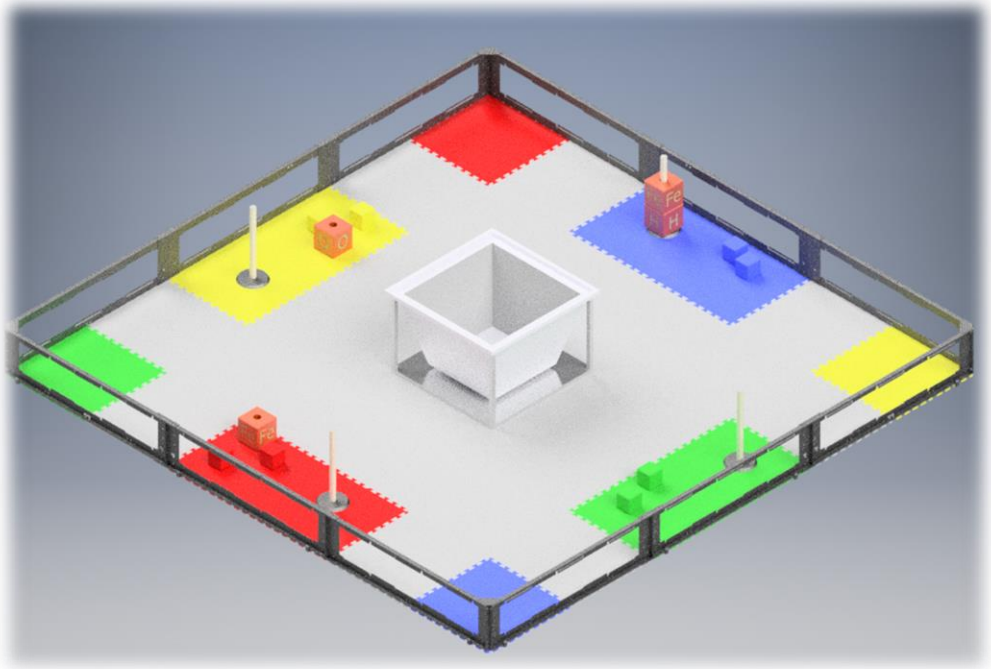
A home-grown African Pharmaceutical industry will play an important role towards the path to longer and healthier lives for all Africans. One of the cornerstones of the pharmaceutical industry is medicine manufacturing.

In this challenge, teams build robots to compete on automating a pharmaceutical manufacturing operation: Feeder, blender/mixer, tablet press, coating, and packaging.

MANUFACTURING MEDICINE

The Story:

A home-grown African Pharmaceutical industry will play an important role towards the path to longer and healthier lives for all Africans. One of the cornerstones of the pharmaceutical industry is medicine manufacturing. Africa has a rich heritage of traditional medicine practice but has lagged in industrializing it. Additionally, advanced research in chemistry, molecular biology, biochemistry, genomics, biotechnology done in African labs can benefit from local pharmaceutical industry to translate their research into pharmaceutical products. That's when **Your team** comes in…



Careers:

Development and manufacturing of medical drugs requires an interdisciplinary group of scientists, engineers, and administrators working together. For PARC 2018, your team will consist of:

- Engineers
- Chemists

MANUFACTURING MEDICINE

Goal:

Build a robot to automate a pharmaceutical manufacturing operation: Feeder, blender/mixer, tablet press, coating, and packaging.

Objectives:

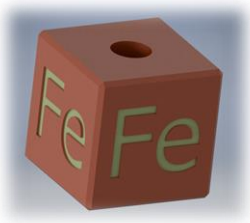
- Objective 1: Unload Ingredients onto the playing field
- Objective 2: Feed Ingredients Cubes into the center Hopper/Mixer
- Objective 3: Figure out Elements Cubes order and place them on playing field from loading square
- Objective 4: Place Elements Cubes into pole for pressing
- Objective 5: Put Capsule on Elements Cubes (Tablets)

Note that objectives 2, 3, 4, and 5 can be done in any order or in parallel.

DEFINITIONS

- Ingredient Cube – 10 cm cube (scored in the center hopper)
- Element Cube – 15 cm cube (teams must use the correct order to get points)
- Starting Base – 60 cm square around the pole teams must start in
- Center Hopper – 35 cm tall and 75 cm in diameter. Ingredient Cubes can be scored in here
- Capsule – 45 cm tall and 17x17 cm wide. This can be placed over the Elements Cubes to double points from Ingredient Cubes in the center hopper
- Ingredient Cube Unload – Releases the Ingredient Cubes onto the field
- Loading Square – Square out side of the field where the chemist can load Element Cubes into the robot

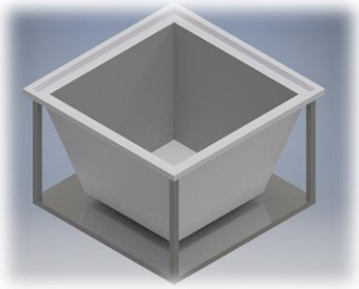
MANUFACTURING MEDICINE



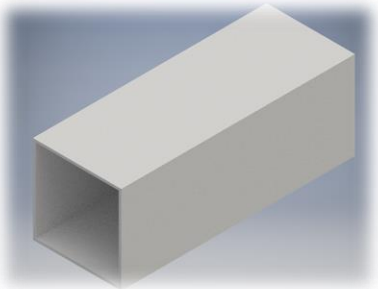
Elements Cube

Ingredient Cube

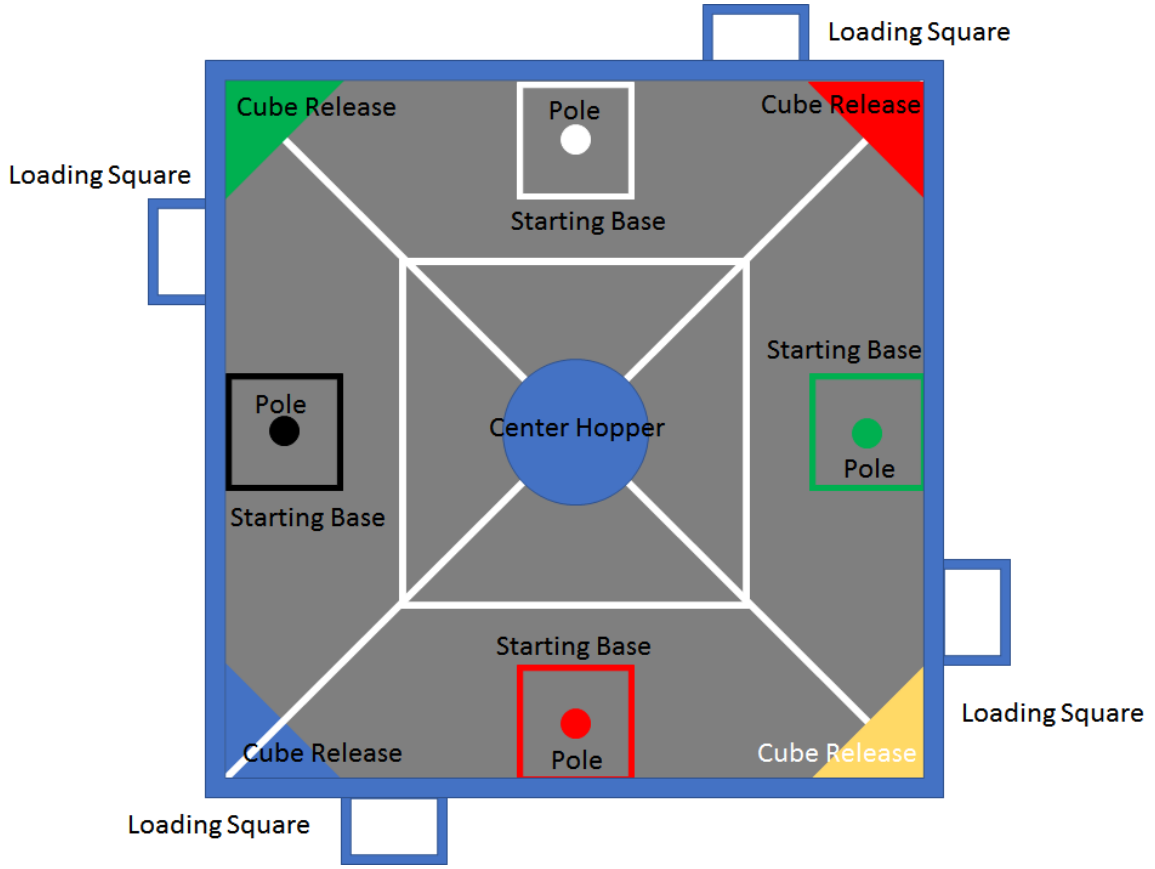
Pole



Hopper / Mixer



Capsule



MANUFACTURING MEDICINE

General Rules

- There are 15 colored 10 cm Ingredient Cubes for each team that must be scored in the center Hopper 25 cm tall. Each teams scores its own color Ingredient Cube.
- There are 10 Element Cubes for each team. The chemist must first complete the chemical puzzle (handed to team at beginning of game) to know which three chemicals (i.e., Elements Cubes) to use. Teams only get points if the combination is right.
- The Element Cubes are 15 cm cubes with a 4 cm hole in the middle and must be placed on the 45 cm long, 3 cm diameter pole in the starting base.
- To put Element Cubes in field, the chemist stands in the loading square and places the cube on the robot or the floor in front of the loading square.
- In autonomous mode, all Robot must move **clockwise** to unload/release Ingredient Cubes
- **Penalties:** kicking down another team's pole (-5)

GAME PLAY

- Robot must start touching the wall and its corresponding colored box, and fit within a 50x50x50 cm box at the being of the game, but can expand after.
- The first 15 seconds the robot can not be controlled by the human players and must operate autonomously.
- The next 1.5 minutes is tele-op.
- The last 30 seconds of the match teams can place their capsule.
- Each team will have two trials.

MANUFACTURING MEDICINE

AUTONOMOUS RULES

15 seconds to do as many of the following. Scores are between the parentheses

- Leave the starting base (1)
- Score Ingredient Cubes (5)
- Trigger Ingredient Cube release (5)
- Score Ingredient Cubes (5)

TELE-OP RULES

2 minutes to do as many of the following. Scores are between the parentheses

- Trigger Ingredient Cube release (5)
- Score Ingredient Cubes (1)
- Score Element Cubes (5)

The last 30 seconds of the match teams can do the following

- Place Capsule over stacked Element Cubes (2x the points for Ingredient Cubes in center hopper)

MANUFACTURING MEDICINE

Robot Kit & Playing Field			
Item	**Price**	**Qt**	**Purchase Link**
VEX EDR Super Kit	$1,100	1	https://www.vexrobotics.com/c-c-super.html?startcustomization=1
Polycarb	$44	2	http://www.andymark.com/product-p/am-2324.htm
Extra kit	$180	1	https://www.vexrobotics.com/vexedr/products/accessories/structure/276-2232.html
Long Al	$80	1	https://www.vexrobotics.com/vexedr/products/accessories/structure/aluminum-kits.html
8/32 0.625 Screw	$20	2	https://www.vexrobotics.com/vexedr/products/accessories/structure/all-screws.html
8/32 Nylocks	$12	3	https://www.vexrobotics.com/vexedr/products/accessories/structure/nuts-8-32.html
8/32 1" Screw	$10	1	https://www.vexrobotics.com/vexedr/products/accessories/structure/all-screws.html
Wrench Set	$40	1	https://www.vexrobotics.com/vexedr/products/accessories/other/tools.html
Mecanun Wheel	$60	1	https://www.vexrobotics.com/vexedr/products/accessories/motion/edr-wheels.html
Double Acting Pneumatics	$230	1	https://www.vexrobotics.com/pneumatics.html
Tubing 5'	$5	1	https://www.vexrobotics.com/pneumatics.html
Total:	**$1,781**		
Competition Field Perimeter (Optional)	$800	1	https://www.vexrobotics.com/vexedr/products/competition-products/278-1501.html
Competition Field Tile Kit (Optional)	$230	1	https://www.vexrobotics.com/vexedr/products/competition-products/278-1502.html

Note: All game elements will be shipped to teams by PARC free of charge

MAKERS LEAGUE

Grades: 9 – 12
Age: 15 – 19 years

Hospitals of the Future

What will tomorrow's hospitals look like? What role will technology play in clinical efficiency, patient comfort, and personalized medicine? Could future hospitals be in our own living rooms?

MAKERS are challenged to use their technical skills and imagination to conceptualize and build a tabletop scale model of a hospital in year 2038. Teams learn the value of the ability to deliver clear, concise and effective oral and visual presentations.

HOSPITALS OF THE FUTURE

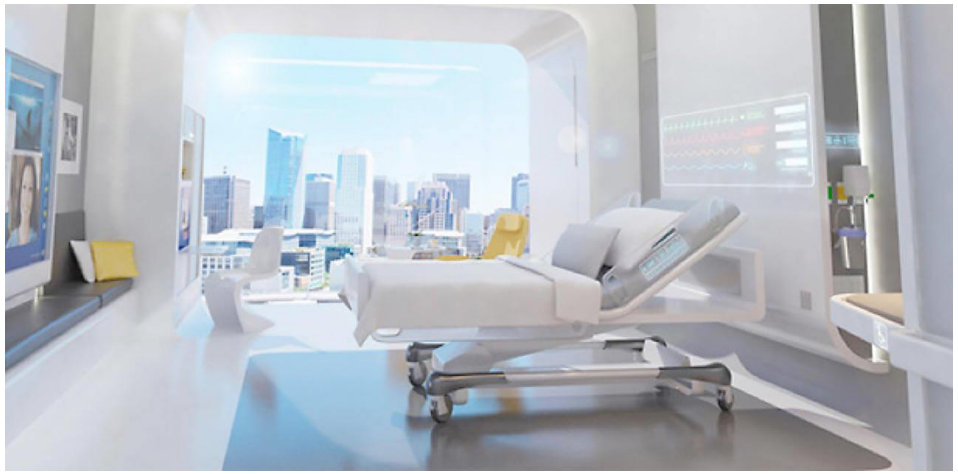
Ideas:

This is an open-ended competition challenge, teams are free to imagine the impossible today. Imagine 20 years from now, how will human and other living species seek medical care, where will they go, what will be done/given to them, how will the care be delivered, by who or by what? Wait…will there be hospitals in the future?

Competition Deliverables:

- Design and build tabletop scale model
- Create a poster (French or English)
- Deliver a presentation (French or English)
- Document your work using Engineering Design Process (Either in French or English)

Each team will be assigned a booth at the competition site in the Kigali Convention Center. Teams should be prepared to answer questions from the judges.



http://medicalfuturist.com/

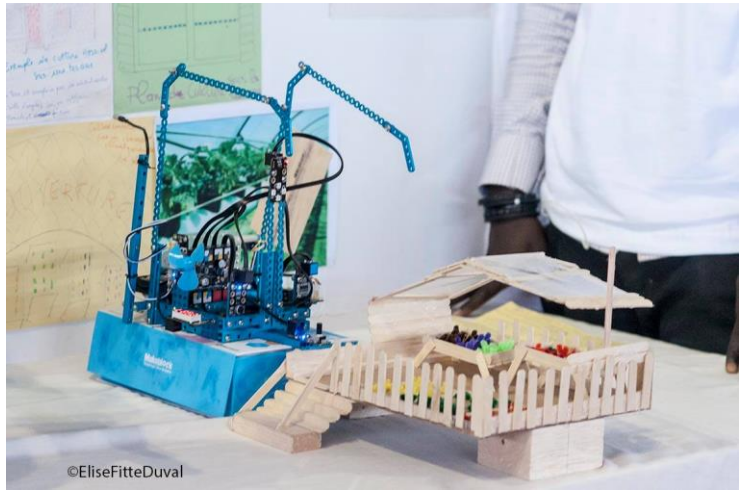
HOSPITALS OF THE FUTURE

Design and Build a Tabletop Scale Model:

Teams are asked to build a model around their idea! The model is an artistic representation of your idea. Model does not need to be on all aspects of proposed "hospitals of the future" idea, but could be on specific sub-components, e.g., a bed, a building, a machine, a procedure, an instrument, an ambulance, a process, etc. Teams will be asked to bring the model to the competition; therefore, you should make plans on how to transport your model on plane or car to competition site.

The model has some parameters that teams will need to follow.

- Model cannot be larger than 1.22 m in width, 2.44 m in length and 1.22 m in height.
- Model material cannot cost more than **$200 USD**. Teams will need to provide a material expense list. Teams will have to estimate the value of scrap and donated materials
- No restriction on materials used to build model, which could include electronics and moving parts. However, models cannot include hazardous or illegal materials.



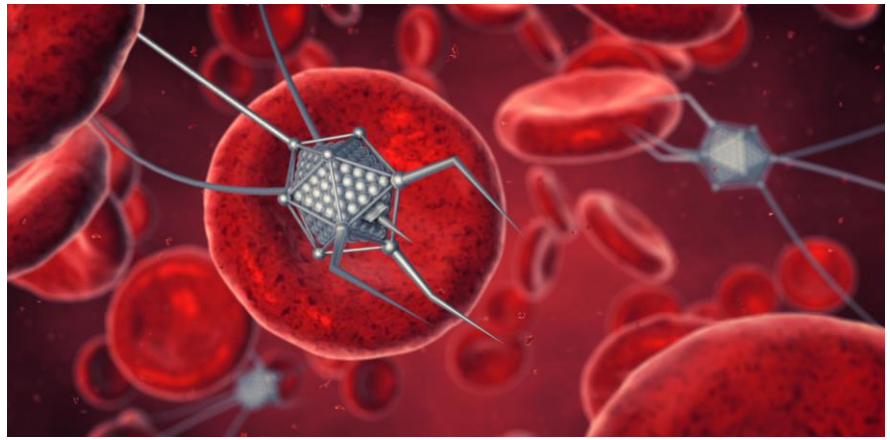
HOSPITALS OF THE FUTURE

Create a Poster:

Teams will have the opportunity to show off their hard work and creativity by developing a poster. It is recommended to use a tri-fold post but teams can use a standard poster board.

Content of the poster can include information on:

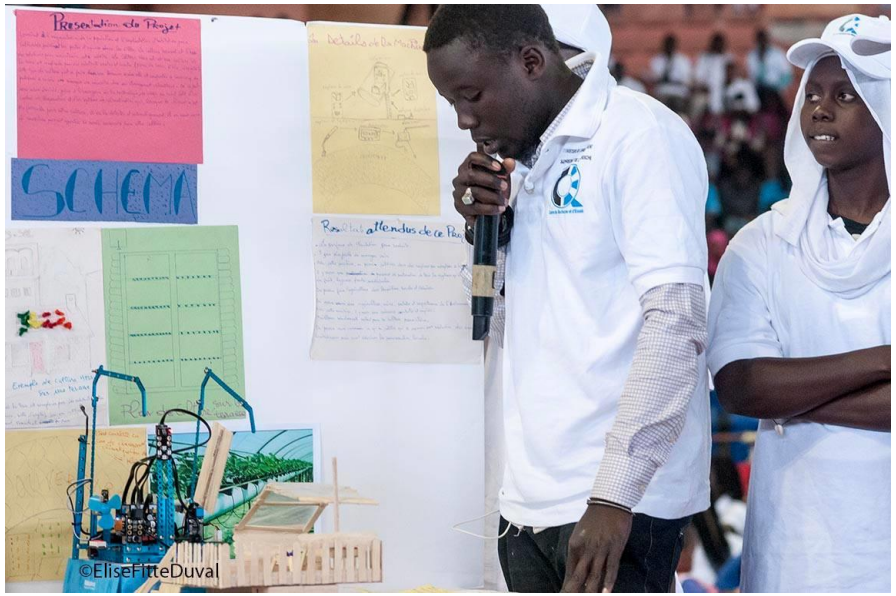
- Team members
- Country and or City
- Your Future Hospital Idea/Proposal
- Problems you faced during the development of your model
- Other items you want to share



HOSPITALS OF THE FUTURE

Presentation:

Teams will need to deliver a 5-7 minutes presentation about their project. All team members are encouraged to have a speaking part during the presentation. Team members can use items such as their model or poster during the presentation. This is your moment to shine in front of hundreds of spectators and supporters, be creative and make it exciting. ☺



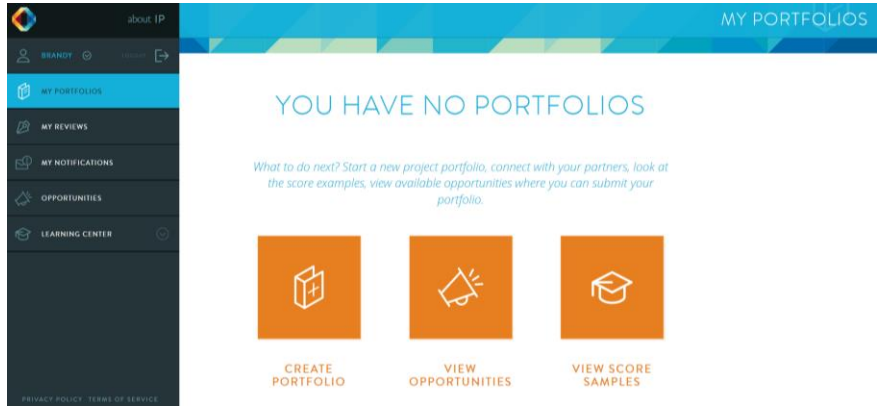
HOSPITALS OF THE FUTURE

Engineering Design Process:

What is an engineering design process? The engineering design process is a series of steps that engineers follow to come up with a solution to a problem. Many times the solution involves designing a product (like a machine or computer code) that meets certain criteria and/or accomplishes a certain task (Science Buddies, 2017).

Teams will be asked to use *Innovation Portal* to show their Engineering Design Process. Follow the A-H Element Rubric guidelines to guide you through the Engineering Design Process. Teams will need to print a final version of the portfolio and bring to the competition. Teams should be prepared to answer questions from the judges.

- Link: https://www.innovationportal.org/



HOSPITALS OF THE FUTURE

How teams will be judged?

Teams will be judged in each of the four areas on a scale of 0-10:

- Model (idea, imagination, creativity, aesthetics, workmanship)
- Poster (content, aesthetic/organization)
- Presentation (content, clarity, team work)
- Engineering Design Process (follow Innovation Portal guidelines)

Teams will need to follow all guidelines and teams should review the Engineering Design Process rubric for judging guidance: A - F

ENGINEERS LEAGUE

Grades: College Undergraduates
Age: N/A

Enabling the Disabled

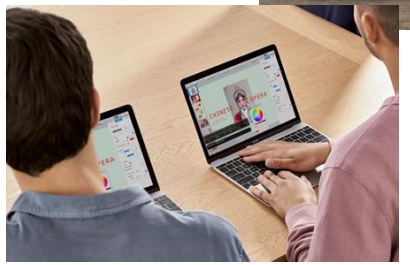
ENGINEERS are challenged to use their engineering skills to design and build a working gadget, device, machine, system, or software to improve the lives of disabled people or animals.

Mobility, Accessibility, Dexterity, Vision, Hearing, Mental, and Rehabilitation are just a few areas for which teams can develop assistive technologies.

ENABLING THE DISABLED

Competition Overview:

Your team is challenged to design and prototype a solution (hardware and/or software) to improve the lives of disabled peoples or animals. Your solution should provide greater independence to and allow a person or animal with physical or cognitive handicap to fully or partially integrate back to mainstream society. Solutions are broadly interpreted to include medical assistive technologies, accessibility, as well as rehabilitation technologies. Think mobility, accessibility, dexterity, vision, hearing, mental, and rehabilitation, and then come up with a Novel and Innovative **Technology-Enabled** solution. Remember to think BOLD.



(John Hopkins, MIT, Apple,)

Competition Rules:

- Solution cannot be entirely off-the-shelf product; at minimum 50-60% of solution must be developed by team (e.g., 50-60% of effort needed for the development of solution)
- No limit on size or money spent to develop solution/prototype. Do keep in mind however that prototype needs to be transported to competition site in Kigali, Rwanda
- Prototype must be safe to users and audience

ENABLING THE DISABLED

Deliverables:

- Fully working prototype of solution
- 15 minute power-point presentation and on-stage demonstration of prototype (French or English)
- Quad Chart Poster (see next page for template)
- Project Report: 15 pages (including title page, images, graphs, and appendices if applicable), 12-point font (French or English)

Prototype Scoring Rubric:

On a scale of 0 -10, prototypes will be judged based on:

A. Solution/Product Need
B. Functionality
C. Innovation & Novelty
D. Aesthetic (note that this applies to both hardware and software if applicable)

QUAD CHART POSTER – TEMPLATE

PARC	**Engineering League** **Name of team members** **University or Organization**	**LOGO of Team**

Title of Solution / Project Use graphic images or photographs to describe the problem and proposed solution / prototype. Use labels or descriptive text as needed for clarification.	**Operation & Implementation** Tell how solution works, explain how solution would be implemented in real-word application. Use images, graphics, and/or schematics for clarification.
Technical Approach Specifically, describe the technologies used in developing the solution. Use bullet points if appropriate.	**Innovation** What's unique about the proposed solution?

ENABLING THE DISABLED

Project Report Scoring Rubric:

Final Project report will be judged based on both style (i.e., writing, presentation, drawings…) and content. Teams are encouraged to follow the following guideline for their report. Descriptions of these guidelines can be downloaded here:

A. Presentation and Justification of the Problem
B. Documentation and Analysis of Prior Solutions Attempts
C. Presentation and Justification of Solution Design Requirements
D. Design Concept Generation, Analysis, and Selection
E. Application of Engineering Principles and Practices
F. Consideration of Design Validity
G. Construction of a Testable Prototype
H. Prototype Testing and Data Collection Plan
I. Testing Data Collection and Analysis
J. Documentation of External Evaluation

CREDITS SLIDE

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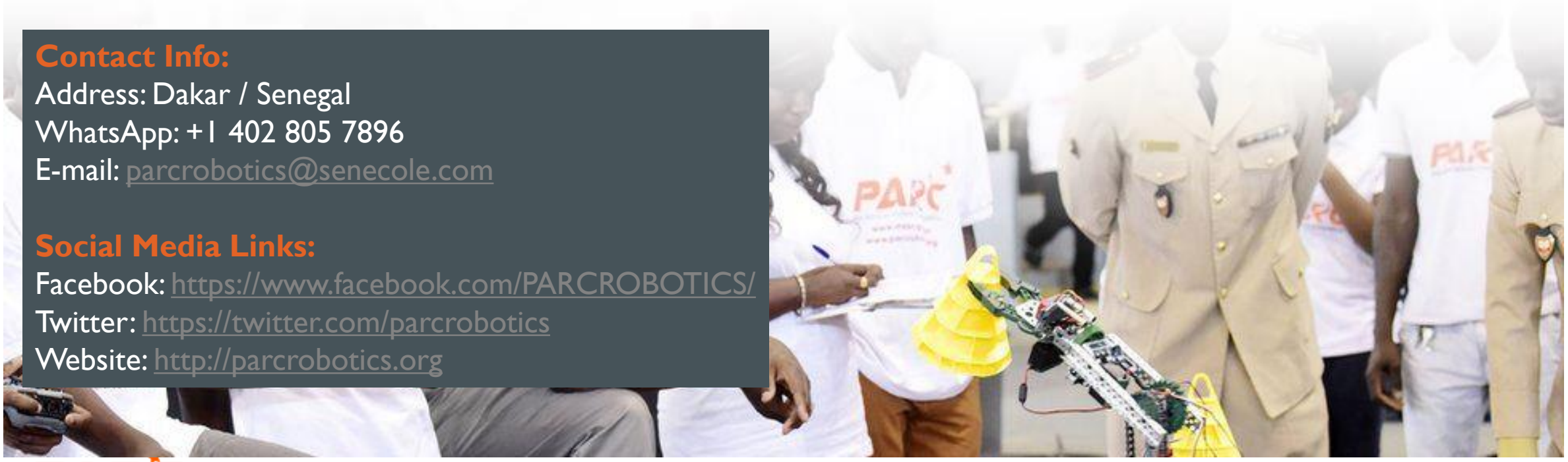
LET THE FUN BEGIN

2018 PAN-AFRICAN ROBOTICS COMPETITION



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Social Media Links:
Facebook: https://www.facebook.com/PARCROBOTICS/
Twitter: https://twitter.com/parcrobotics
Website: http://parcrobotics.org