Dagozilla Mechanical Description 2022

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Abstract. In order to participate in the 2022 RoboCup Middle Size League (MSL), **Dagozilla** designed and made changes in order to improve our MSL robots**.** This paper will cover most of the robots’ mechanical aspects. The systems and structure includes the locomotion system, kicker mechanism, ball dribbling mechanism, vision system structure, and expanding system.

Keywords: Middle-size League, RoboCup.

1. Robot Structure Overview

The first base is the primary frame of the robot that is designed to hold the hardware components as seen in **Fig. 1**. The first base is composed of metal plate-rods structure that supports the PMMA electrical board cases. The structure is sufficiently stiff and strong to bear the weight of the robot. The robot second base is designed to store the personal computer (PC), battery, compass, and the robot's hardware interface also keeping the PC at a safe temperature. This base is featured by a camera connected to the front side as shown in **Fig. 2**.

The majority of the robot frame structure is made of an aluminum plate manufactured by laser cutting employed with bending processes for the second base. Aluminium is used to produce a lighter weight while preserving the strength of the structure. Shaft components are made of stainless steel rods manufactured by a turning process. Each component holder uses nylon material that is manufactured by milling process. Additional materials such as PMMA and PVC are laser cutted and milled respectively.

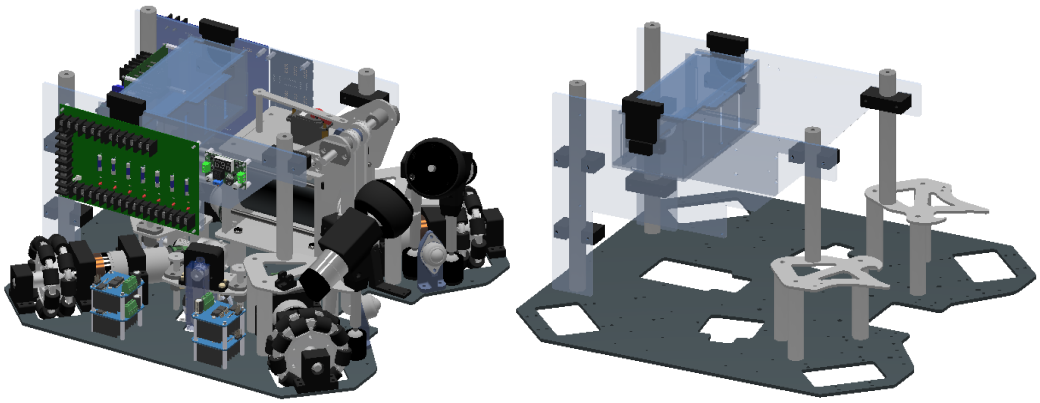

Fig. 1 Component on the first base (left) and the basic structure (right)

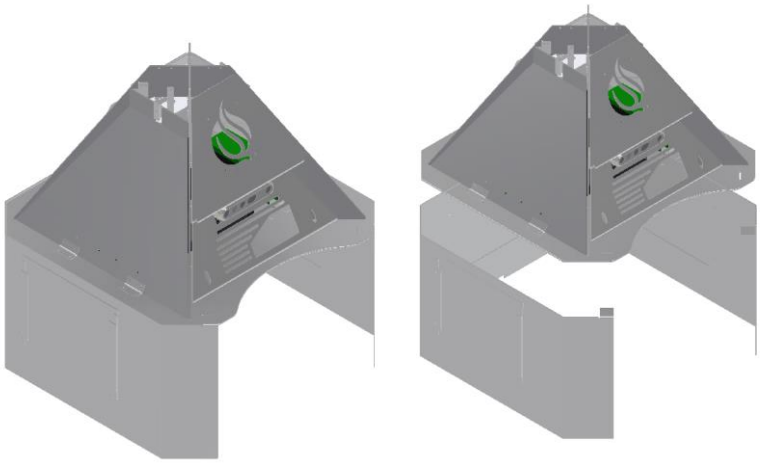

Fig. 2 The Assembly of the second base (left) and the exploded view between armor and base (right)

2. Locomotion System

The locomotion system of this robot uses four PG45 RS775 DC brushed motors as the main power. Compared to the previous design, the current robot adds one motor in order to increase the acceleration and the velocity of the robot. The power is directly transmitted to the 100 mm omnidirectional wheel hub by addition of a shaft. The locomotion module design is shown in **Fig. 3**.

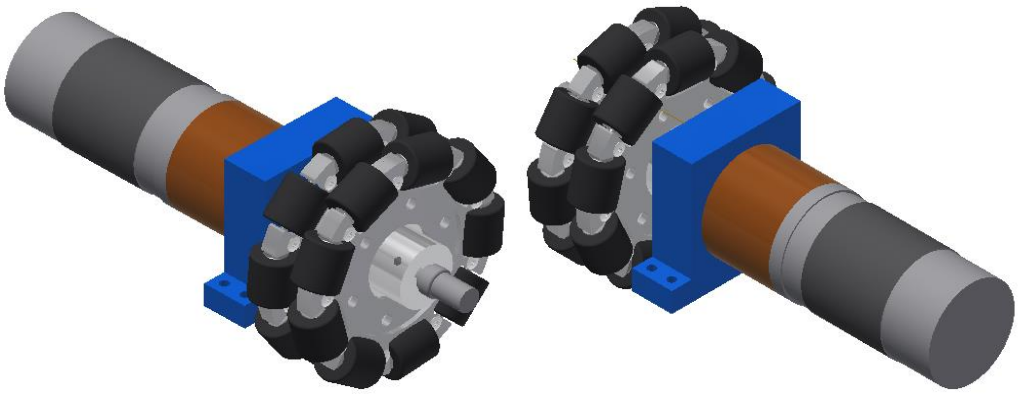

Fig. 3 The locomotion system from two point of views

3. Kicking Mechanism

In the current robot development, the kicking module is designed to have two modes of kicking, flat and lob shoot. This kicker is powered by a high voltage discharge from a capacitor to the solenoid coil to generate a high impulsive magnetic force. The current design adds a reversal system at the back of the solenoid system to maintain the position of the plunger. This module has an impact barrier component with an additional cushion of soft rubber attached to the plunger to protect the solenoid system from high impact.

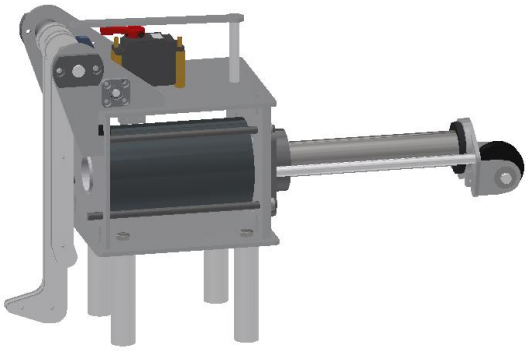

Fig. 4 The kicking module

4. Dribbling Mechanism

The robot ball handling system or called dribbling system is designed to grip and control the ball as seen in **Fig. 5**. This module uses a rubber wheel to grip the ball with a torque that is driven directly from the RS775 brushed DC motor. There is a free-roll ball caster as a support structure to keep the ball stay in position. The materials used in this dribbler are 3D-printed PLA parts, ABS parts and steel parts.

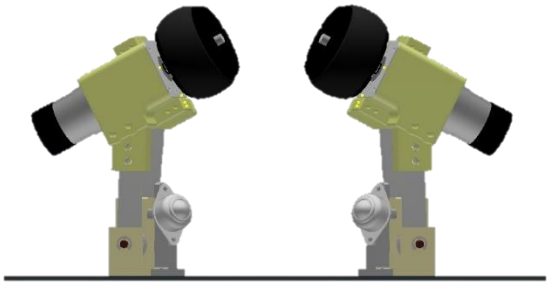

Fig. 5 The ball dribbling module

5. Vision System

In 2022, the robot's vision system is divided to the top vision and front vision. Each robot would have an additional camera at its front side for greater vision system support. A mounting plate is bent at a certain angle to hold the camera in a particular height. As for the top vision, it is designed by using a transparent structure of a PMMA tube to get a clear image. This design significantly improves the robot's view, as well as eliminating the blind spot from the last generation design. The robot

visualized the ground field by reflecting the image using an omni directional mirror then captured by a camera. The robot mirror is made of aluminium manufactured by CNC machining process and surface-finished with a chrome coating to get a reflective surface.

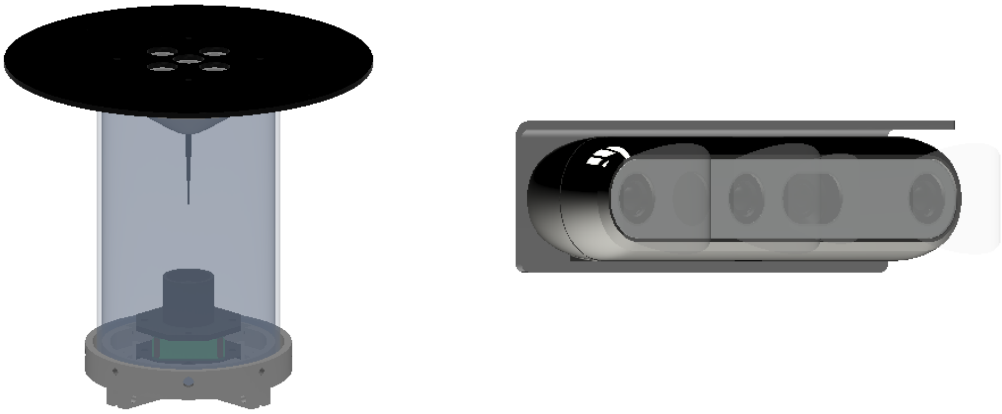

Fig. 6 The top vision system (left) and front vision system (right)

6. Expanding System

Recently, a keeper robot was built that comprises of the majority of other robot components but excludes the ball dribbling mechanism yet contains an expanding system. The expanding structure is primarily made of aluminum profiles, with aluminum plates helping in the expansion mechanism. Stepper motors are used to generate the expanding motion that covers three sides of the robot: left, right, and upward.

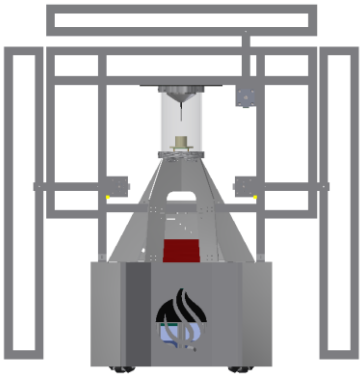

Fig. 7 The Expanding System