1. Project Overview

The **Auto Start Grease System** is an embedded control solution designed to automate lubrication cycles for industrial machinery. Specifically, it controls **28 grease motors** in Esfahan Steel Company's Rolling Mill 300.

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Author: Amir Shoaei (offlineone23@gmail.com / 09131066907)
Chip: ATmega128A @ 16 MHz
Memory Model: Small
Company: Esfahan Steel

Key Objectives:

- Automate motor start/stop cycles based on configurable time intervals
- Ensure reliable operation in industrial electrical environments
- Reduce grease wastage and maintenance effort
- User-friendly interface using only **3 buttons** and **16x2 LCD**

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2. Hardware Overview

- **Microcontroller:** ATmega128A
- **Display:** 16x2 Alphanumeric LCD
- **Motor Drivers:** Relays connected to GPIO ports (PORTA, PORTC, PORTD, PORTF)
- **Input Buttons:** Three buttons connected to PINE ports for navigation and setting values
- **Power Supply:** Stabilized industrial PSU, isolated from MCU to prevent reset due to noise

GPIO Allocation Example:

- PORTD.0–7: Motors 2z1, 3z1, 5z2, 018, 020, 2z5, 888, 889
- PORTC.0–7: Motors 8810–8817
- PORTA.0–7: Motors 8818–4z7
- PORTF.4–7: Motors 010, 013, 016, 017

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3. Software Architecture

- **Language:** Embedded C (CodeVision AVR)
- **Timer:** Timer1 overflow interrupt increments seconds
- **Main Loop:**

- Updates time counters (seconds, minutes, hours, shifts)
- Calls motor handler functions (`gs2z1()`, `gs3z1()`, …)
- Manages **flag-based motor control** (start → delay → stop)
- Updates LCD pages and handles button inputs for configuration

Motor Control Logic:

1. Each motor has **hour and minute settings** stored in variables like `ch2z1`, `cm2z1`
2. Flags (`flag2z1`, `flag3z1`, …) indicate if a motor should run
3. Main loop state machine (`flag`) handles:
   - 0: Idle
   - 1: Activate motor if its flag is set
   - 2: Delay counting
   - 3: Stop motor and reset flag

LCD Interface:

- Page 0: Main Clock & Shift counter
- Pages 1–28: Motor timers
- Button interactions:
  - Increment hours/minutes
  - Save settings
  - Navigate between motors