Robots on a Mission: Safeguarding Animals from Wildfire Disasters

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April 10, 2024

Executive Summary

Wildfires pose a severe threat to both human and animal lives, resulting in significant social, economic, and environmental impacts. These disasters are exacerbated by extreme weather conditions and climate change, with suburban areas in developed countries particularly vulnerable to economic and social devastation.

In response to this pressing issue, we propose the implementation of a cutting-edge initiative utilizing robotics technology for animal rescue and reset operations during wildfires. The primary objective is to enhance the efficiency and safety of animal rescue efforts, thereby mitigating harm to wildlife and domestic animals.

Develop and deploy robotic systems for animal rescue in wildfire-affected areas.

Enhance the safety of animals and human responders during rescue operations.

Collaborate with relevant organizations and authorities for effective implementation.

Promote public awareness and education regarding animal rescue during wildfires.

The project will explore the application of optical sensors in firefighting Vex robots, enabling them to detect and navigate towards areas with higher heat intensity, indicative of potential fire sources. By adapting the optical sensor to recognize temperature changes instead of color variations, the robots will autonomously scan their surroundings for temperature anomalies and approach areas with elevated temperatures, simulating firefighting scenarios.

The utilization of robotics technology for animal rescue during wildfires represents a groundbreaking opportunity to safeguard the lives of animals affected by these disasters. We seek support and partnership to bring this project to fruition and make a significant impact on wildlife conservation and disaster response efforts. Thank you for considering our proposal, and we look forward to discussing this initiative further and working together to protect and rescue animals during wildfire emergencies

Introduction

Fires have been used by humans for millennia and play a critical role in many ecosystems. The use of fire for hunting, favoring preferred plants for food, fodder, clearing for agriculture and grazing, easing travel and controlling pests is well documented, historical and continues today. This is particularly the case in developing countries where people depend directly on forests and agriculture for their livelihood and food security. Fires maintain some ecosystems, such as savannas. (1);(2)

About 4 % of the global vegetated area is burnt every year by fires, natural, prescribed and wild. Wildfires have significant impacts on humans and on the natural environment. They affect human lives and livelihoods and result in high social and economic costs, associated not only with the damage, but also with the prevention and suppression measures put in place every year. Fires cause large increases of atmospheric emissions and pollutants, soil erosion, reduce the provision of goods and services by forests, and change land cover patterns and landscape ecosystem dynamics1. A review of extreme wildfire events between 2002 and 2020 identified that: • Wildfires can have disastrous impacts and extreme wildfire events can be 'disasters' (characterized by impacts including damage and loss to built assets and infrastructure and loss of life), are globally distributed and nearly all (96%) are associated with dangerous and unusual weather conditions such as high fire danger, high winds, high temperatures, anomalous climatic conditions such as drought or abundant precipitation stimulating vegetative growth in arid regions.(3);(4)
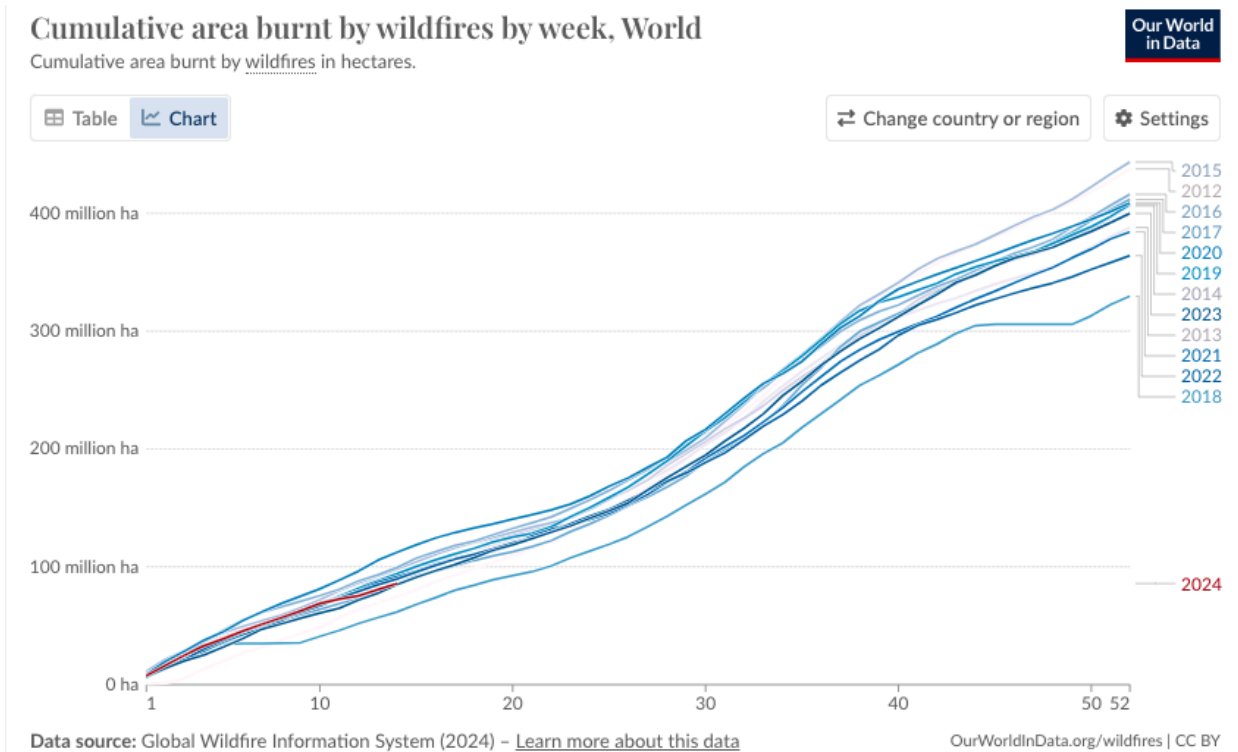
 • Wildfires reported as being economically or socially disastrous are concentrated in suburban areas intermixed with flammable forest in the developed world.
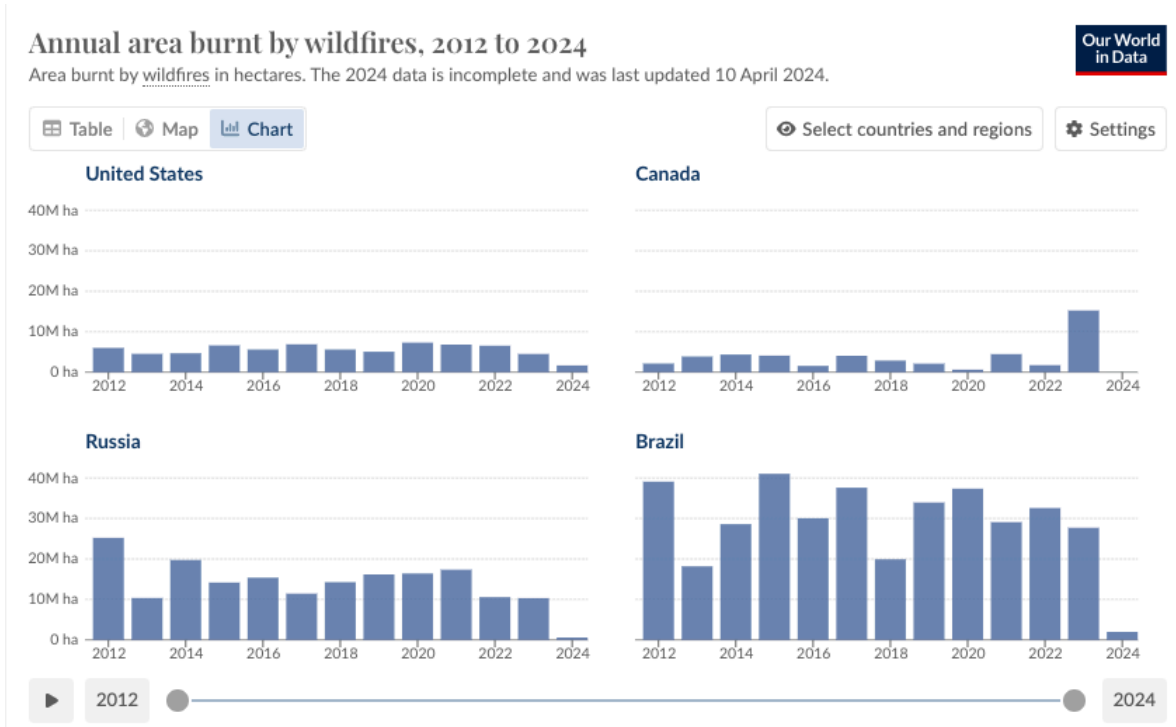
• Wildfires reported as being economically or socially disastrous are concentrated in suburban areas intermixed with flammable forest in the developed world.

• The influence of weather conditions in extreme wildfire events suggests increasing vulnerability to these events with climate change

Our planet is constantly facing several threats. From global warming and pollution to resource wastage – Earth has suffered at the hands of human mistakes. Wildfires are one of the more serious repercussions of our impact on the planet. According to the Global Fire Monitoring Center, 87% of all wildfires that occur each year are generally caused by humans. However, wildfires are becoming more prominent due to windy conditions, dry environments, and heat waves. Since we are in the AI and Robotics era, now we need to explore advanced wildfire technology that can help to fight in a smarter way.(6)
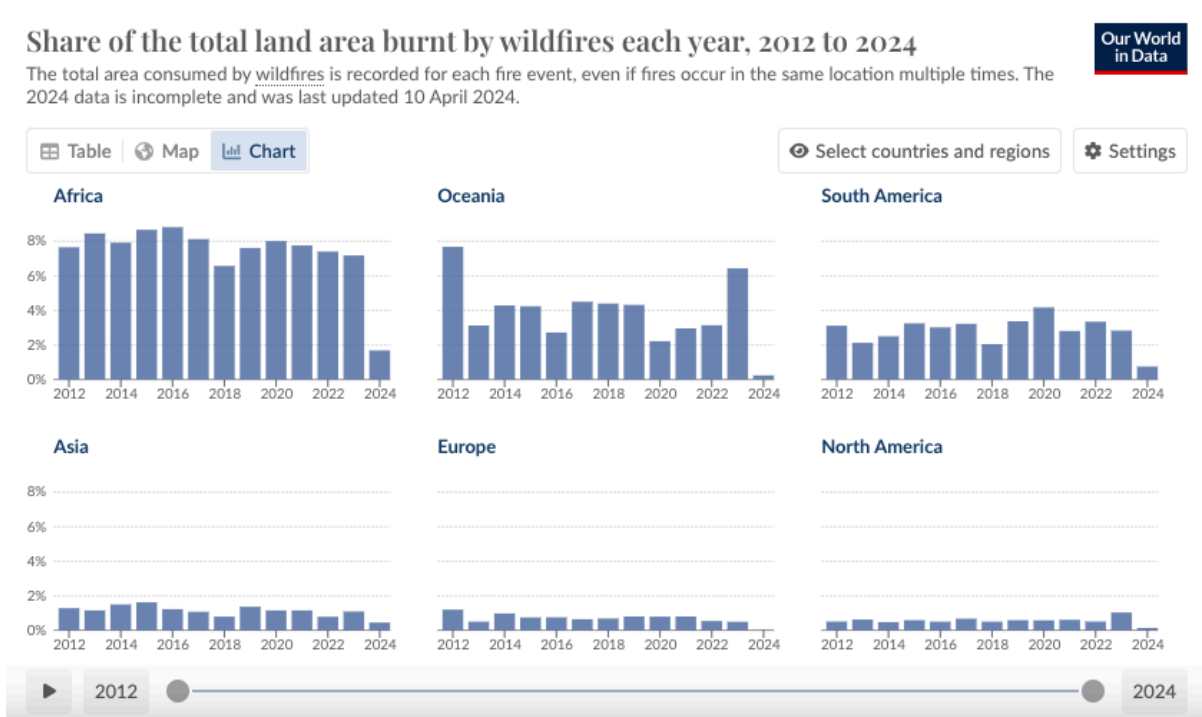
Cumulative are burn by wildfires by Week World

Cumulative area burnt by wildfires by week, World
Cumulative area burnt by wildfires in hectares.

Data source: Global Wildfire Information System (2024) – Learn more about this data

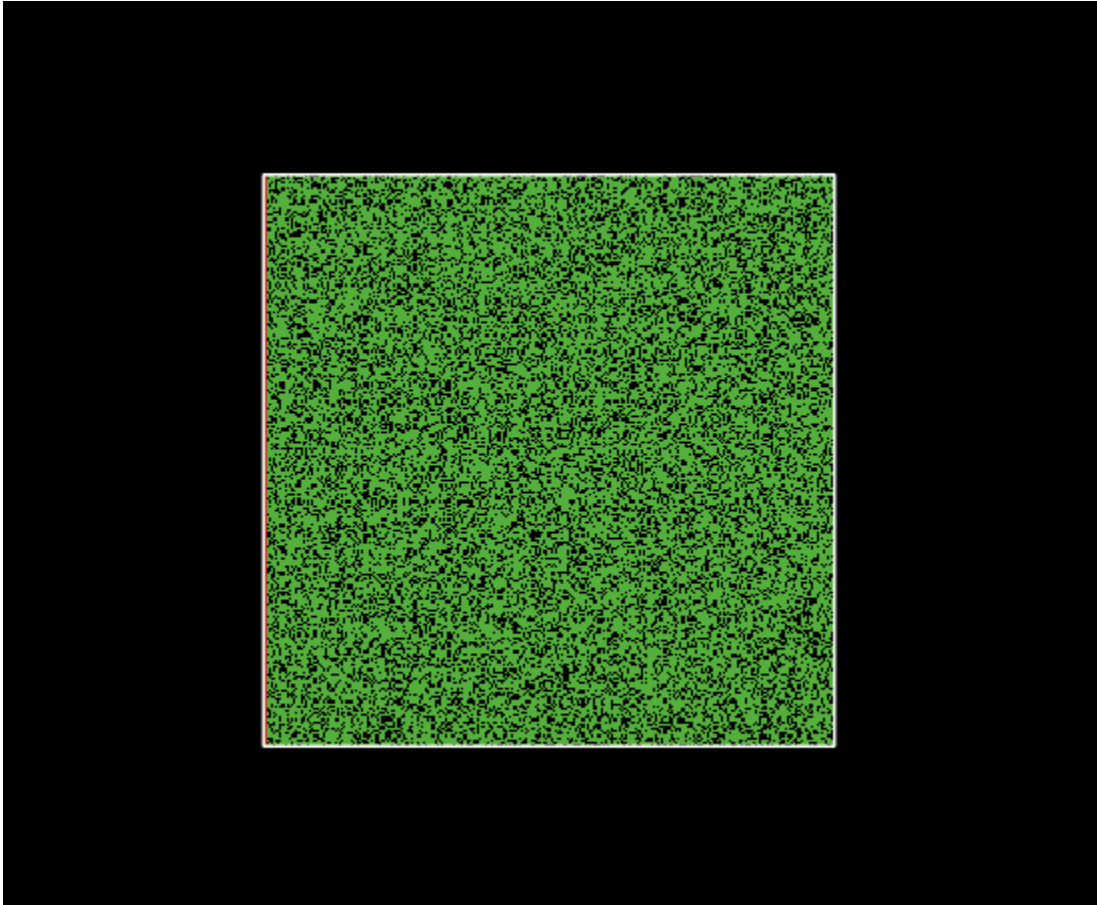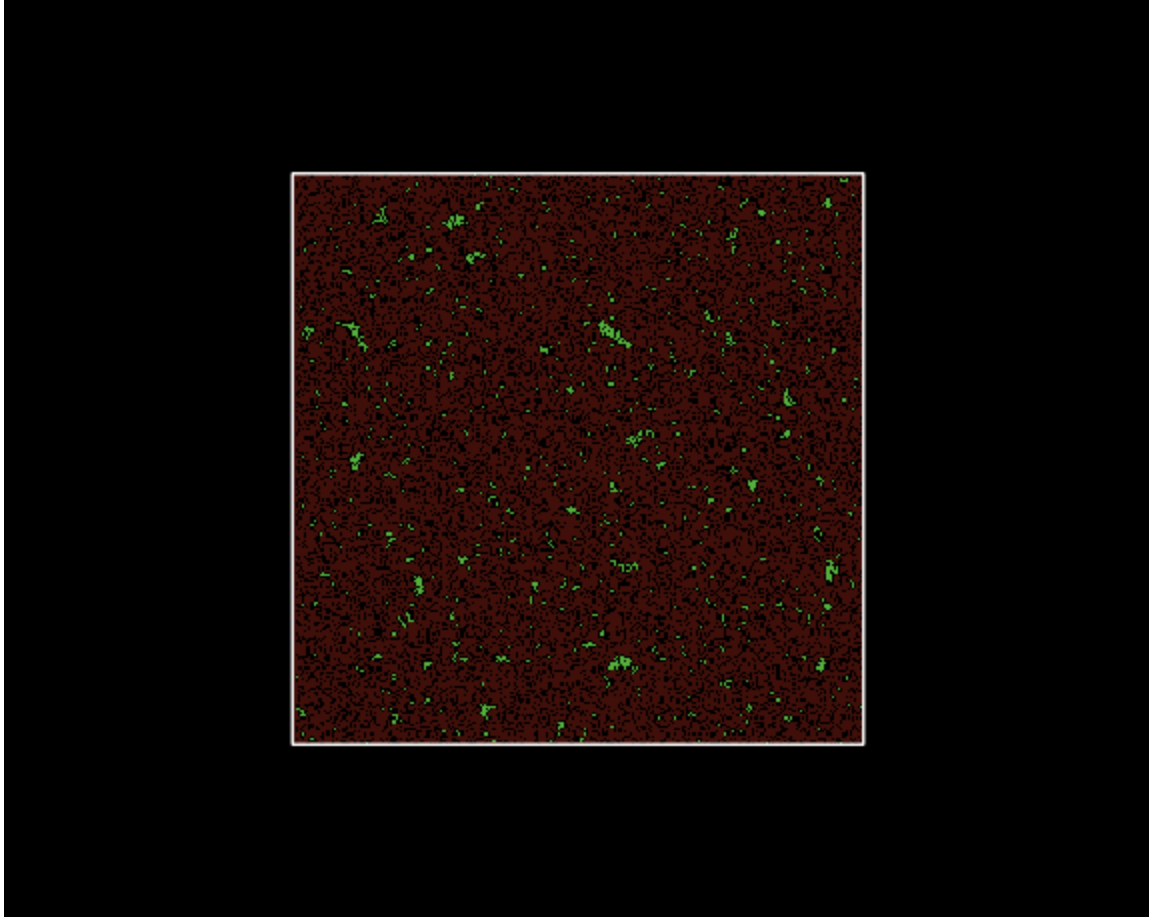OurWorldInData.org/wildfires | CC BY

Source Our World Data (8)

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Source Our World Data (8)

WildFire Simulation NETLOGO

Density 70%

Percent burned 97.7%

Probability of spread 95%

PLAN

We propose the implementation of a cutting-edge initiative that employs robotics technology to rescue and reset animals affected by wildfires. The primary objective of this project is to enhance the efficiency and safety of animal rescue operations during wildfires, thereby mitigating the harm caused to wildlife and domestic animals.

Background: Wildfires pose a severe threat to the well-being of animals residing in forests, natural habitats, and even in residential areas. The conventional methods of animal rescue during wildfires often encounter limitations due to the dangers posed by the fire itself. Deploying specialized robots equipped with rescue capabilities can significantly improve the effectiveness of these operations.

Project Goals:

- Develop and deploy robotic systems for animal rescue in wildfire-affected areas.
- Enhance the safety of both animals and human responders during rescue operations.
- Collaborate with wildlife conservation organizations, fire departments, and relevant authorities.
- Promote public awareness and education regarding animal rescue during wildfires.

Robots VEX EXP

The EXP Controller is used to wirelessly control the EXP robot.

Source Vex (7)

Using the Driver Control Program, the straightforward, user-friendly design of the EXP Controller helps students navigate the buttons and joysticks with ease. The Brain's Driver Control program to carry out robotic movements such as driving the robot forward, in reverse, left, and right without coding.
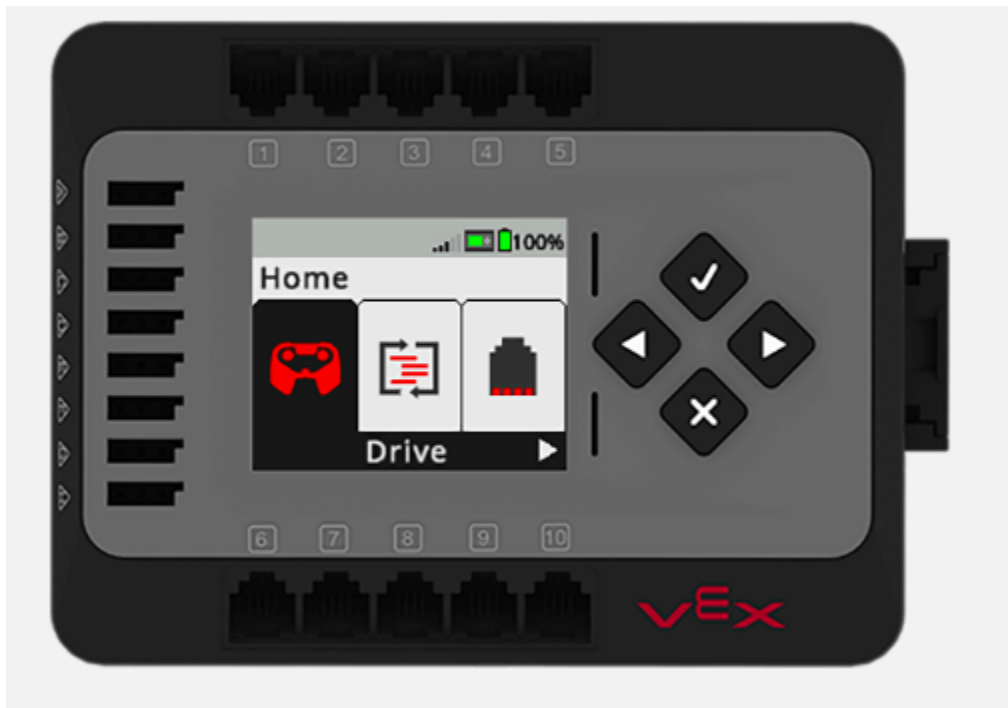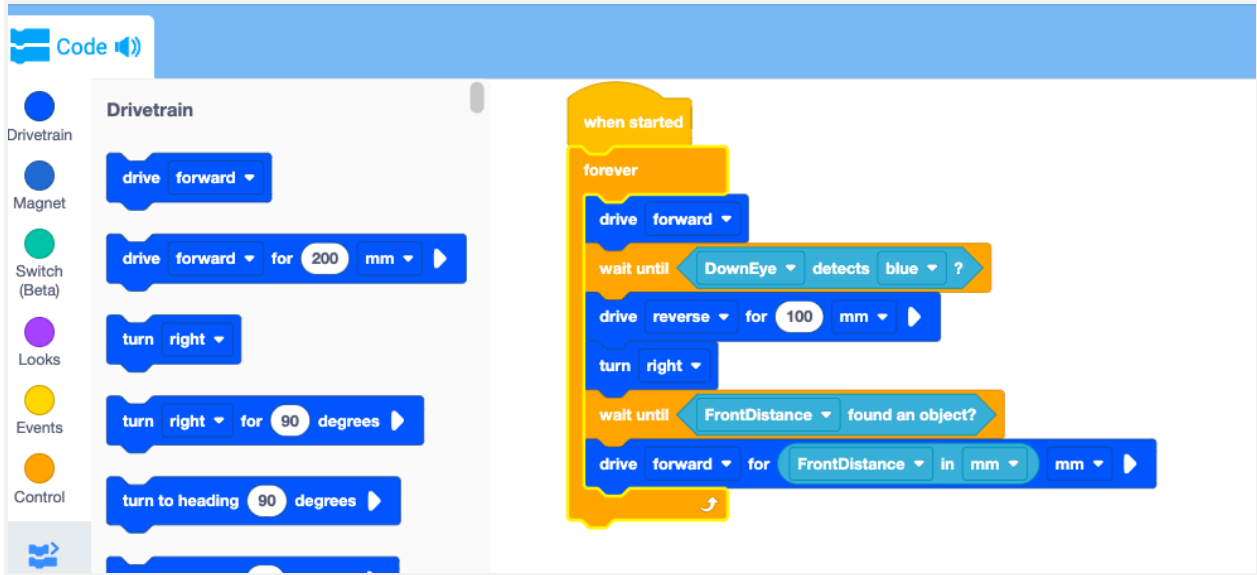

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The optical Sensor can detect and report the proximity of an object, its colors and the brightness of light surrounding the sensor.
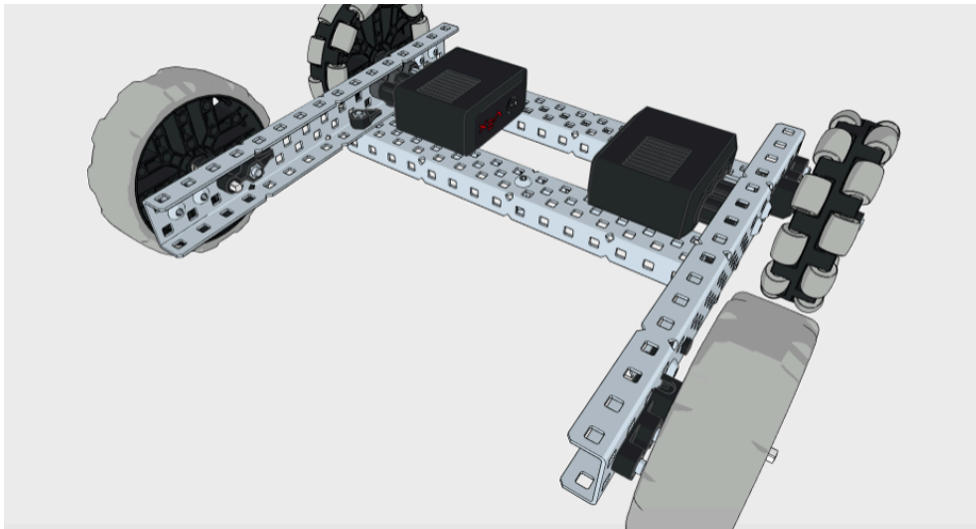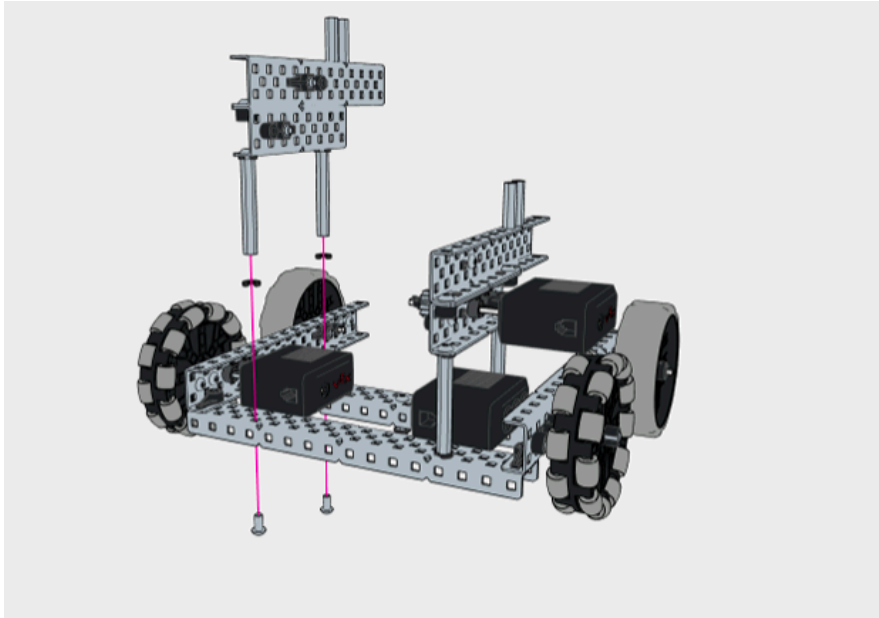

Source Vex (7)

Coding with VEX EXP
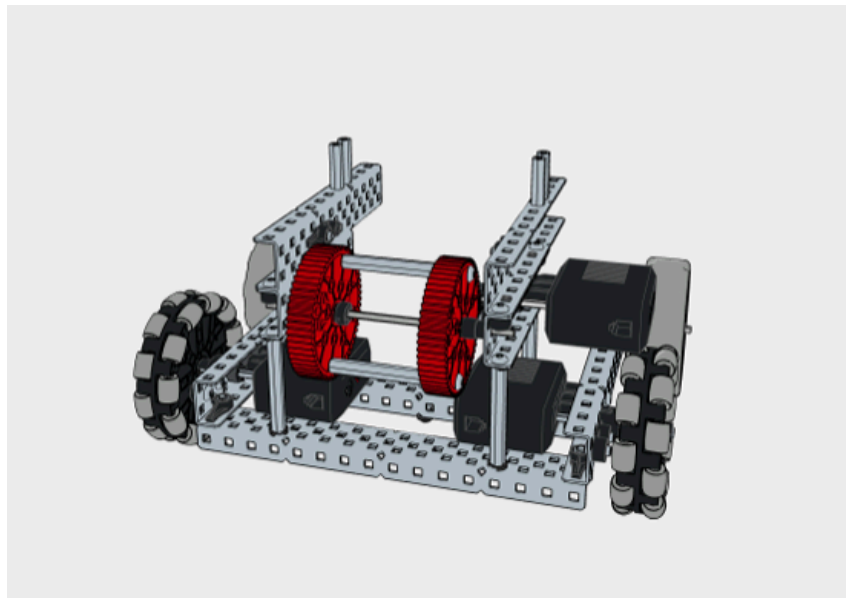

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Build Instructions

Step 1

Source Vex (7)

Step 2

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Step 3

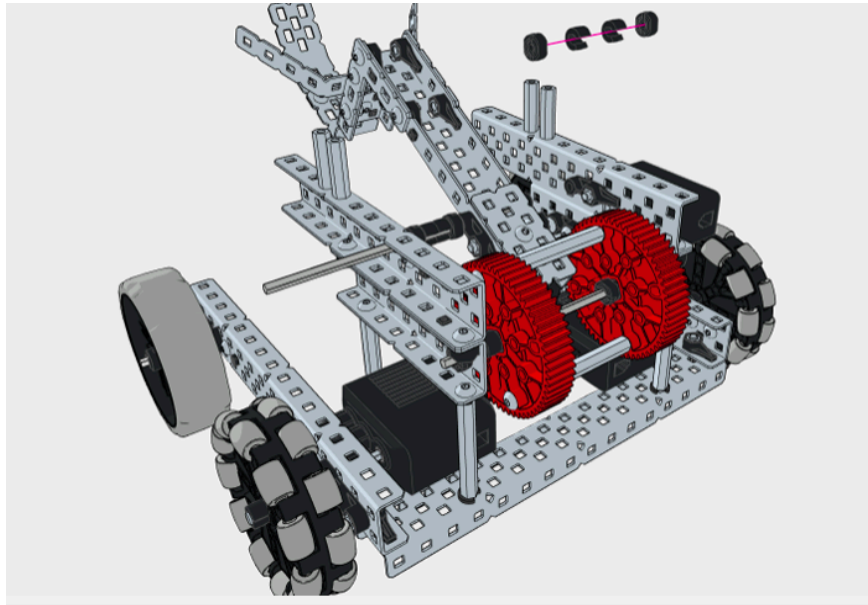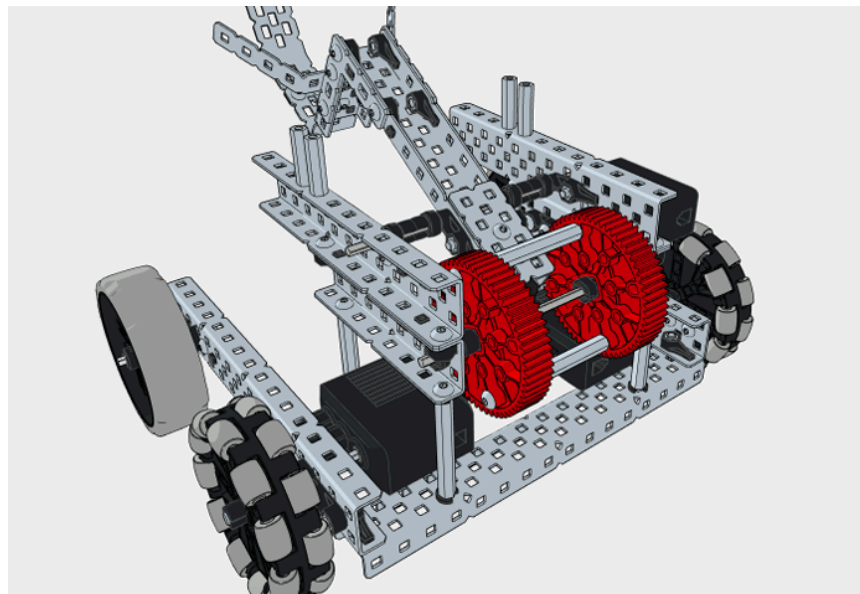Source Vex (7)

Step 4

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Step 5
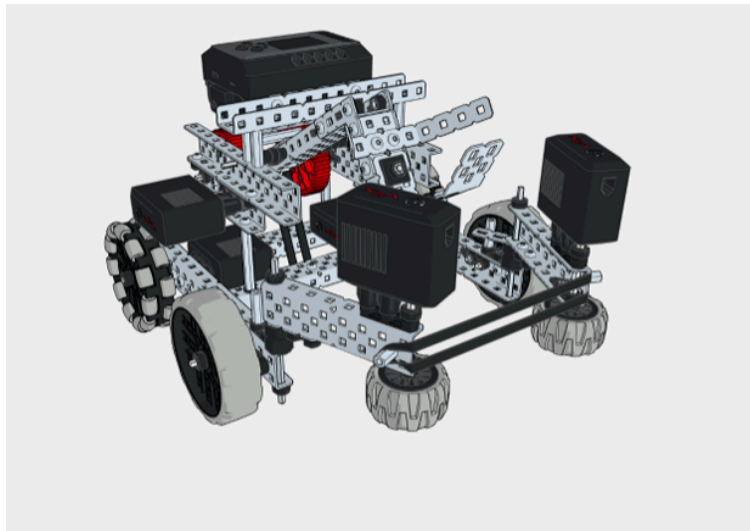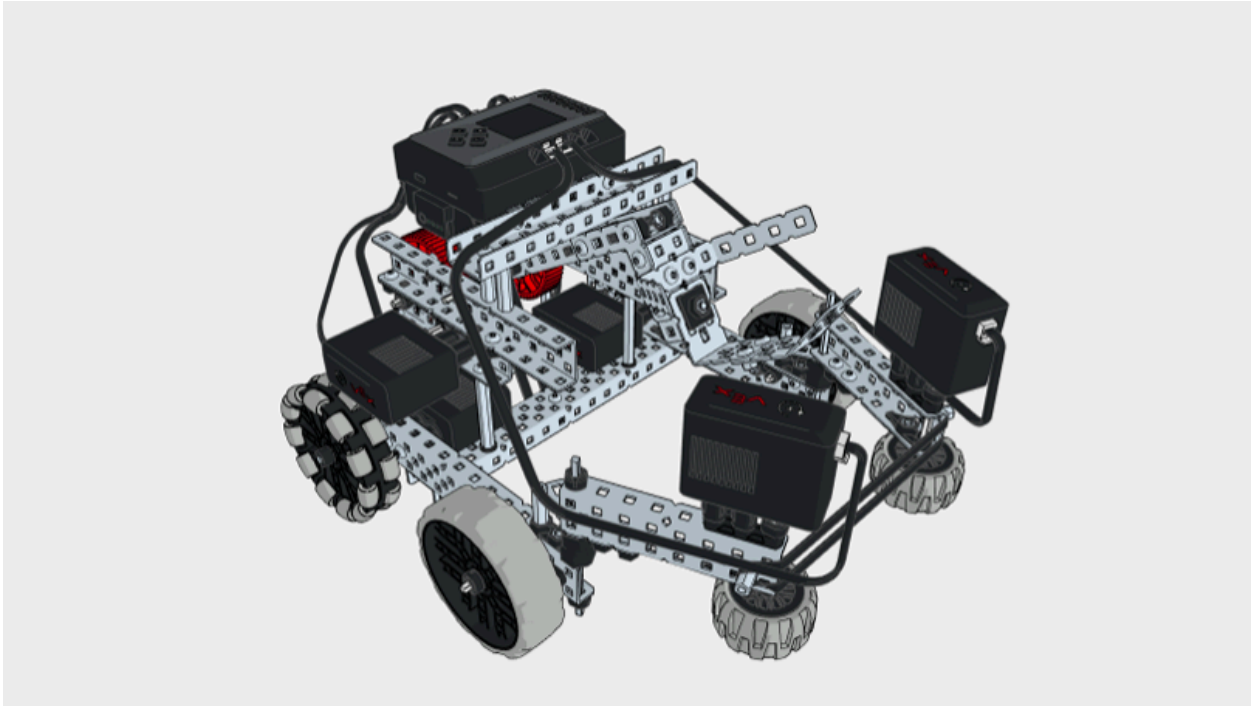

Source Vex (7)

Step 6

Source Vex (7)

Step 7

Source Vex (7)

Step 8

Source Vex (7)

Results

Robotic Technology:

- Acquire and adapt robotic platforms capable of traversing wildfire-affected terrain.
- Equip robots with cameras, sensors, and manipulator arms for locating and rescuing animals.
- Implement remote operation capabilities for human control and supervision.

Animal Detection and Rescue Algorithms:

- Develop algorithms for identifying and tracking animals in real-time using robotic sensors and cameras.
- Create algorithms for safely capturing and securing animals for transport to safety.
- Establish a communication network between robotic systems, human operators, and emergency responders.
- Collaborate with wildlife experts, veterinarians, and animal rescue organizations to ensure the well-being of rescued animals.
- Number of animals rescued and reset during wildfire incidents.
- Response time for robotic systems to reach and rescue animals.
- Effectiveness of robotic algorithms in animal detection and capture.
- Public engagement and awareness levels.

The utilization of robotics technology for animal rescue during wildfires represents a groundbreaking opportunity to safeguard the lives of animals affected by these disasters. We seek your support and partnership to bring this project to fruition and make a significant impact on wildlife conservation and disaster response efforts.

Conclusions and Discussions

The integration of robotic technology in wildfire response efforts holds immense potential for improving the rescue and rehabilitation of animals affected by these devastating disasters. By leveraging robotic platforms equipped with advanced sensors, cameras, and manipulator arms, we can effectively navigate and traverse challenging terrain to locate and rescue animals in distress. The development of sophisticated algorithms for real-time animal detection and tracking, coupled with safe capture and transport protocols, further enhances our ability to swiftly and efficiently rescue animals from wildfire-affected areas.

Through collaboration with wildlife experts, veterinarians, and animal rescue organizations, we ensure the well-being of rescued animals and optimize our

rescue operations. Moreover, establishing a robust communication network between robotic systems, human operators, and emergency responders enhances coordination and facilitates timely decision-making during rescue missions.

Key metrics such as the number of animals rescued and resettled, response time for robotic systems, effectiveness of robotic algorithms, and public engagement levels serve as indicators of the success and impact of our efforts. By monitoring and evaluating these metrics, we can continuously improve our capabilities and maximize our contribution to wildlife conservation and disaster response initiatives.

In conclusion, the utilization of robotics technology for animal rescue during wildfires presents a groundbreaking opportunity to mitigate the impact of these disasters on wildlife populations. We invite your support and partnership in realizing this vision, as together, we can make a tangible difference in safeguarding the lives of animals and preserving biodiversity in wildfire-affected regions.

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