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Internet of Robotics Things (IoRT) Based Integration of Robotic Applications for Advanced Research

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Research Article

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Abstract— IoT and robotics industries are united to create the Internet of Ro- botics Things (IoRT). IoRT is the idea of intelligent machines monitoring the environment around them and using local and distributed intelligence to decide on courses of action and making decisions accordingly. IOT is a network of de- vices that are connected to the internet, including devices and equipment con- nected by sensors. These elements are essential for businesses trying to drive customer facing innovation, data-driven decisions, new applications, digital transformation, business models and revenue streams. Robots must be very flexible in order to respond to unforeseen circumstances. These robots can handle any unexpected situation with the aid of AI. Robotics and Simulation are key elements in the solutions of advancing manufacturing and production. Many people often think of IoT and robotics technologies in separate fields but they have been get- ting increasingly close in recent years. The In this way, such processes are used to avoid the loss of human life and the automation of processes which need high performances. Robotic and simulated application have been successfully de- ployed to functions in real world scenarios that man will not be able to accom- plish such as study of volcanoes, and space center on its own. Additionally, robotic implementations allow robots to operate safely and effectively in challenging environments without suffering physical harm.

Introduction

Robots and Internet of Things (IoT) devices use sensors to collect data about their environment, process that data, and make choices. IoT apps can only handle certain tasks, but robots are better equipped to handle unexpected situations. Robots are active and function in the real world, which is the primary difference between the robotics community and the Internet of Things. It occurs. Additionally, efforts are increasingly concentrated on the physical aspect of the Internet of Things, rather than the cyber component. Up until now, a number of closely related but distinct goals have mostly dominated the robotics and Internet of Things communities. IOT focuses on auxiliary services, while robotic Communities emphasize autonomy, engagement, and productive activity. Combining two concepts would boost their worth. This is exactly how the Internet of Robotic Things came to be. With the use of IoT sensor and data analytics technology, robots can perform their tasks more efficiently thanks to improved situational awareness.Although the concept of automation is not new, its popularity is growing as labor prices increase. With the same number of employees, we can increase total productivity by using robots in the workplace. The Internet of Things may be used for both fixed and mobile applications. While some would alter the program, others would continue with it. These robots' increasingly advanced sensors will be a crucial consideration for businesses and consumers alike.
The scientists may automate their work to get the predicted outcomes using a variety of open-source and free robotic platforms and simulation frameworks. Additional steps are

planned when the outcomes on robotic platforms and simulations are deemed appropriate [1, 2]. The robotic platforms provide a collection of databases, protocols, and software designed to make the task of creating intricate and reliable robot movements in a variety of real-time industrial scenarios easier. From the robot's perspective, difficulties that seem straightforward to humans also vary greatly depending on the activity and environment. Such robotic systems are very helpful in delicate environments where programmable gadgets or automated machinery might be installed. While seated in a distant control room, the scientists and data analysts may get the data via satellite or other wireless methods. [3, 4].

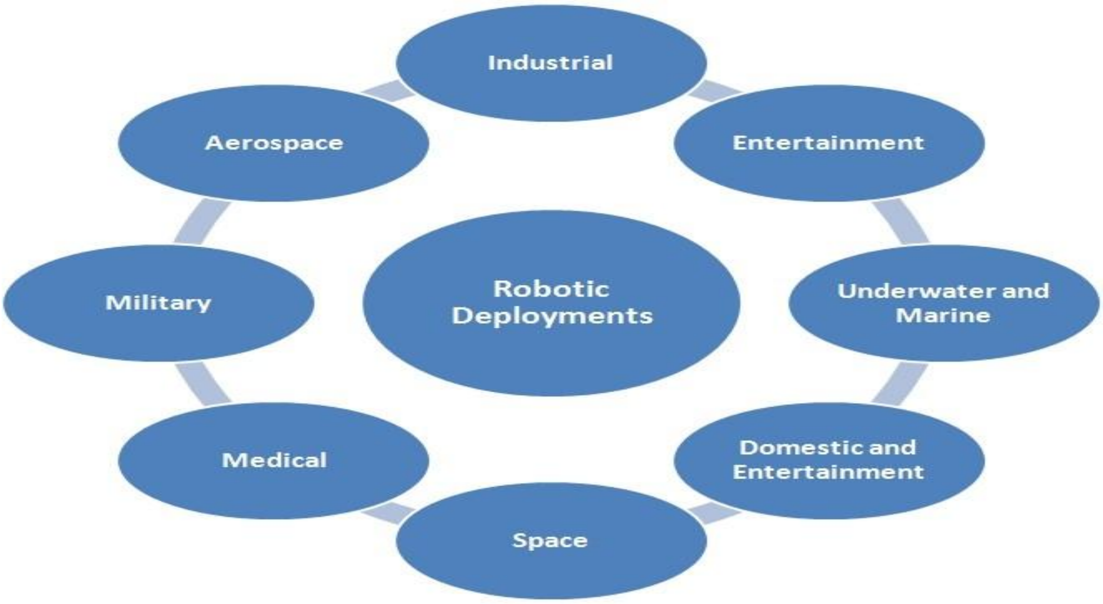

Fig. 1. Key Dimensions of Robotic Deployments

Robotic platforms typically have the following features: • CAD templates can be imported for mechanical and production engineers; • OpenStreeMap and Google Maps can be integrated for real-time locations; • The interface is simple to use; • Plugins and icons for various automations, such as automotive, space, drones, aerospace vehicles, volcanoes, underwater, marine, aircraft, and many more • Several programming languages are integrated for feature customization; the output is exported in various formats. • Collaboration with many libraries from various technical fields to ensure compatibility

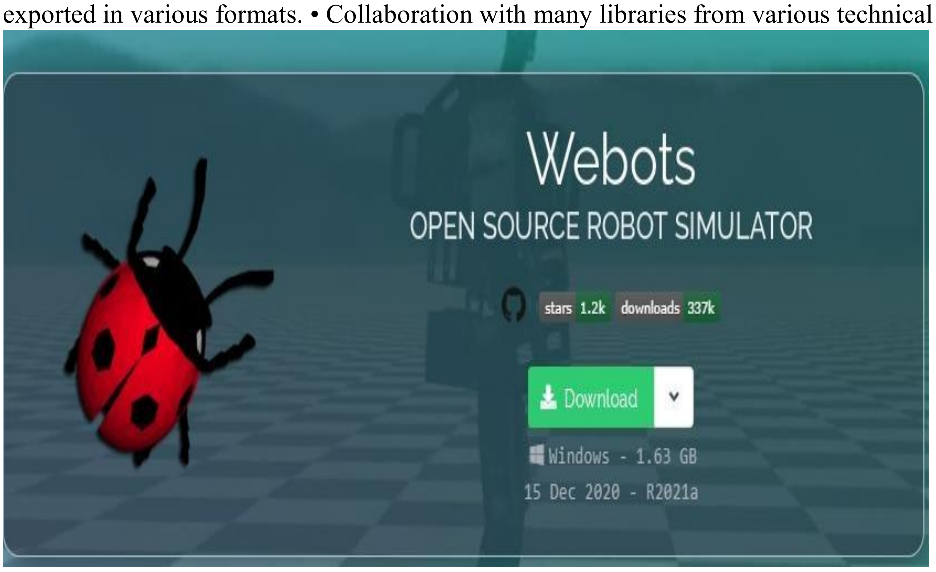

Fig. 2. Official Portal of Webots

Following are the free and open-source robotics development frameworks which are widely used for industrial, social, corporate, military and related applications. These are programmable libraries with support to customize as per the requirements of the domain in which to implement [7, 8, 9].

Table 1. Free and Open Source Platforms for Robotic Simulations

Robotic Simulation Platform	**URL**
Webots	cyberbotics.com
Gazebo	gazebosim.org
Robot Operating System	ros.org
Open Robot Control Software	orocos.org
Yet Another Robot Platform	yarp.it/git-master
Mobile Robot Programming Toolkit	mrpt.org
Robatarium	robotarium.gatech.edu
Poppy-Project	poppy-project.org
CoppeliaSim	coppeliarobotics.com

Working with Robotic Scenarios for Industrial and Corporate Applications

A cross-platform tool for industrial robotic applications and simulation is CoppeliaSim. For a variety of circumstances, this tool enables the creation of portable, scalable, and easily maintainable simulations [10, 11, 12]. Interfaces to many programming languages, including C, Lua, Java, Python, Matlab, and Octave, are available in this framework. The Cop-peliaSim Robot Simulator uses a distributed control architecture framework for an interactive production environment. For high performance control-based applications, each object or model must be individually controlled by an embedded script. These characteristics provide CoppeliaSim very flexible and adaptive capabilities for a wide variety of robotic systems [13]. High-speed algorithms, plant modeling, quick prototyping, validations, remote control, double-check security, automatic double-checking, and many more applications are developed using CoppeliaSim [14, 15]. The following are the main characteristics of CoppeliaSim that make it a very efficient and performance-based platform for a variety of applications, such as engineering, aerospace, military, health sciences, and many more. [16, 17] Remote APIs; collision detection; minimum distance computation; physics and dynamics; dynamic particles; kinematics; path and motion planning; integrated editing modes for customization; custom user interfaces; high performance data import/export; RRS interface and motion library; full interaction modes in multiple dimensions and coordinates; full-featured scene hierarchy Coppelia Sim with Bullet mechanics, Newton, Differential Equations, and other integrations can be used to implement the convergence of dynamics and physics. This allows for simple and efficient dynamic calculations that simulate real-life physical and entity encounters, such as collision reaction, grabbing, collision response, grasping, and many more. Time graphs may be successfully combined with xy-graphs or 3D curves, and many recordable data sources (including user-dependent) can be seen [18, 19, 20]. Viewable objects for a dynamic environment with camera objects, vision sensors, and proximity sensors are among the elements that CoppeliaSim incorporates for real-time automations [21].

Collision Detection and Avoidance in CoppeliaSim

The implementation of collision detection and avoidance, one of the main characteristics of robots, is briefly described here. Should a robot be created for industrial or commercial use, it should be designed to avoid colliding with other parts or equipment inside the industrial facility. CoppeliaSim makes it simple to configure the collision detection and avoidance module, ensuring that the robotic application's appearance and feel are maintained. You can efficiently set up the collision and distance parameters under Menu->Tools->Calculation.

Fig. 3. Collision Detection in Robotic Platform of Coppelia

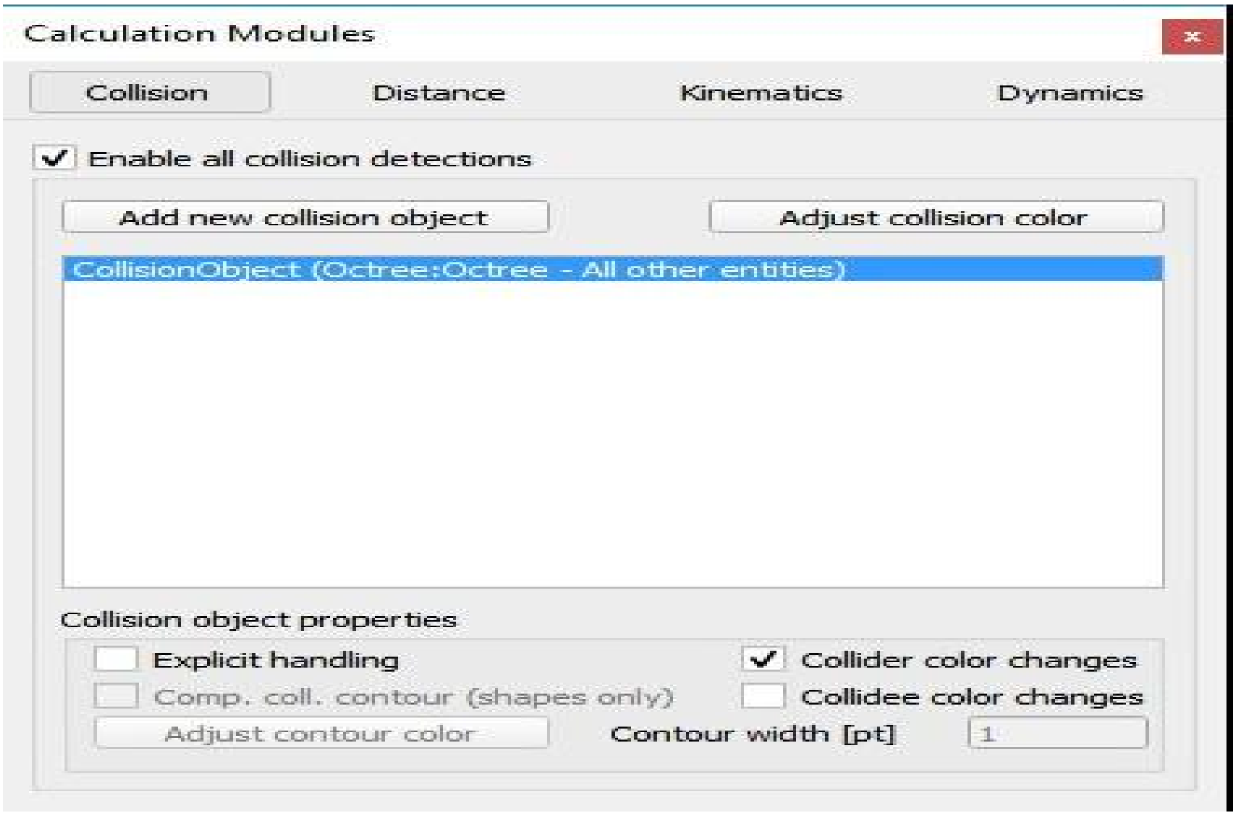

Fig. 4. Setting Panel to Detect Distance for Collection Avoidance

Conclusion

In robotic applications, where real infrastructure and equipment are highly expensive to build, scientists and practitioners have a great deal of flexibility in simulating their research activities utilizing these open source platforms. Open source libraries and frameworks make it simple for researchers to develop, model, and get research-based results from their algorithms and iterations without the need for physical hardware and devices.

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