Analog Gauge Reader for Home Assistant

An advanced Home Assistant custom integration that uses Computer Vision (OpenCV) to read analog gauges (such as boiler pressure monitoring) from any camera stream and convert them into digital sensors.

■ Features

- **Universal Compatibility**: Works with any camera entity in Home Assistant.
- **Intelligent Processing**: Uses OpenCV to detect gauge needle angle.
- **Resource Efficient**: Configurable update intervals (1 min / 15 min) to save CPU.
- **Integrated Alarms**: Built-in logic for multi-stage visual alarms (Warning, Critical).
- **Easy Calibration**: Simple definition of min/max values.

■■ How it Works

The integration captures snapshots from your existing camera and processes them to extract data.

```
graph TD
   A[Camera Entity] -->|Snapshot| B(Analog Gauge Reader)
   B -->|OpenCV Processing| C{Analyze Image}
   C -->|Find Circle| D[Detect Gauge]
   C -->|Find Line| E[Detect Needle]
   D & E --> F[Calculate Angle]
   F --> G[Map to Pressure (Bar)]
   G --> H((Sensor Value))
   H --> I{Check Thresholds}
   I -->|Val >= Alarm 1| J[Binary Sensor: Alarm 1 ON]
   I -->|Val >= Alarm 2| K[Binary Sensor: Alarm 2 ON]
```

■ Installation

1. **Download Source**: Copy the `analog_gauge_reader` folder into your `/config/custom_components/` directory. `text /config/ ■■■ custom_components/ ■■■ analog_gauge_reader/ ■■■ __init__.py ■■■ manifest.json ■■■ ...`
2. **Restart Home Assistant**: This is crucial to load the required `opencv-python-headless` libraries.

   Add Integration:

- Navigate to **Settings** > **Devices & Services**.
- Click **+ ADD INTEGRATION**.
- Search for `Analog Gauge Reader`.

■■ Configuration Parameters

Parameter	Description	Default
Camera Entity	The source camera to read from.	*Required*
Interval	How often to process the image.	`15 minutes`
Min Reading	The value at the start of the scale (usually bottom-left).	`0.0`
Max Reading	The value at the end of the scale (usually bottom-right).	`3.0`
Alarm 1, 2, 3	Threshold values for triggering binary alarm sensors.	*Optional*

■ Calibration & Troubleshooting

Best Practices for Camera Setup

- **Direct View**: The camera should face the gauge as directly as possible (90° angle) to avoid parallax error.
- **Lighting**: Ensure consistent lighting. Avoid direct glare or reflections on the glass face of the gauge.
- **Focus**: The needle must be clearly visible and sharp.

Common Issues

Problem: Sensor shows `Unknown` or `Unavailable`.

Solution: 1. Check the logs (`Settings > System > Logs`) for "Analog Gauge Reader". 2. Ensure the camera entity is streaming correctly. 3. Verify that the gauge takes up a significant portion of the image.

Problem: The value is inaccurate.

Solution: The algorithm assumes a standard ~270° gauge sweep starting from the bottom-left. If your gauge has a different layout (e.g., 180° sweep), the readings will be scaled incorrectly.

■ Expert Details

OpenCV Logic: The system uses `HoughCircleTransform` to find the gauge face and `HoughLineTransformP` (Probabilistic) to find the strongest line originating near the center of that circle.

Dependencies: - `opencv-python-headless` - `numpy`

These are installed automatically by Home Assistant upon the first run.