EE400/1 Capstone Design Project: Inertial Measurement Unit

Design Group Members	Year
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Controls an onboard camera platform in 2 perpendicular axes for an Unmanned Aerial Vehicle (UAV) for the student group UAARG

Inertial Measurement Unit designed and built using the XInC2 microprocessor from Eleven Engineering Incorporated

Gyroscopes:

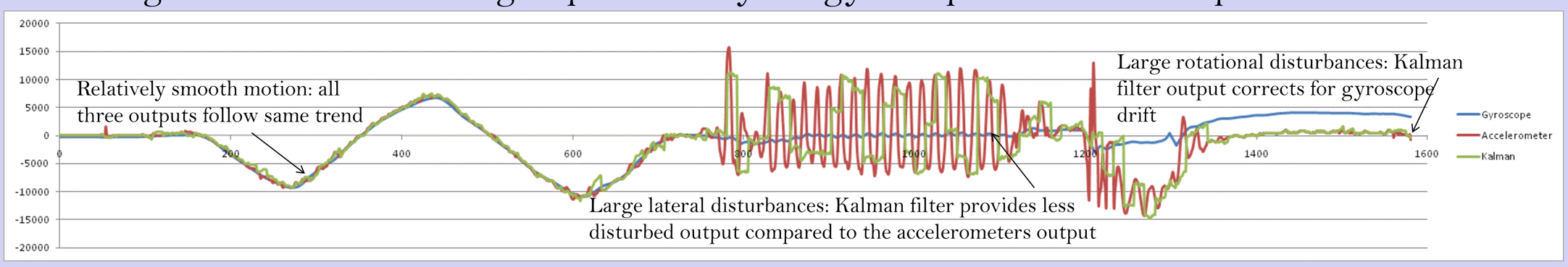
- LPR530AL and the LY530ALH
- Measure rotation along the roll/pitch and yaw axes

Accelerometers:

- LIS331AL three-axis microelectromechanical systems (MEMS)
- Measure acceleration in X, Y and Z axis

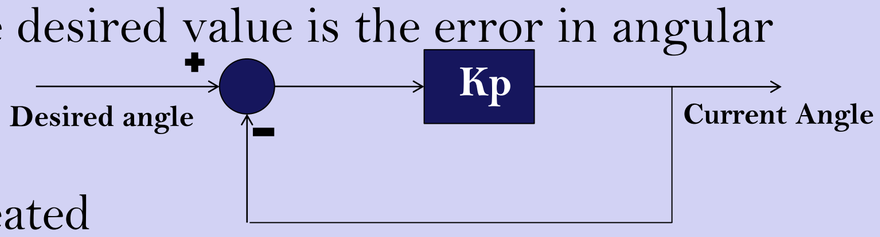
Processing:

- All signals "zeroed" by subtracting offset, then converted to quantities representing physical units
- Gyroscope data is integrated to get angular position
- Newtonian motion equations used to compensate accelerometer readings for centripetal force
- Compensated accelerometer readings used to find corresponding angular position from arctangent lookup table
  - **Kalman Filter** uses an intricate weighted average to calculate the most probable orientation of the gimbal based on the angles produced by the gyroscopes and the lookup table



Motor Control:

- Value calculated from Kalman filter represents current angular position in pitch and roll
- The difference between the calculated value and the desired value is the error in angular position
- Error values are converted to motor signals
- By this method a proportional control system is created



We would like to acknowledge Eleven Engineering Incorporated and the University of Alberta Aerial Robotics Group (UAARG) for their contributions to the project

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