ZERO ROBOTICS
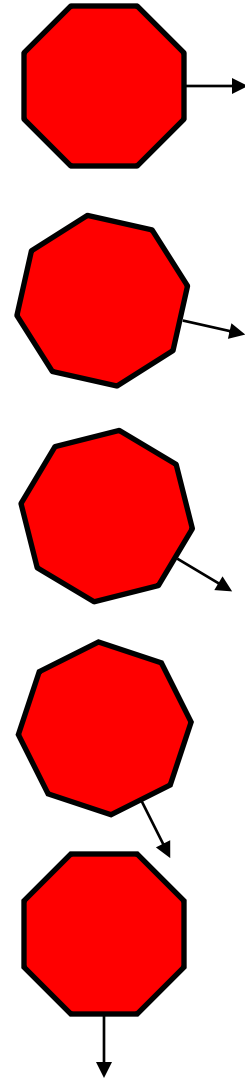
SPHERES CHALLENGE 2010

Rotate to Face Target Tutorial
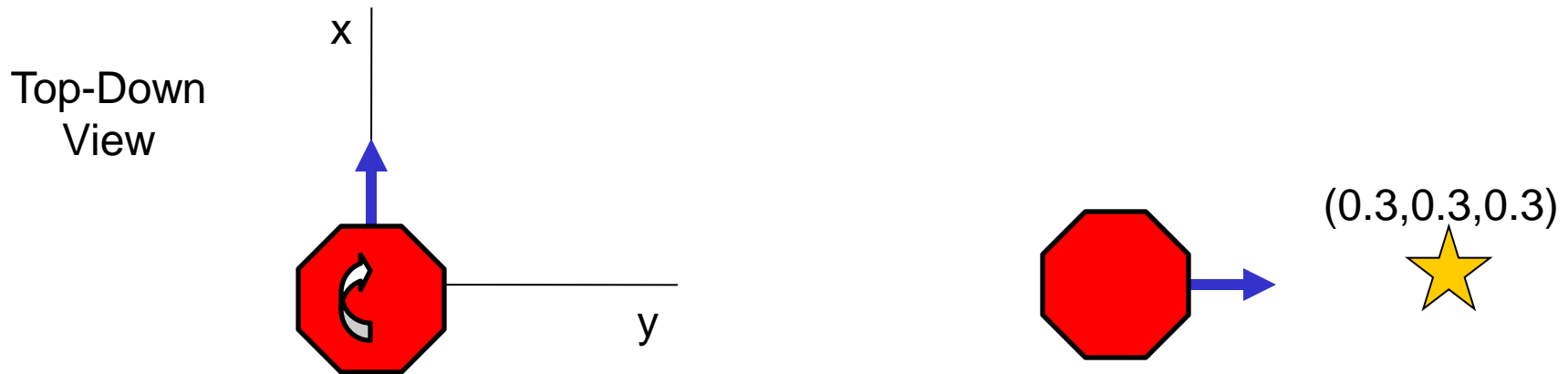
ROTATE THE SATELLITE TO POINT TOWARDS A TARGET

- Objective: command the satellite to rotate to face a target
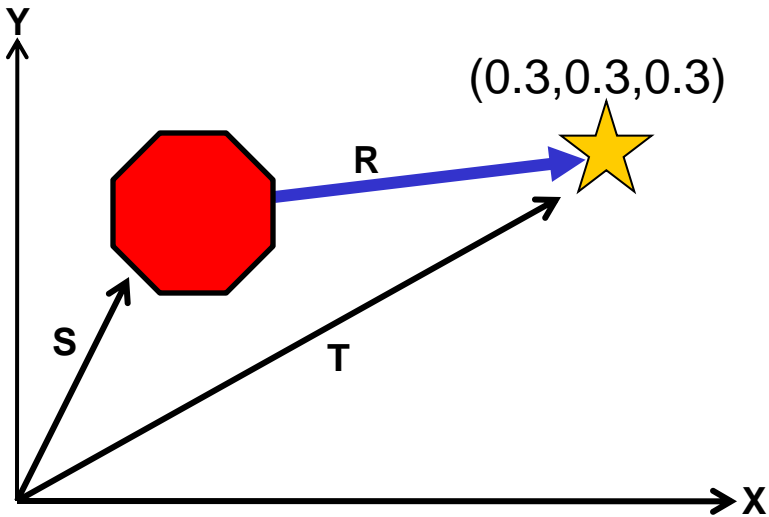
- The target will be the point (0.3, 0.3, 0.3)

x

Top-Down
View

y

(0.3,0.3,0.3)

Inputs/Outputs

- loop provides:
    - **myState[12]**
    - **time**
- We can use
    - **api.setAttitudeTarget**

You have to:

1. Calculate the vector from your satellite to the target

2. Create a unit vector from the relative vector

3. Set the directional vector as a target with the **api.setAttitudeTarget(float *attTarget)** function

(0.3,0.3,0.3)

R = Satellite to Target relative vector

T = Target position vector

S = Satellite position vector

To find the relative vector, we subtract the satellite's position from that of the target.

myState + satelliteToTargetRelVec = targetPosition
satelliteToTargetRelVec = targetPosition - myState

The detailed equation is:

$$\begin{bmatrix} R_x \\ R_x \\ R_x \end{bmatrix} = \begin{bmatrix} T_x \\ T_x \\ T_x \end{bmatrix} - \begin{bmatrix} S_x \\ S_x \\ S_x \end{bmatrix}$$

In order to specify direction, the relative vector needs to be normalized.

A nonzero vector is normalized by dividing it by its length. The resulting vector has length 1 and lies in the same direction.

In 2D, the length of $v = (x, y)$ is given by Pythagoras's formula: $.|v| = \sqrt{x^2 + y^2}$

In 3D, the length of $v = (x, y, z)$ is

In any dimension, the normalized vector of v is $v/|v| = v / \sqrt{v \cdot v}$

```c
//Make an array to hold the attitude vector we want to set
float attTarget[3];

//Make an array to hold our Target's position
float targetPos[3] = {0.3,0.3,0.3};

//Make an array to hold our satellite to target relative vector
float satTargetRelVec[3];


int i;

//Calculate the relative vector and assign the attitude target
for (i=0; i<3; i++)
{
        satTargetRelVec[i] = targetPos[i] - myState[i];
        attTarget[i] = satTargetRelVec[i];
}
mathVecNormalize(attTarget, 1); //user's own predefined function
//Command the Satellite to face the target point
api.setAttitudeTarget(attTarget);
```
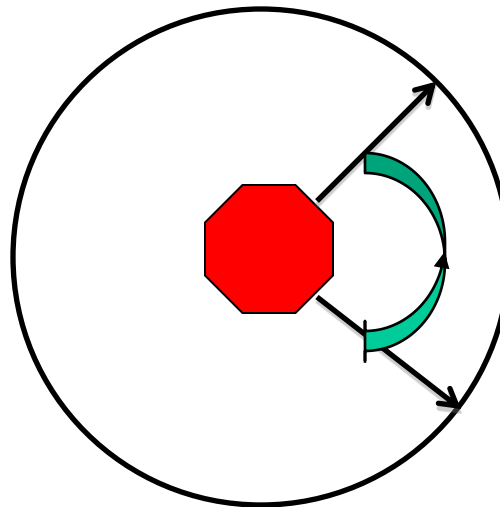
ROTATE THE ATTITUDE VECTOR OF THE SATELLITE

- Rotate the attitude vector of the satellite on a fixed plane (X-Y Plane) such that it sweeps a circle continuously