CPE 325 Project Proposal

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Digital Level

A digital level is an electronic tool designed to measure surface tilt angles with high accuracy. This project uses a 3-axis accelerometer to detect the device's orientation, calculates the tilt angle in real time, and displays the results using LED indicators. A calibration button allows the user to set a reference zero position for measurements. The angle values are transmitted to a PC terminal using RS-232 communication for monitoring and debugging.

Topics/Peripherals

- SPI Communication to interface the MSP430F5529 with the 3-axis accelerometer.
- Timer A for periodic sampling of accelerometer data.
- Port I/O for LEDs and interrupt for switch.
- RS-232 communication to display data

External Components

- Switch to set reference point.
- LEDs - GREEN LED (P4.7) for tilt < 5° and RED LED (P2.1) for tilt > 5°.
- 3-axis accelerometer(ADXL335) to measure orientation in X, Y, Z directions.

Algorithms

Angle calculations for X and Y tilt angles using accelerometer data:

$$T_X = arctan(\frac{X}{\sqrt{Y^2+Z^2}}) \cdot \frac{180}{\pi} \qquad\qquad T_Y = arctan(\frac{Y}{\sqrt{X^2+Z^2}}) \cdot \frac{180}{\pi}$$