01 Message types in projects

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Information: A collection of the message types used in my projects for quick reference.

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1 geometry_msgs

`geometry_msgs/Point.msg`

Type	Name
float64	x
float64	y
float64	z

- Represents the **position** of a point in free space

`geometry_msgs/Quaternion.msg`

Type	Name
float64	x
float64	y
float64	z
float64	w

- Represents an **orientation** in free space in **quaternion** form
- In short, unit quaternions provide a convenient (though not intuitive) mathematical notation for representing spatial orientations and rotations of elements in three dimensional space
- For detailed information, one available reference is the wikipedia taking about *Quaternions and spatial rotation*

`geometry_msgs/Pose.msg`

Type	Name
geometry_msgs/Point	position
geometry_msgs/Quaternion	orientation

- A representation of **pose** in free space, composed of position and orientation

`geometry_msgs/PoseWithCovariance.msg`

Type	Name
geometry_msgs/Pose	pose
float64[36]	covariance

- Represent the **pose** in free space **with uncertainty**
- The 6×6 **covariance matrix** is represented in row-major form
- Use a fixed-axis representation for the orientation
- In order, the parameters are

$$(x, y, z, R, P, Y)$$

  - R stands for *rolling*, meaning the rotation about X axis
  - P stands for *pitching*, meaning the rotation about Y axis
  - Y stands for *yawing*, meaning the rotation about Z axis

`geometry_msgs/Vector3.msg`

Type	Name
float64	x
float64	y
float64	z

- Represents a vector in free space
- It is only meant to represent a **direction**
- It does make sense to apply a translation to it
  - When applying a generic rigid transformation to a *Vector3*, only the rotation will be applied

`geometry_msgs/Twist.msg`

Type	Name
geometry_msgs/Vector3	linear
geometry_msgs/Vector3	angular

- Expresses **velocity** in free space broken into its linear and angular parts

`geometry_msgs/TwistWithCovariance.msg`

Type	Name
geometry_msgs/Twist	twist
float64[36]	covariance

- Represent the **velocity** in free space **with uncertainty**
- The 6×6 **covariance matrix** is represented in row-major form
- Use a fixed-axis representation for the orientation
- In order, the parameters are
$$(x, y, z, R, P, Y)$$
  - R stands for *rolling*, meaning the rotation about X axis
  - P stands for *pitching*, meaning the rotation about Y axis
  - Y stands for *yawing*, meaning the rotation about Z axis

`geometry_msgs/Transform.msg`

Type	Name
geometry_msgs/Vector3	translation
geometry_msgs/Quaternion	rotation

- Represent the transform between **two coordinate frames** in free space

2 trajectory_msgs

`trajectory_msgs/MultiDOFJointTrajectoryPoint.msg`

Type	Name
geometry_msgs/Transform[ ]	transforms
geometry_msgs/Twist[ ]	velocities
geometry_msgs/Twist[ ]	*accelerations*
duration	time_from_start

- Represent a fully defined state point for a **multi-joint robot**, including **positions, velocities and accelerations** for for all joints
- *`transforms`*: Each multi-dof joint can specify a transform (up to 6 DOF)
- *`velocities`*: There can be a velocity specified for the origin of the joint
- *`accelerations`*: There can be an acceleration specified for the origin of the joint

`trajectory_msgs/MultiDOFJointTrajectory.msg`

Type	Name
std_msgs/Header	header
string[ ]	joint_names
trajectory_msgs/MultiDOFJointTrajectoryPoint[ ]	points

- The *`header`* is used to specify the coordinate frame and the reference time for the trajectory durations
- Use a series of fully defined state points to specify a **multi-dof joint trajectory**
- The order and length of every point must be same as the order of length as the *`joint_names`* array

3 Others

`std_msgs/Header.msg`

Type	Name
uint32	seq
time	stamp
string	*frame_id*

- Generally used to communicate **timestamped** data in a **particular coordinate frame**
- *`seq`*: Sequence ID, consecutively increasing ID
- *`stamp`*: Two-integer timestamp that is expressed s:
  - *`stamp.secs`*: seconds (stamp secs) since epoch
  - *`stamp.nsecs`*: nanoseconds since stamp_secs
- *`frame_id`*: Frame this data is associated with

`nav_msgs.msg.Odometry`

Type	Name
std_msgs/Header	header
string	child_frame_id
geometry_msgs/PoseWithCovariance	pose
geometry_msgs/TwistWithCovariance	twist

- Represents an **estimate** of a **position and velocity** in free space
- *`pose`* should be specified in the coordinate frame given by *`header.frame_id`*
- *`twist`* should be specified in the coordinate frame given by the *`child_frame_id`*