

## Test Bench Gimbals Rig for Quadcopter CAD Design

### Description

Here we will build a Test Bench Gimbals Rig for Quadcopter. but first, we need to know first what is a Test Bench Gimbals Rig for Quadcopter?

Quadcopter is a *helicopter* that lifted and driven by 4 rotors. The rotor is an electric motor or an electric generator that rotates on the Rotor axis. Rotor rotation is caused due to the magnetic field and email wire coil on the rotor. Quadcopters are classified as *rotor craft*, as opposed to planes since their lift is produced by a set of rotors. A French aircraft designer and manufacturer named Louis Charles Breguet was the first designer of the quadcopter.

To find out if the quadcopter can be used properly, it requires tested on the bench gimbals rig first. This test bench is used to test whether the quadcopter is viable to operate or not. Most gimbals test bench is a circle shaped, but here we will make it with a square shape as its gyroscope frame.

Since the rapid growing era of technology around the year 2005 to 2010, advances in electronics allowed the production of light flight controllers. This resulted in quadcopter configurations becoming so popular for small unmanned aerial vehicles (UAV). With its small size and maneuverability, the quadcopter can be flown indoors or outdoors. The design that is almost similar to a drone causes this object to be often called a drone. Although like that, both the quadcopter and the drone have a difference in many aspects: Drone is a generic term used for all unmanned aerial vehicles (UAV), although quadcopter can also fly unmanned by combining the character of a drone inside. Drone is a generic term used for all unmanned aerial vehicles (UAV), although quadcopter can also fly unmanned by combining the character of a drone inside. Unmanned aircraft could be described as drones or quadcopters (depending on their characteristics), but the aircraft could not be classified as a quadcopter from its characteristics.

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- Between both of them, drones usually have a GPS set to move from one place to another without

a crew, unlike the quadcopter in general that is controlled through a remote.

- Unmanned planes have the ability to actually fly by themselves with the help of GPS, but some manufacturer also made quadcopter that with built-in GPS inside it to be able to fly independently

The following model is an overview of the quadcopter that is designed from SolidWorks software. SolidWorks is one of the CAD programs used to help to design the process of an object or building with ease. CAD (*Computer Aided Design*) Program is a program devoted to creating/design objects in the form of 2 dimensions as well as 3 dimensions.

SolidWorks divided into 3 versions, based on its function and needs.

1. Solidwork Standard, commonly used to assist 3-dimensional and 2-dimensional modeling process with maximum speed.
2. SolidWorks Premium, a 3-dimensional CAD software with a comprehensive design and additional features.
3. Solidworks Professional, higher above Solidworks standard and premium. Solidworks Professional has better features, such as: file management, almost real rendering results, etc.

Compared to other CAD software, SolidWorks occupies the top position of most users as a modeling software. Modeling is creating a 3-dimensional object that is applied in visual form. The 3-dimensional Modeling was originally used for scientific purposes only. Modeling also has 3 types, namely:

1. Polygonal Modeling, is a Modeling object that uses dots to become a line to create fields.
2. Curve Modeling, is a Modeling object that uses curves to create fields.
3. Digital Sculpting, a modeling object that has a high degree of smoothness, is usually used to design sculptures.

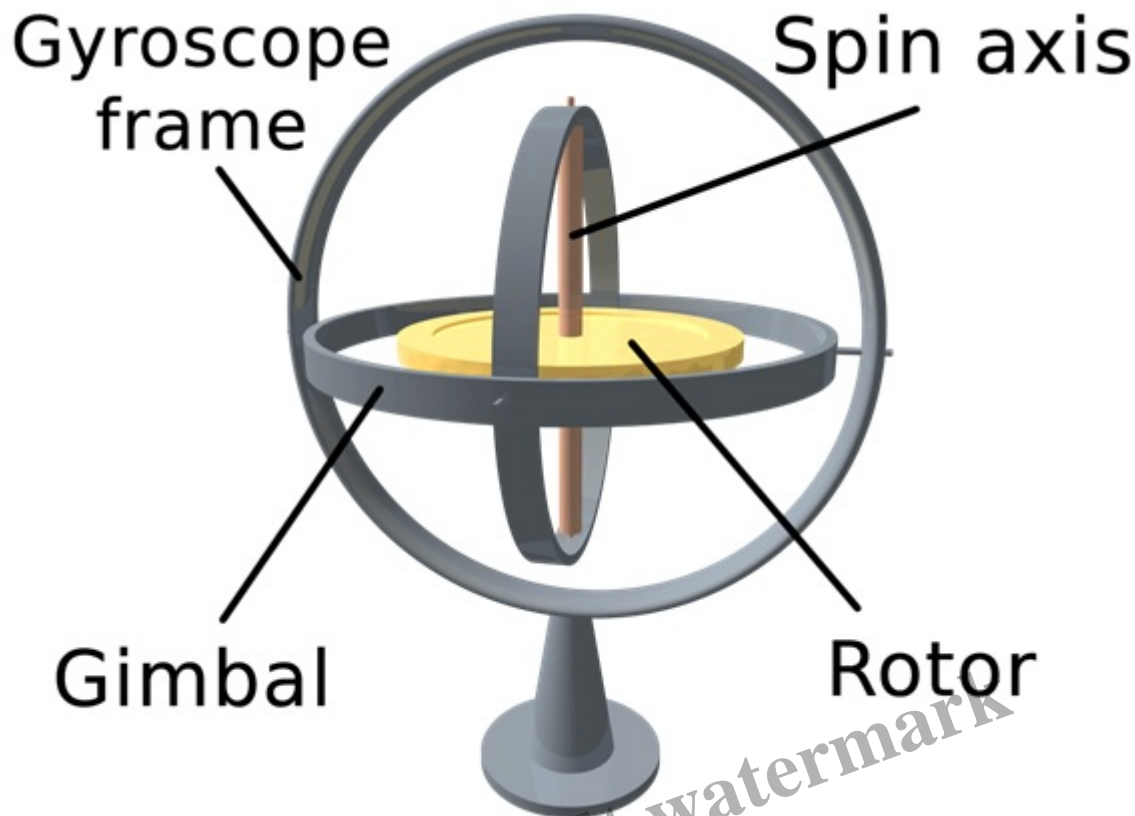
SolidWorks was introduced in 1995 as a competitor to CAD programs such as Pro / ENGINEER, NX Siemens, I-Deas, Unigraphics, Autodesk Inventor, Autodesk AutoCAD dan CATIA.

The design starts from several parts, it includes:

- Rectangle gyroscope frame
- Gimbal
- Spin axis
- Bolt
- Gimbal bridge connector
- Rotor

And then, it will be assembled at the final stage. For more details, it can be found on the following video link.

Test Bench Gimbal Rig for Quadcopter Parts



- Gyroscope is a device for measuring or maintaining orientation, with the principle of angular momentum determination, this tool works with the accelerometer. The mechanism is a spinning wheel with a disc in it that remains stable. This stuff is often used to be in robots or drones as well as other advanced tools. Inside the gyroscope, there is a gyro sensor to determine the orientation of the motion by resting on the wheels or discs that rotate quickly on the axes. The gyro sensor itself has a function to detect the movement according to Gravity, or in other words, detect the movement of the user

#### The working principle of Gyroscope

The gyro sensor must be calibrated first with a pendulum. The calibration process serves to obtain the calibration factor value. The gyroscope has the output of angular velocity from the 3-axis direction, which then will be the angle of the Phi (right and left) of the Y-axis and later to be the angle of the theta (top and bottom), therefore the Z-axis later becomes the angle of psi (front and back).

#### The usability of Gyroscope

1. In the past, the gyroscope was already used for navigation, camera stabilizer, and aviation.
2. On Android phones, Gyroscope can provide orientation information with more precision up to 360 degrees angle. Thanks to this particular sensor, the Android photo sphere camera feature can provide information on how many devices that have been rotated and in which direction.
3. Gyroscope is also applied to games that are mostly on the smartphone either it's on IOS or android platform, where the use of games for example is a 3D-based game and has ample space, for example, in a game we usually have to swipe the screen in various directions to move

the space around, but with the presence of this tool only have to move the gadget in the direction that is desired.

#### The advantage of Gyroscope

1. It can detect movement in any direction.
2. The result of an image from the movement is smoother/not broken as in the accelerometer.
3. Not influenced by gravity.

#### The disadvantage of Gyroscope

1. The price is quite expensive.
2. It only can be used if there is any
  - The Spin Axis can move to a three-point axle, i.e. with quadcopter drones. The quadcopter can move forward, left to right, and spin or on the X, Y, Z axis or often called Pitch, Roll, Yaw movement. Pitch is a drone movement to move forward and reverse. The move can by advancing the stick forward and backward according to the RC settings we do. Roll is a drone movement for the right or left of the movements that can be reversed to the right and left of the RC. While Yaw is a drone movement to spin from the left or right and its movements are also controlled with the same RC moves with a roll but different sticks.
  - Gimbals are a quadcopter balancing system. also, dreadlocks serve as a liaison between the drones and the camera respective shapes that are different but have the same function that is to create a steady shot of photos or videos using drones. so if there any shocks and winds factor that can make the drone unsteady or the camera blur, it can be eliminated.
  - The rotor is part of an electric motor or electric generator that rotates on the rotor axis. Rotor rotation is caused due to magnetic field and email wire coil on the rotor. Quadcopters are classified as rotor craft, as opposed to planes.

In this project the Rig for Quadcopter Gimbal made on Solidwork are designed slightly different on the Gyroscope part, the previously shaped Circle replaced to the shape of the box according to the video on the link <https://www.youtube.com/watch?v=wAxHFTzAP-U>

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1. Artikel

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1. CAD Design
2. Test Bench Gimbals Rig for Quadcopter CAD Design

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