# New Features Implementation for Servosila Engineer Model in Gazebo Simulator for ROS Noetic

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**Abstract**

Virtual experiments play an important part in robotics allowing to reproduce complex environments, perform complicated and risky tasks. Yet, a virtual model is not always a one-time build action and it requires revisions in a timely manner as operating systems and dependent software evolves. This article presents a number of technical updates of the Servosila Engineer crawler type robot virtual model. The model evolution necessity was caused by a migration from an outdated robot operating system (ROS) of Melodic version to the modern ROS Noetic version. In addition to migration issues, for the robot virtual model a new onboard torch control unit and a robot head aligning unit were developed.

*Keywords*: ROS, Simulation, Servosila Engineer crawler type robot, Gazebo, Webots.

## 1. Introduction

A simulation is useful for evaluating new algorithms in complex virtual environments. It decreases chances of serious robot's malfunctions during real time experiments due to conceptual or coding errors. Simulators are often employed in a wide variety of situations, including manufacturing[1][2], medical[3][4], and urban search and rescue operations[5]. Additionally, a simulation allows to easily replicate complex environments[6]. This article presents an updated virtual model of the crawler robot Servosila Engineer and demonstrates a methodology of enhancing the model in accordance with actual robot behavior. The virtual model is upgraded from ROS Melodic to ROS Noetic version.

## 2. Real robot and its virtual models

The Servosila Engineer robot (Fig.1) was designed by Russian company Servosila[7]. The robot is equipped with four cameras, a laser rangefinder, an inertial measurement unit sensor, and a light source that allows acquiring data about surroundings in absence of external light sources.

A robot virtual model for the Webots simulator[8] is one of our most recent research initiatives. Webots has an excellent physics-based realization, a high level of visual realism and already contains tracks for a crawler-type robot that are typically difficult to generate. The simulation model of the Servosila Engineer robot is shown in Fig.2.


Fig.1. Servosila Engineer robot

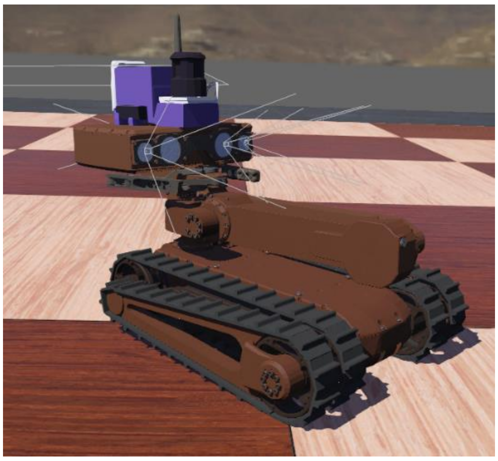
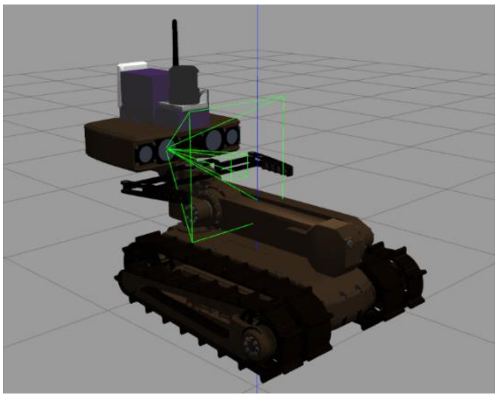


Fig.2. Webots simulation model

Even though various options are available for creation of different types of crawlers and ROS-based systems in Webots, it has a number of disadvantages, e.g., a lack of some types of plugins, including *mimic* joints that are widely presented in the Servosila Engineer model[9]. Separate scripts are needed to generate *mimic joints* to complete the robot model. The current version of the Servosila Engineer with all controllers and on-board sensors was presented in[10].

Several Servosila Engineer models are currently available in Gazebo simulator. Since there are no built-in virtual crawler models for a tracked base, solutions using various wheels to approximate traditional tracks were proposed[11]. A variety of plugins that enable creation of mimic joints and additional artificial light sources made it a valuable option. The Servosila Engineer model for Gazebo simulator (Fig.3) with controllers and a navigation algorithm[12] was demonstrated in[13].

Fig.3. Gazebo simulation model



## 3. New features of the Gazebo model

### 3.1. *ROS upgrade*

One of the goals was to migrate the Servosila Engineer model from ROS Melodic to Noetic version. If a ROS-project does not include specific packages, a migration typically easy and goes smoothly. Yet, one of common packages, *tf*, appeared to have issues while switching from Melodic to Noetic version. In all previous versions of ROS *tf* package allowed users to add namespaces for individual robots in order to launch several homogenous robots within a single simulation. However, the first version of ROS Noetic removed this function. To resolve this issue, we manually compiled an earlier version of *tf* package that is still functionally sound. Due to a standard type of ROS packages, a compilation process was successfully completed.

### 3.2. *Elbow-neck motion*

When the real robot moves, its head joint moves simultaneously with the elbow joint (up or down) to create the head motion and align the head with the horizon. While this feature had been missing in the previous Gazebo model of the robot, a new ROS-node was created to provide such motion. After calculations, the node resends to the head joint commands, which were originally delivered to the elbow joint. The control scheme for the elbow-neck joint motions is shown in Fig.4.

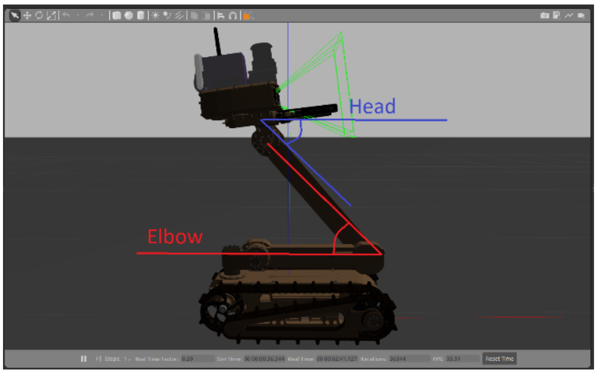



Fig.4. Elbow-neck joints movement scheme (red angle – elbow joint, blue angle – neck joint)

### 3.3. *Onboard torch*

Migration between ROS versions caused problems with the torch presented in Gazebo simulation model. In Melodic version to manipulate a torch status the following command is used:

*rosservice call /gazebo/set_light_properties '{light_name: "spot", diffuse: {r: 0.0, g: 0.0, b: 0.0, a: 1.0}, attenuation_constant: 0.8, attenuation_linear: 0.01, attenuation_quadratic: 0.0}'*

Table 1. Parameters for setting up the light in Gazebo in different versions of the ROS

| *Parameter name* | *ROS Melodic* | *ROS Noetic* |
|---|---|---|
| light_name | yes | yes |
| diffuse | yes | yes |
| specular | **no** | **yes** |
| attenuation_constant | yes | yes |
| attenuation_linear | yes | yes |
| attenuation_quadratic | yes | yes |
| direction | **no** | **yes** |
| pose | **no** | **yes** |

Using the above listed command, the torch calling service responsible for light sources in the scene could be turned off. The same service is available in Noetic version. However, the same command causes the Gazebo simulator crash. To fix this issue, the service structure was modified and the new light control command was formed as follows:

*rosservice call /gazebo/set_light_properties '{light_name: "spot", diffuse: {r: 255.0, g: 255.0, b: 255.0, a: 255.0}, specular: {r: 230.0, g: 230.0, b: 230.0, a: 255.0}, attenuation_constant: 0.8, attenuation_linear: 0.01, attenuation_quadratic: 0.0, direction: {x: 0.0, y: 0.0, z: 0.0}, pose: { position: {x: 0.0, y: 0.0, z: 0.0}, orientation: {x: 0.0, y: 0.0, z: 0.0, w: 0.1}}'*

This command successfully turns the torch off. The light parameters used for the Servosila Engineer robot in ROS Melodic and Noetic are listed in Table 1.

## 4. Conclusion

This article presents a number of technical updates of the Servosila Engineer crawler type robot virtual model. The model evolution necessity was caused by a migration from an outdated ROS of Melodic version to the modern ROS Noetic version. In addition to migration issues, for the robot virtual model a new onboard torch control unit and a robot head aligning unit were developed and validated.

## Acknowledgements

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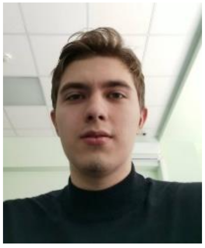

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