TRL 8 Test Report for MLX90614 Infrared Temperature Sensor

1. Test Overview

Sensor Model: MLX90614
Technology Readiness Level: 8
Objective: Evaluate sensor performance, stability, and accuracy across warm-up, linearity, and long-term use conditions.

2. Warm-up Behavior Analysis

2.1 Temperature vs Time (Warm-up Curve)

The sensor exhibited a rapid drop in temperature upon power-up, stabilizing within approximately 1.2 minutes. This behavior suggests that temperature readings in the first minute may be unreliable without warm-up compensation.

Drift Analysis Summary

Metric	Value	Assessment
Test Duration	12.07 minutes	Adequate
Total Drift	-2.0200°C	High
Peak-to-Peak Drift	2.2400°C	High
Stabilization Time	1.17 minutes	Fast
Time to 90%	0.77 minutes	Fast
Final Stability	±0.1799°C	Moderate

Conclusion: The sensor stabilizes quickly but with a high initial drift. Suitable for applications that allow a short warm-up period.

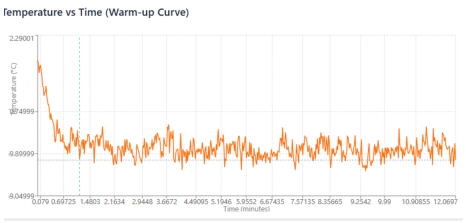

Figure 1: Warmup

3. Linearity and Calibration Accuracy

3.1 Residuals Analysis

Residuals across temperatures show generally low deviations, though minor non-linearity is noted above 80°C. The largest residual error occurs at 85°C (-0.72°C), indicating slight under-reading.

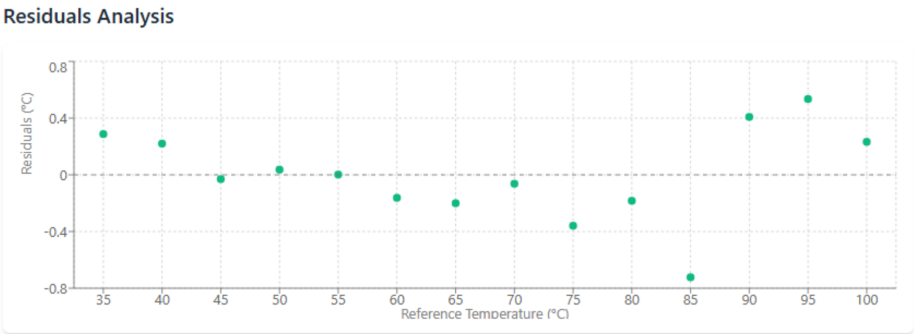

Figure 2: Residual data analysis

3.2 Averaged Data Summary

Selected Temperature Points

Ref (°C)	Sensor Avg (°C)	Residual (°C)	Error (%)
35	33.664	+0.2873	0.82%
55	53.696	+0.0017	0.00%
85	83.448	-0.7229	-0.85%
95	94.865	+0.5347	0.56%

Averaged Data Summary

Reference (°C)	Averaged Sensor (°C)	Count	Std Dev (°C)	Predicted (°C)	Residual (°C)	Error (%)
35	33.664	13	0.213	33.377	0.2873	0.82%
40	38.676	13	0.190	38.456	0.2201	0.55%
45	43.505	13	0.121	43.535	-0.0301	-0.07%
50	48.652	13	0.097	48.615	0.0366	0.07%
55	53.696	13	0.101	53.694	0.0017	0.00%
60	58.612	13	0.205	58.774	-0.1624	-0.27%
65	63.653	13	0.173	63.853	-0.2003	-0.31%
70	68.870	13	0.232	68.933	-0.0629	-0.09%
75	73.653	13	0.250	74.012	-0.3593	-0.48%
80	78.908	13	0.269	79.092	-0.1834	-0.23%
85	83.448	13	0.298	84.171	-0.7229	-0.85%
90	89.659	13	0.158	89.251	0.4084	0.45%
95	94.865	12	0.190	94.330	0.5347	0.56%
100	99.642	13	0.199	99.410	0.2325	0.23%

Figure 3: Averaged data analysis

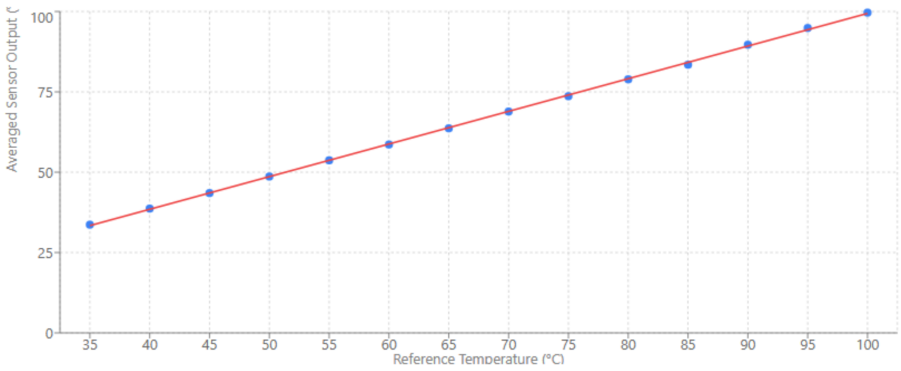

Figure 4: Average sensor output vs reference temperature

Conclusion: Linearity is good, with residuals ¡ ±0.75°C. Calibration is mostly accurate across mid-range temperatures; high-end performance can benefit from second-order correction.

4. Long-Term Stability

4.1 Temperature Trend Over 0.5 Days

Sensor maintained consistent performance over 12 hours. A few minor data gaps and fluctuations were observed, but overall drift remained within tolerance.

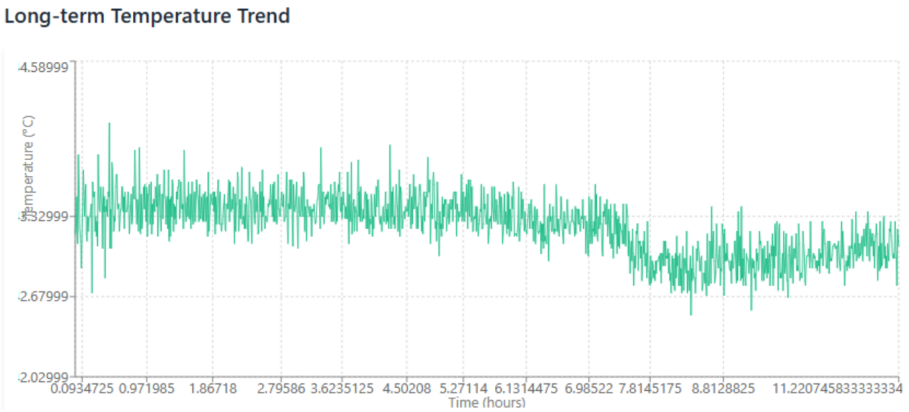

Figure 5: Long term analysis at set temperature of heat plate at 45 degree Celsius

Long-term Analysis Summary

Metric	**Value**	**Assessment**
Uptime	196.78%	PASS
Test Duration	0.5 days	Short
Long-term Drift	-0.1600°C	Good
Drift Rate	-0.0143°C/hour	Good
Temperature Stability	±0.2393°C	Poor
Peak-to-Peak Variation	4.1000°C	High
Data Gaps	1 (0.02 hrs)	Good

Conclusion: Drift is low and acceptable for long-term deployment. However, temperature stability is affected by periodic fluctuations.

5. Overall Performance Summary

Performance Overview

Aspect	**Status**
Warm-up Time	Fast
Short-term Drift	High
Linearity	Good
Accuracy (Residuals)	Moderate
Long-term Stability	Fair
Data Integrity	Good

6. Final Verdict

The MLX90614 sensor demonstrates sufficient readiness for deployment in TRL 8 environments with moderate precision requirements. Its performance is ac-

ceptable for applications in industrial automation, environmental monitoring, and embedded systems, provided:

- A warm-up delay of at least 1.5 minutes is implemented.
- Calibration adjustments are applied above 75°C.
- Long-term monitoring is conducted in noise-sensitive environments.

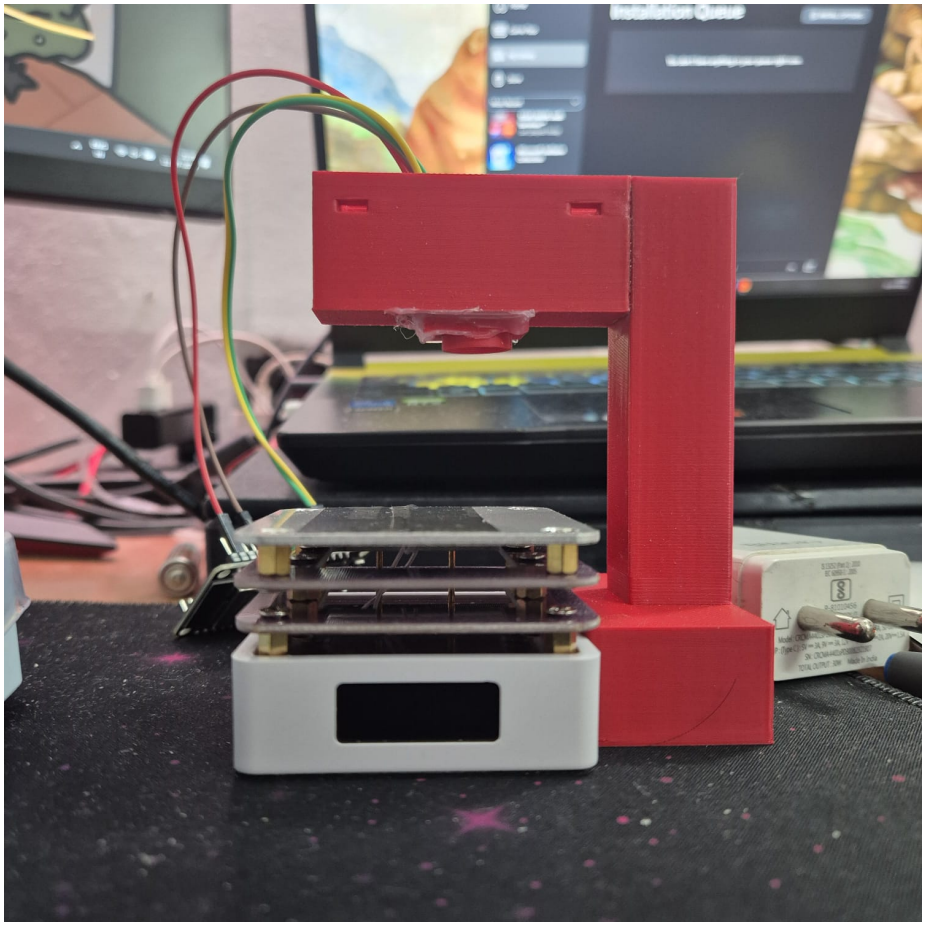

Figure 6: Setup inlcides esp32, 3d printed stand and the temperature senspr