Hand Controlled Pan-Tilt Stand

Sriram Subramanian and Anand Balakrishnan

CSE 341

University at Buffalo

sriramsu@buffalo.edu **&** *anandbal@buffalo.edu*

Effective Summary:

The Hand Controlled Pan-Tilt Stand uses motion sensors attached to the hand to obtain the orientation of the hand and use this to drive the servo motors that control the pan and tilt of the stand. It uses an Arduino Uno for all the computations, a 6DOF motion sensor and two servo motors (for pan and tilt).

The project can be extended to be used in occupations involving the control and use of heavy machinery, like in construction. Being able to control such machinery precisely and remotely will enable a safe working environment. The main benefit of this project is that is helps develop a safe way to use machines while at the same time not compromising on precision and accuracy in their control.

It is designed such that there is a motion sensor attached to the hand from which we can obtain the orientation of the hand in terms of angles along x-, y-, and z-axes (Pitch, Roll and Yaw) and these angles can in turn be used to drive the angle of the servos on the stand. While it uses a single Arduino Uno for the computations, the components can be split up using wireless technology, as the only things that need to be communicated to the servos are the angles.

Project Objectives:

The Hand Controlled Pan-Tilt will meet the following objectives:

- Enable users to efficiently control servos via hand movements.
- Provide a simple interface to setup and operate the pan-tilt stand.

Project Approach:

The project will involve building the pan-tilt stand and the motion controller separately, and then integrating them together. Thus, the project will be developed in two simultaneous paths. We will:

1. *Build the pan-tilt stand:*

    a. Purchase and assemble commercially available kit.

    b. Write code to control the servos efficiently.

    c. Develop an interface to receive angles as input and drive the servos.

2. *Build the hand-controller unit:*

    a. Purchase commercially available inertial sensors and assemble simple handheld unit.

    b. Computes angles from the readings from sensor and output them via an interface.

Project Description:

- Software Design:
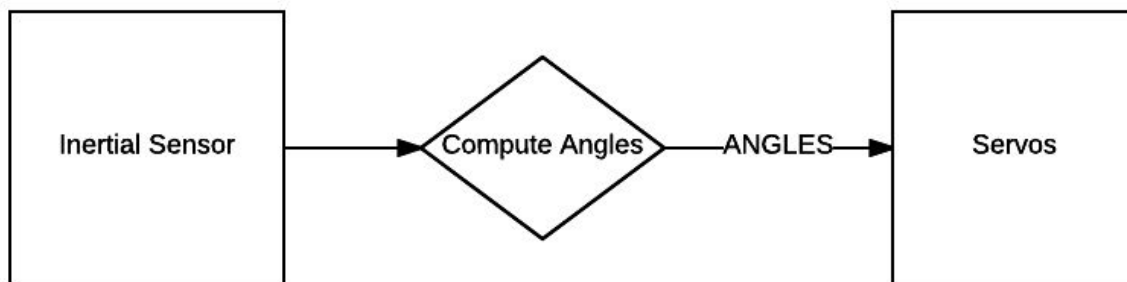
- Hardware Design:

    - The hand-controller unit consists of a MPU6050 inertial sensor with 3-axis accelerometer and gyroscope. The sensor also has a state-of-the-art "Digital Motion Processing Unit" (DMP), which, if used correctly, outputs accurate 3-dimensional measurements of the angles along each axis.

    - The servos are directly connected to the Arduino, which drives them using the angles outputted by the MPU6050.

Design Details:

- Components Used:

  1. Arduino Uno   -   Link

  2. Pan-Tilt Stand   -   Link
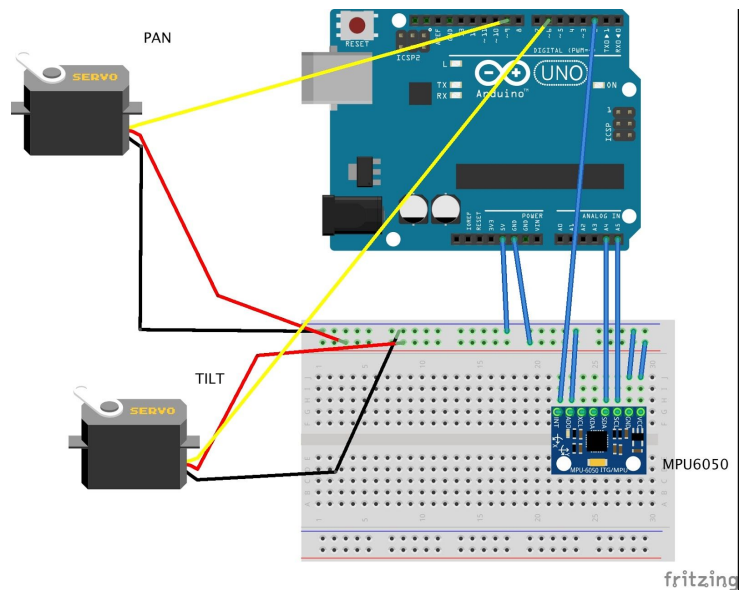
  3. Motion Sensor (IMU): MPU-6050 GY-521   -   Link

- Libraries Used:

  1. I2CDev library   -   Link

  2. MPU6050 Library   -   Link

  3. Arduino Servo Library

User/Programmer Manual:

Setup and use of the Hand-controlled Pan-Tilt Stand is easy.

- Assemble the pan-tilt stand as described in this link[1].

- Use the sketch below to assemble the other components:

- Flash the Arduino sketch provided at the link below.

References:

1. https://learn.adafruit.com/mini-pan-tilt-kit-assembly

2. http://playground.arduino.cc/Learning/SingleServoExample

3. http://playground.arduino.cc/Main/MPU-6050

Code: https://github.com/anand-bala/motion-controlled-pan-tilt