AFIA: Aid For Investigating Accidents

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Abstract

In Ghana and other sub-Saharan countries access to robotics is extremely limited by the lack of materials and the cost of imports. The AFIA team developed a robot made mostly out of materials readily available in Ghana in the hopes that future designs like this can help make robotics more accessible. The robot is a multipurpose robotic platform designed to travel on poorly maintained dirt roads that are common in remote areas around the world and allows for the addition of sensors to fulfill the needs of the user. The goal of this project was to create an affordable, sustainable, multipurpose robotic mobile base to expand the availability of robotic technology.

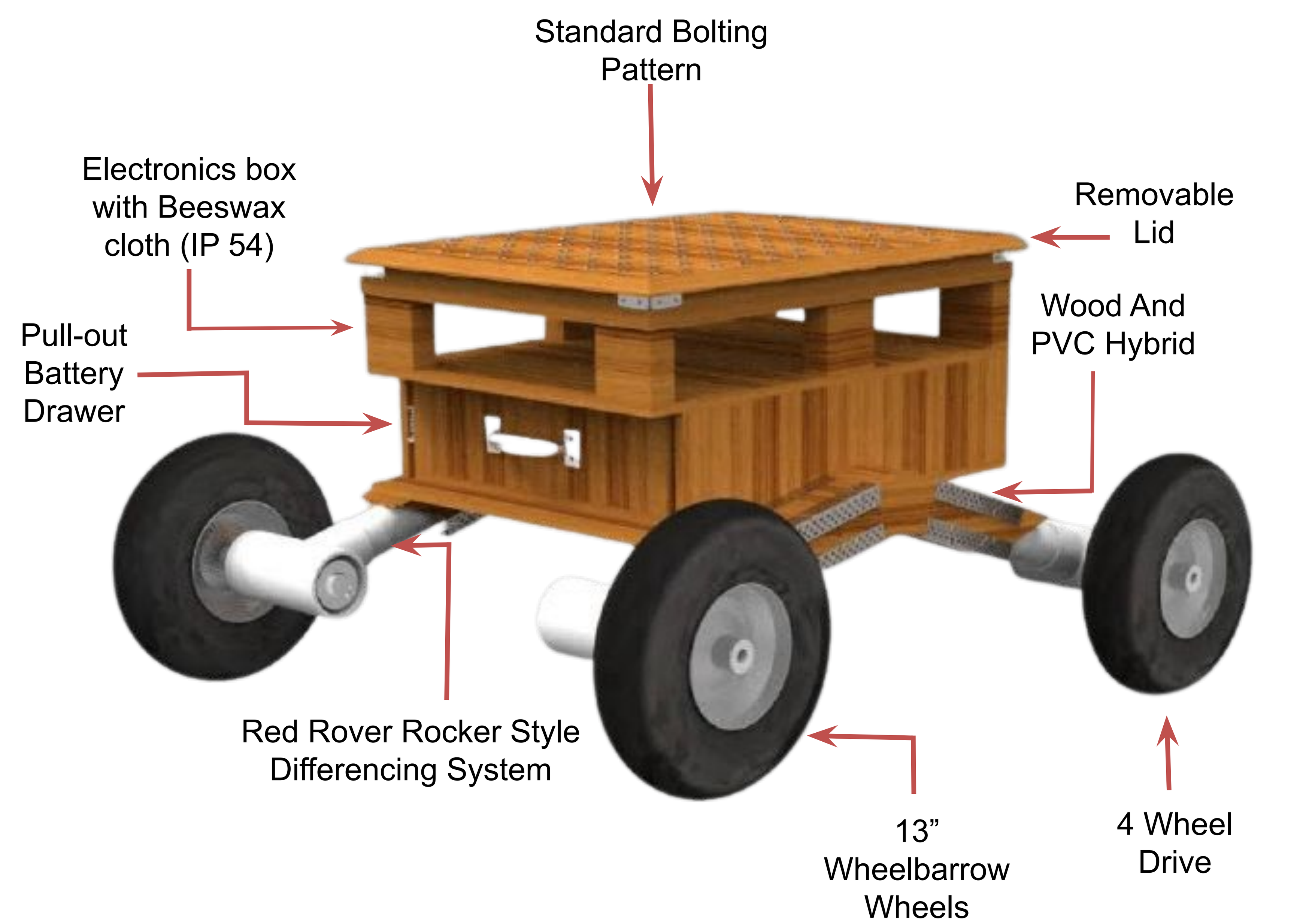
Challenges of Robots in Sub-Saharan Africa

- Traditional robot materials like metal must be imported which increases cost significantly
- Infrastructure required for robot maintenance and repair not present
- Robotics viewed as an expensive short-term solution to a long term infrastructure problems

Project Goals

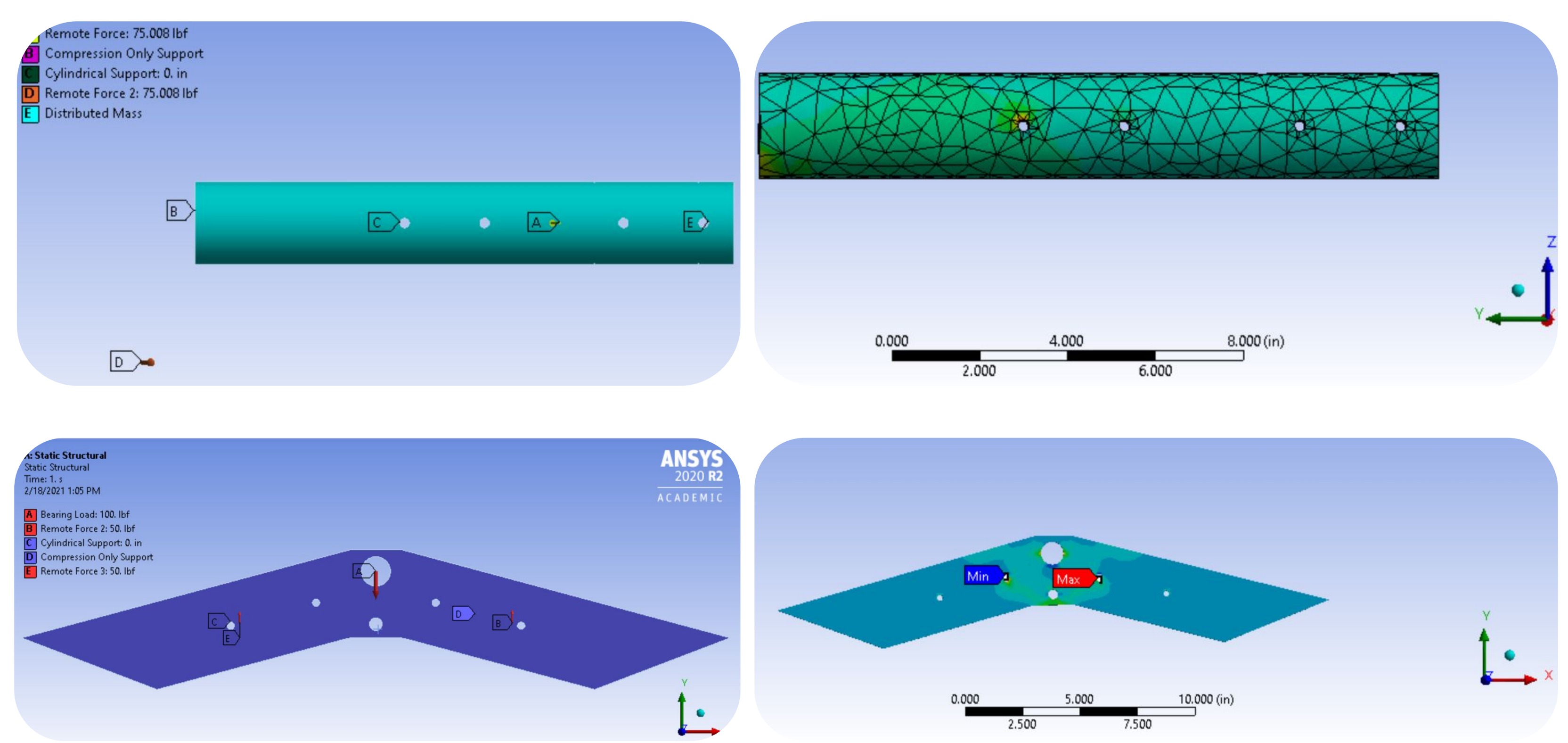
Size Goal	• Upper Bound: 4 ft by 2.5 ft by 2.5 ft disassembled • Lower Bound: 2 ft by 1 ft by 2 ft
Minimum Travel Speed on Flat Terrain	• 4 mph
Ingress Protection Rating	• IP Code 54
Maximum Ambient Operating Temperature	• 90 Degrees Fahrenheit
Teleoperation and Augmented Autonomy	• Teleop: RC controlled • Augmented Autonomy: Robot will avoid obstacles it cannot overcome
Terrain Capabilities	• Minimum Obstacle Size: 6 in • Minimum Ditch Size: 6 in
Longevity	• Battery Life Minimum: 2 hours • Payload: 20 lbs • Additional Sensors: 10 • Materials should be readily available in Ghana

Robot Design



*Not shown: Beeswax cloth and filter around the electronic box

Material Analysis



- FEA performed to ensure non-traditional materials would not break
- PVC Safety Factor:
  - Tensile = 2.8, Compressive = 7
- Teak Safety Factor:
  - Tensile = 2.75, Compressive = 54

Results

- Able to reduce the amount of imported materials, significantly but not completely
- Connection point between the rocker and the box was was highly inefficient
  - Caused a uneven load distribution which caused motor brown out
- Electronics box was able to be splash and dust proof (IP54) while operating in high temperatures
- Teleoperation and obstacle detection was achieved

Conclusion and Recommendations

- Non-traditional materials can be used to create robust robotic systems
- For rocker style flexible chassis, the rocker support must extend through the entire robot
- Recommendations:
  - Improve the augmented autonomy into full autonomous driving
  - Research into other non-traditional materials and building methods
  - Refining the current design to improve terrain capabilities

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