Promoting Innovation in Africa through Robotics Education

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Mathematics and Science for Sub-Saharan Africa (MS4SSA):
A World Bank Initiative to Improve Student Learning in Africa
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What is the purpose of Education?

It is to provide for the fullest possible development of each learner for living morally, creatively and productively in a democratic society.

- ASCD Committee on Platform of Beliefs

It is to strengthen the mind so that one can more easily learn to deal with specific challenges one will face throughout life.

- Philip Guo

What is the purpose of Education?

Education is not the filling of a bucket, but the lighting of a fire.

- William Butler Yeats

Education is the most powerful weapon you can use to change to the world.

- Nelson Mandela

What is the purpose of Engineering Education?

To equip people with the ability to apply sound scientific principles to solve real and physical problems.

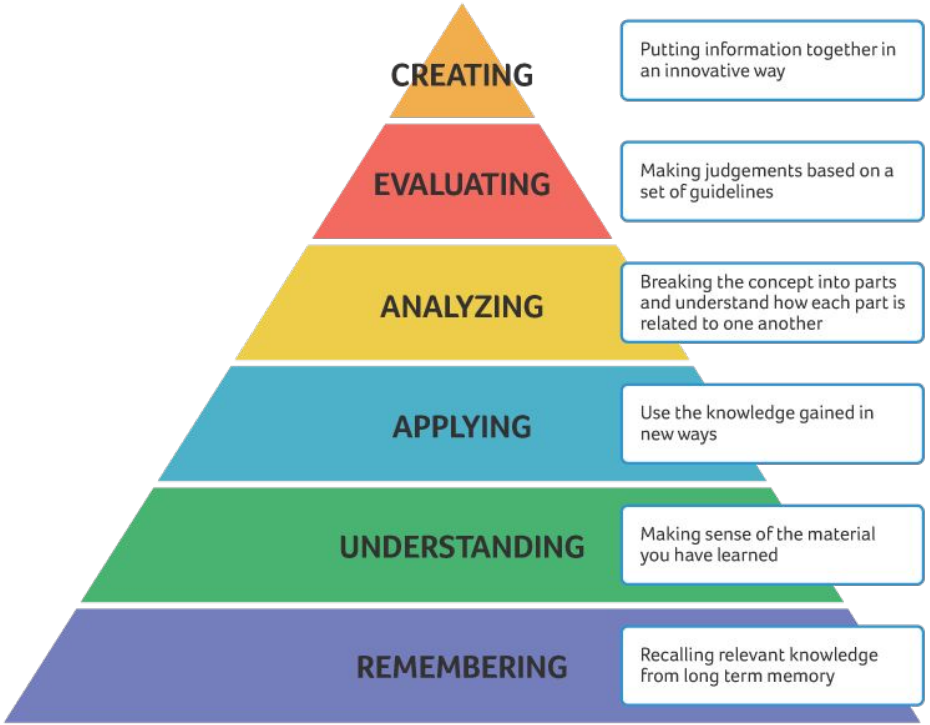
To empower people with the relevant technical knowledge and skills required to enable them solve problems and build an improved society.

In Sub-Saharan Africa, we have **tens of thousands** of engineering graduates each year in **electrical, mechanical, civil,** etc...

But,

be still have **major fundamental challenges** in power infrastructure, construction, water, agriculture, and the list goes on...

Where is the disconnect?



...practice

...application

...skill

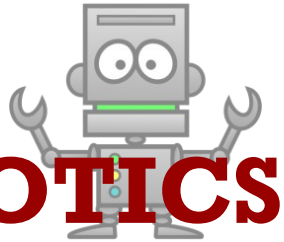
Little Background About Me

- Born and lived in Lagos, Nigeria all my life
- Strong desire to demonstrate the **nexus** between **human capital development** and **socio-economic development**
- PhD student in Robotics Engineering at WPI and Member of WPI Robotics Education Resources Team

Why Consider Robotics Education?

ROBOTICS

Why Consider Robotics Education?



ROBOTICS

ELECTRONICS

MECHANISMS

PROGRAMMING

Robotics - Electronics

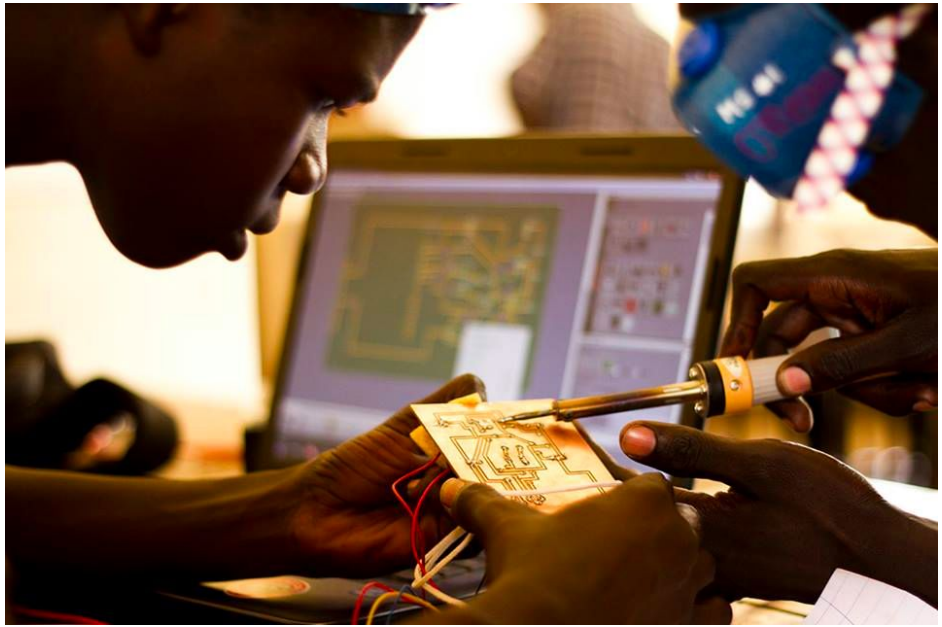


Image credit: FundiBot

- **Electronics:** Design of circuits using transistors, ICs, and other components.
- Other components: sensors, actuators, input devices, etc.

Robotics - Programming

Image credit: FundiBot

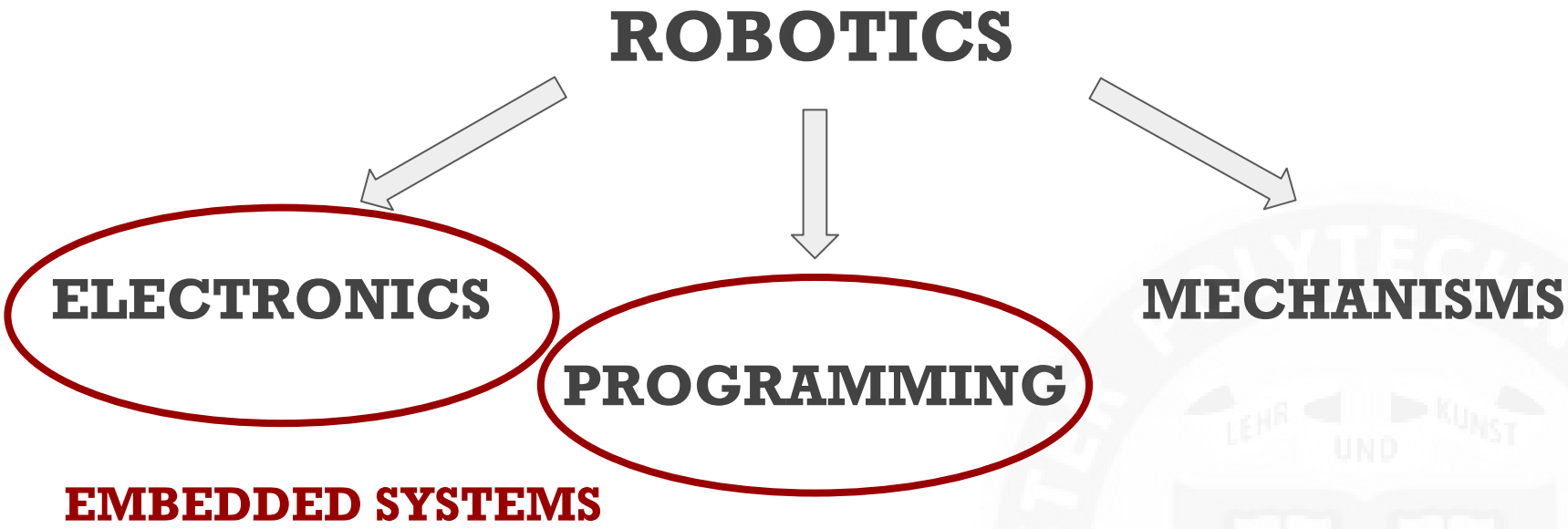
- **Programming:** Creating a set of instructions to tell a computer how to perform a task.

Robotics - Mechanisms

- **Mechanism:** Assembly of moving parts to accomplish a functional motion or task.

Image credit: PARC

Robotics: Automation



AUTOMATION

Robotics: Automation

- **Industrial:** Industrial robots
- **Military:** UAVs, UGVs
- **Vehicles:** Cars, Drones, Underwater vehicles, driverless cars

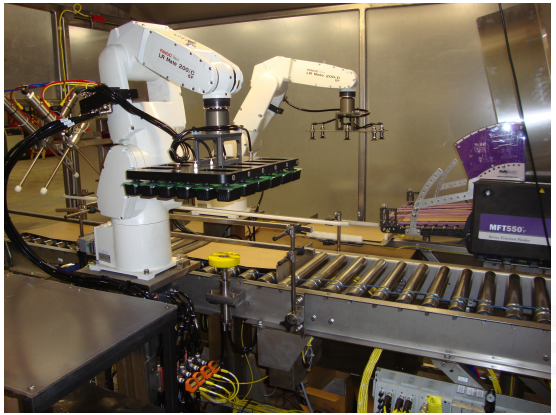


Image credit: FANUC, AMS South Africa

Robotics: Automation

- **Agriculture:** Irrigation systems, soil monitoring systems, etc.

- **Medical:** Prosthetics, clinical equipment, etc.

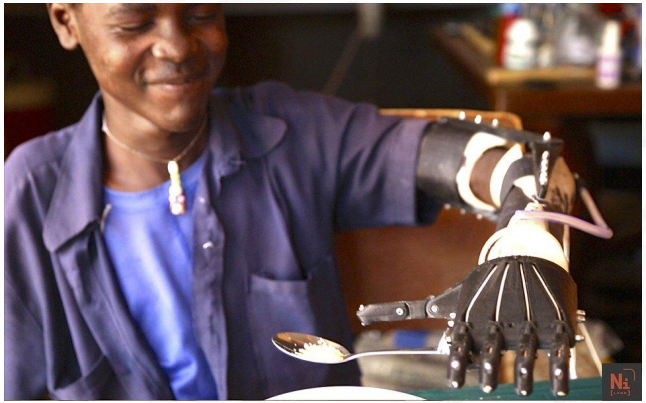


Image credit: SSWM, NiL, ABE Research UIUC

Robotics: Automation

- **Domestic:** Renewable Energy Devices, etc.

Image credit: Arnergy Nigeria

Robotics on the African Continent

Robotics and STEM programs are growing all over the continent

Summary: 81+

Top countries:

- South Africa (19)
- Nigeria (12)
- Kenya (6), Ghana (6)
- Senegal (5), others

Image credit: Wikipedia, Jan 2017 Update

Robotics on the African Continent

FundiBot

- **Reach:** 15 schools, 600 students
- **Founded:** 2011
- **Focus:** Robotics from local materials, programming, basic electronics
- **Approach:** Bootcamps, summer programs

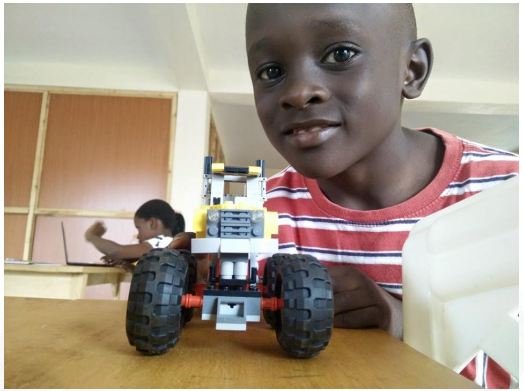
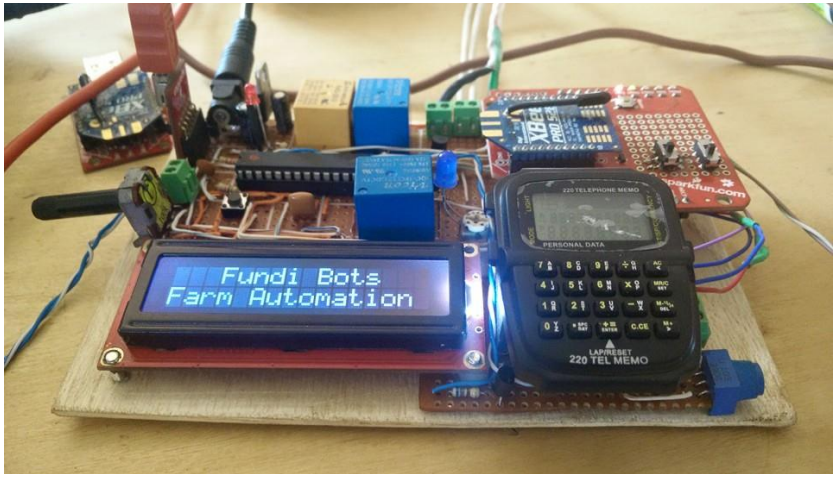


Image credit: Facebook - FundiBot

Robotics on the African Continent

FundiBot



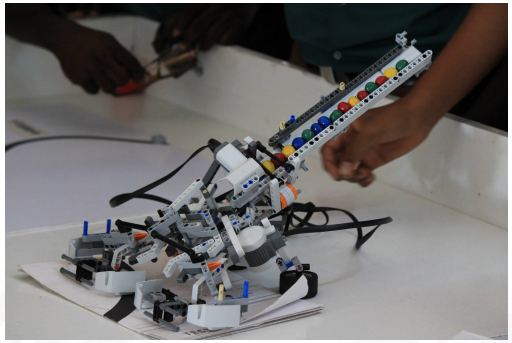
Fundi Bot Farm Automation System

Image credit: Facebook - FundiBot

Robotics on the African Continent

Ghana Robotics Academy Foundation

- **Reach:** ~500 students in robotics competitions annually
- **Founded:** 2011
- **Focus:** Robotics kits programming, assembly
- **Approach:** RiSE, World Robotics Olympiad (WRO)



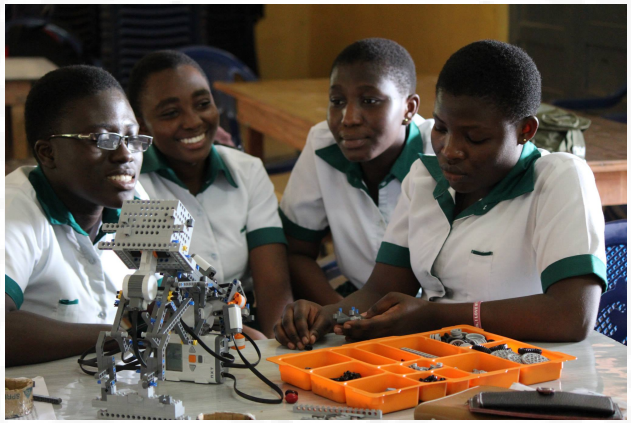


Image credit: Facebook - GRAF

Robotics on the African Continent

Ghana Robotics Academy Foundation

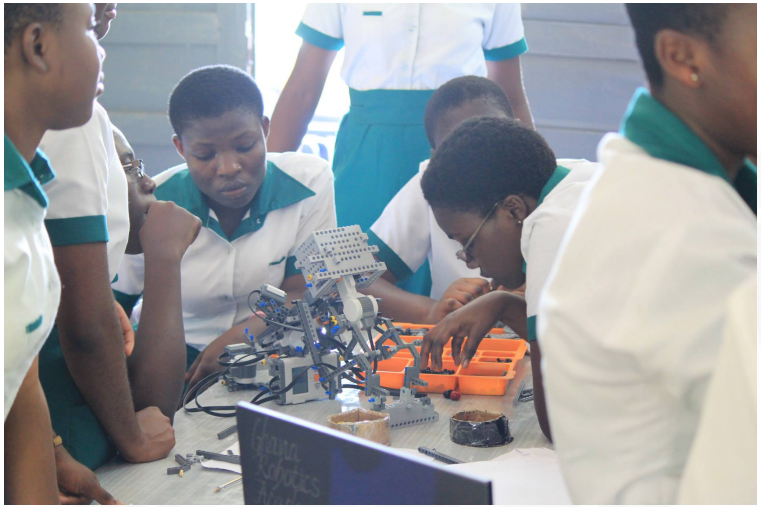


Image credit: Facebook - GRAF

Robotics on the African Continent

SenEcole

- **Reach:** Over 25 schools (as at 2016)
- **Focus:** Robot design, programming
- **Approach:** Summer STEM/robotics camps, competitions

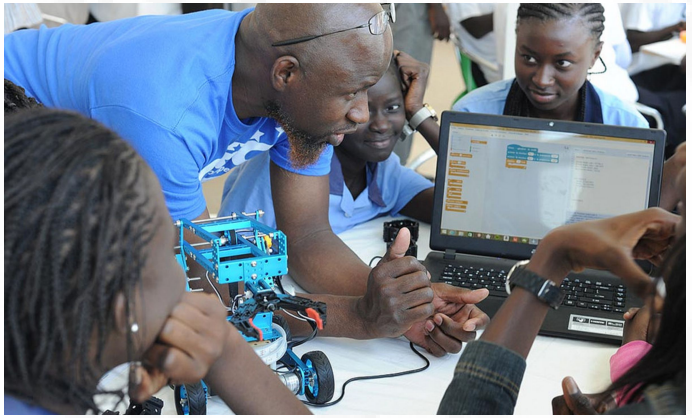
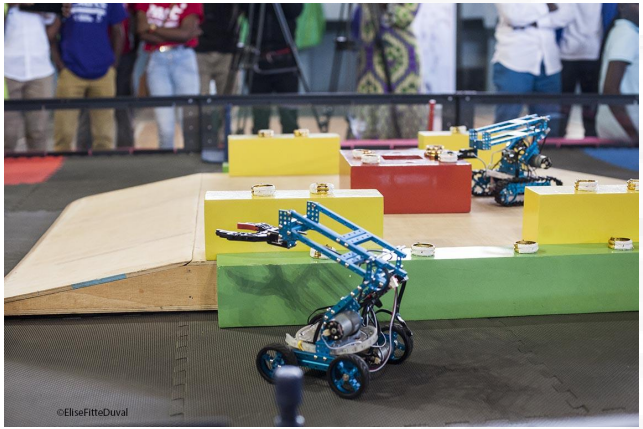


Image credit: senecole.com

Robotics on the African Continent

SenEcole - Pan-Africa Robotics Competition

PARC
Pan-African Robotics Competition

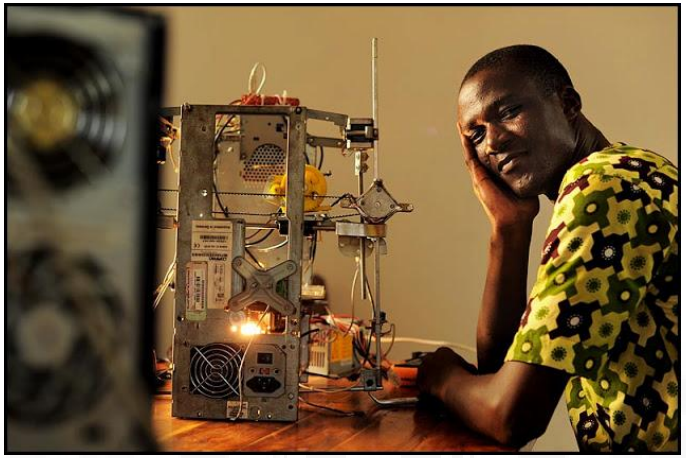


“Made in Africa”

Image credit: PARC, senecole.com

Robotics on the African Continent

WoeLabs



- **Focus:** Building innovative technology from available resources, e.g. e-waste.
- **Approach:** Shared workspace open to members for innovation

Image credit: woelabo.com

Robotics on the African Continent

WoeLabs

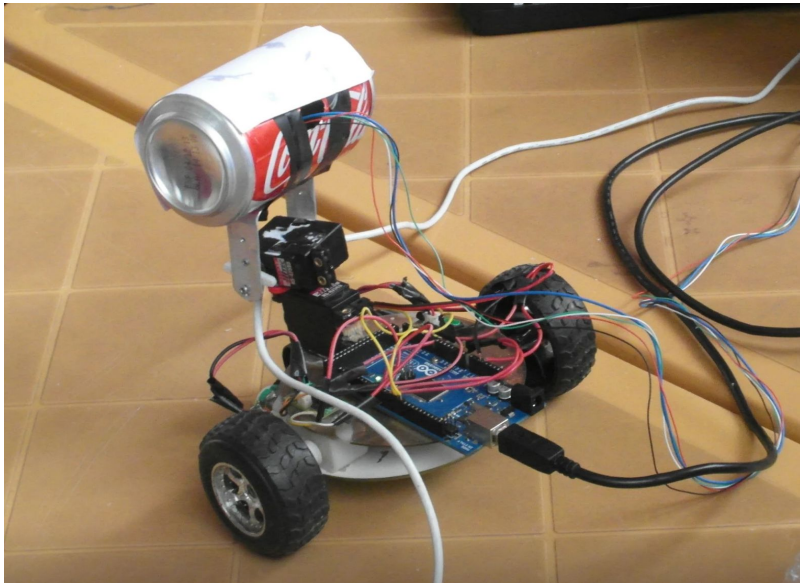
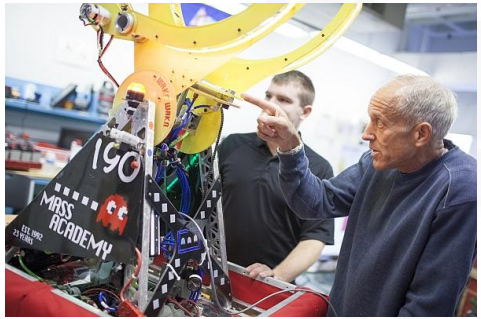
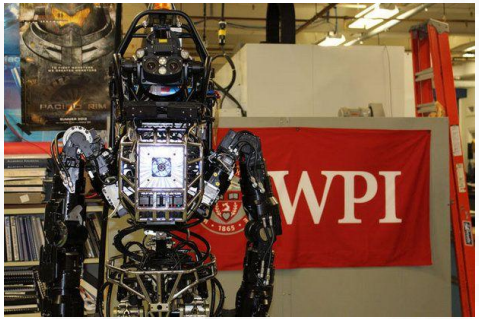


Image credit: woelabo.com

WPI Robotics Engineering

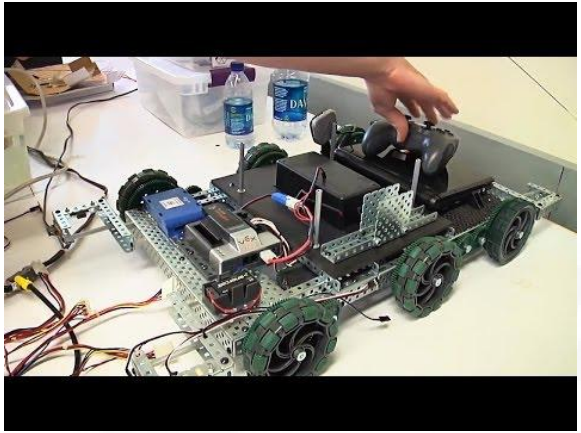
- First school in the US to offer **Robotics Engineering degrees** in the undergraduate level.
- Has **years of experience** in supporting **robotics competitions** all over the US.
- Has long history of successful **robotics summer camps** for middle and high school students.

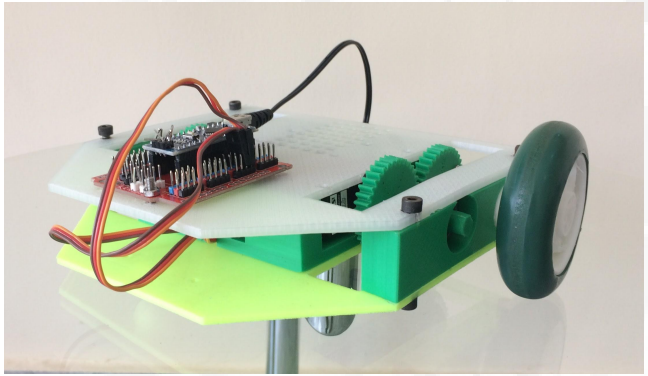




What is WPI MS4SSA Offering?

- **Free robotics training modules:**
  - From basic to advanced concepts in programming, electronics and mechanics (videos, handouts, assessments, etc.)
- **Access to 3D-printable robotic platforms:**
  - Robotic Mobile Base (< $100)
  - 3-DOF Robot Arm





“The **future** depends on us.

We are the **architects** of the society

our children will inherit.

Let’s do our best to **make it great!**”

Thank you for listening!