Final Project Proposal

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Subject: Final Project Proposal

# Acknowledgements

- I have reviewed the project guidelines as presented in Lecture 4c.

- I will be working alone on this project.

- No significant portion of this project will be (or has been) used in other coursework.

# Embedded System Description

The goal of this project is to develop a wireless, heat-tracking turret system that detects and follows a heat source using infrared (IR) sensors. The system can rotate horizontally and tilt vertically to track the target in real time using a feedback-based control loop.

* Inputs:
* IR Sensors – Four sensors detect temperature gradients for horizontal and vertical positioning.
* Keypad – Allows user input for the initial position and manual overrides.
* Bluetooth (Incoming to Slave) – Slave MCU receives vertical motor commands from the master.
* Process:
* Master MCU – Handles sensor input, keypad, LCD, and controls the horizontal motor.
* Slave MCU – Controls the vertical motor based on Bluetooth commands.
* Outputs:
* LCD Display – Shows system status and movement direction.
* Horizontal Stepper Motor – Controlled by the master for turret rotation.
* Vertical Motor – Controlled by the slave for turret tilt.
* Bluetooth (Outgoing from Master) – Sends vertical control commands to the slave.
* Status LED – Indicates tracking activity.

# Hardware Setup

The horizontal stepper motor is driven directly by the master using a dual H-bridge and powered by a 12V supply. The vertical motor, controlled by the slave, is driven through a transistor circuit and powered by battery. Both MCUs (MSP430FR2355 as master, MSP430FR2310 as slave) communicate wirelessly via zs-040 Bluetooth modules.

# Software Overview

The master reads IR sensors and processes the data using PID control to adjust horizontal and vertical positioning. It controls the horizontal motor, handles keypad input, and updates the LCD. The slave receives commands via UART over Bluetooth and adjusts the vertical motor using PWM or step sequences.

# Testing Procedure

Subsystems will be tested individually before full system integration. A heat source will be placed at various positions to evaluate the turret's tracking performance. The final demo will include live LCD output and real-time motion.

# Prescaler

Desired Prescaler Level: 100%

# Prescaler Requirements

* Inputs:
* IR Sensors – For horizontal and vertical heat detection.
* Keypad – For user interaction and settings.
* Bluetooth (Incoming to Slave) – For vertical motor control.
* Outputs:
* LCD Display – Shows real-time system status.
* Horizontal Stepper Motor – Controlled by the master.
* Vertical Motor – Controlled by the slave.
* Bluetooth (Outgoing from Master) – Sends commands to the slave.
* Status LED – Indicates tracking activity.

# Project Objective

To design and implement a wireless, two-axis heat-tracking turret system using IR sensors, PID control, Bluetooth communication, and two MSP430 microcontrollers with clearly separated roles.

# New Hardware or Software Modules

* New Hardware:
* zs-040 Bluetooth modules
* Horizontal stepper motor
* Vertical motor
* Dual H-bridge motor driver
* IR sensors
* New Software:
* UART-based protocol for Bluetooth communication
* PID control system for motion commands

# Master Responsibilities

Reads IR sensors, performs PID control, drives the horizontal motor, manages user input and display, and sends vertical motor commands to the slave.

# Slave Responsibilities

Receives commands from the master and controls the vertical motor. Ensures accurate vertical motion and responds to real-time tracking requirements.

# Argument for Desired Prescaler (100%)

This project meets the 100% prescaler level by integrating multiple real-time inputs and outputs, wireless communication, a feedback control loop, and modular system design. It uses PID algorithms, UART protocol, and new hardware components to demonstrate advanced embedded system design principles.