

## Introduction / Background

Maintaining proper tire pressure is critical for safety, fuel economy, and handling. In Saudi Arabia's heat and off-road conditions, manual pressure adjustment becomes slow, unsafe, and inaccurate. TPMS only warns so it does not fix the problem. Our system provides automatic, real-time tire pressure control to make driving safer, faster, and effortless.

## Problem Statement

Drivers often face inconvenient, unsafe, and inaccurate manual tire pressure adjustments. High heat, repeated stops, and physical effort make the process difficult, while TPMS only warns and offers no automatic correction. This results in safety risks and poor driving performance. A fully automated system with simple mobile app control is needed to remove manual work and keep tire pressure accurate at all times.

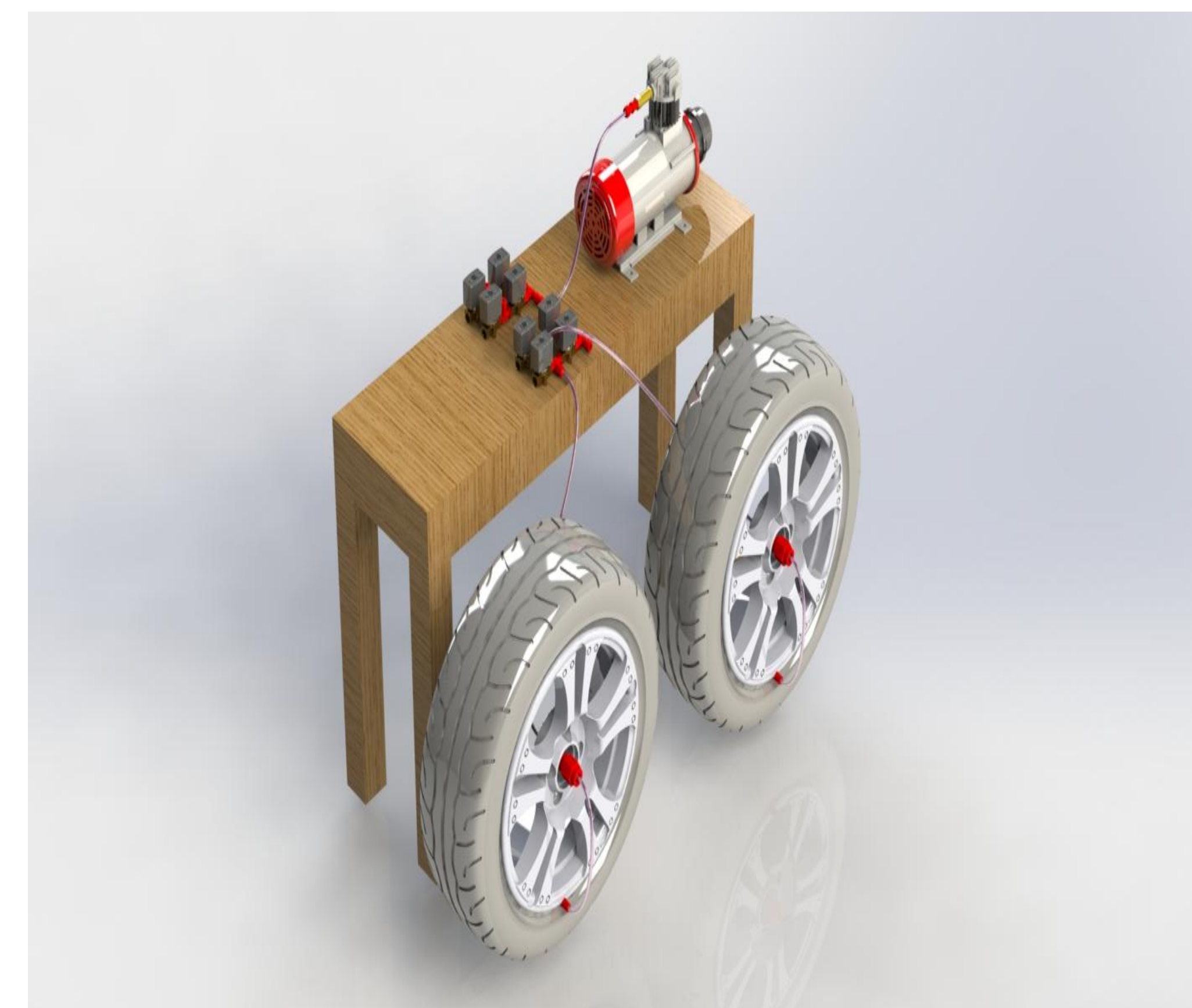
## Constraints

- Runs on 12 V, <30 A peak.
- Valves draw  $\leq 1$  A each.
- Installs without permanent changes.
- Bluetooth control with  $\geq 10$  m range.
- Alerts if pressure drops  $>0.5$  PSI/min.
- Fits a 1 m  $\times$  2 m demo frame.
- Works with Schrader valves, tires 16–22

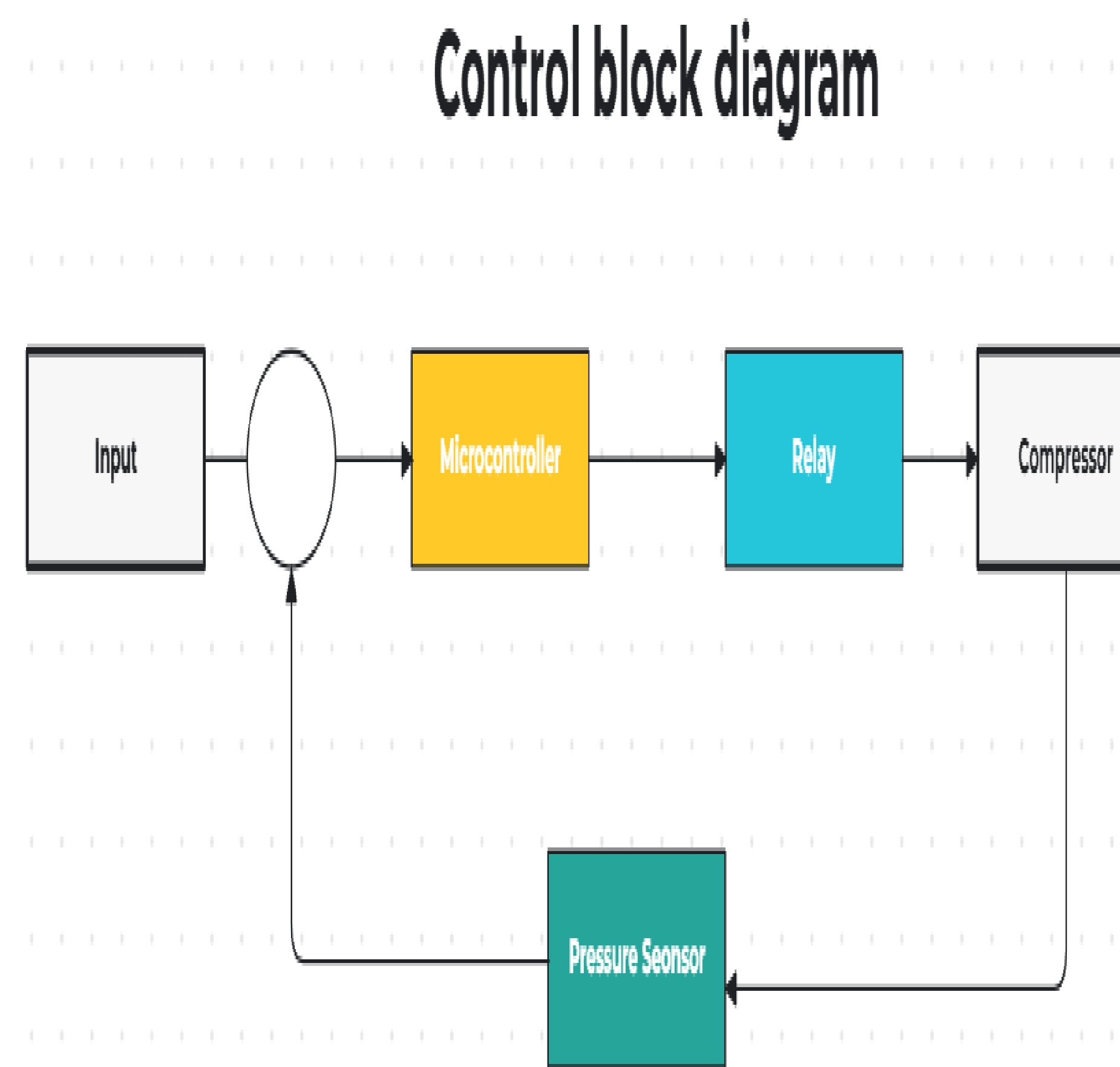
## Specifications

- Adjusts all 4 tires by  $\pm 15$  PSI in 3–5 minutes with  $\pm 1$  PSI accuracy.
- Pressure readings refresh every  $\leq 5$  seconds.
- System uptime maintained at  $\geq 99\%$ .
- Compressor airflow  $\geq 70$  L/min
- Tread depth accuracy  $\pm 0.5$  mm with alerts below 3 mm.
- Mobile app control in 5 steps or less.
- Auto-shuts off if pressure above 50 PSI

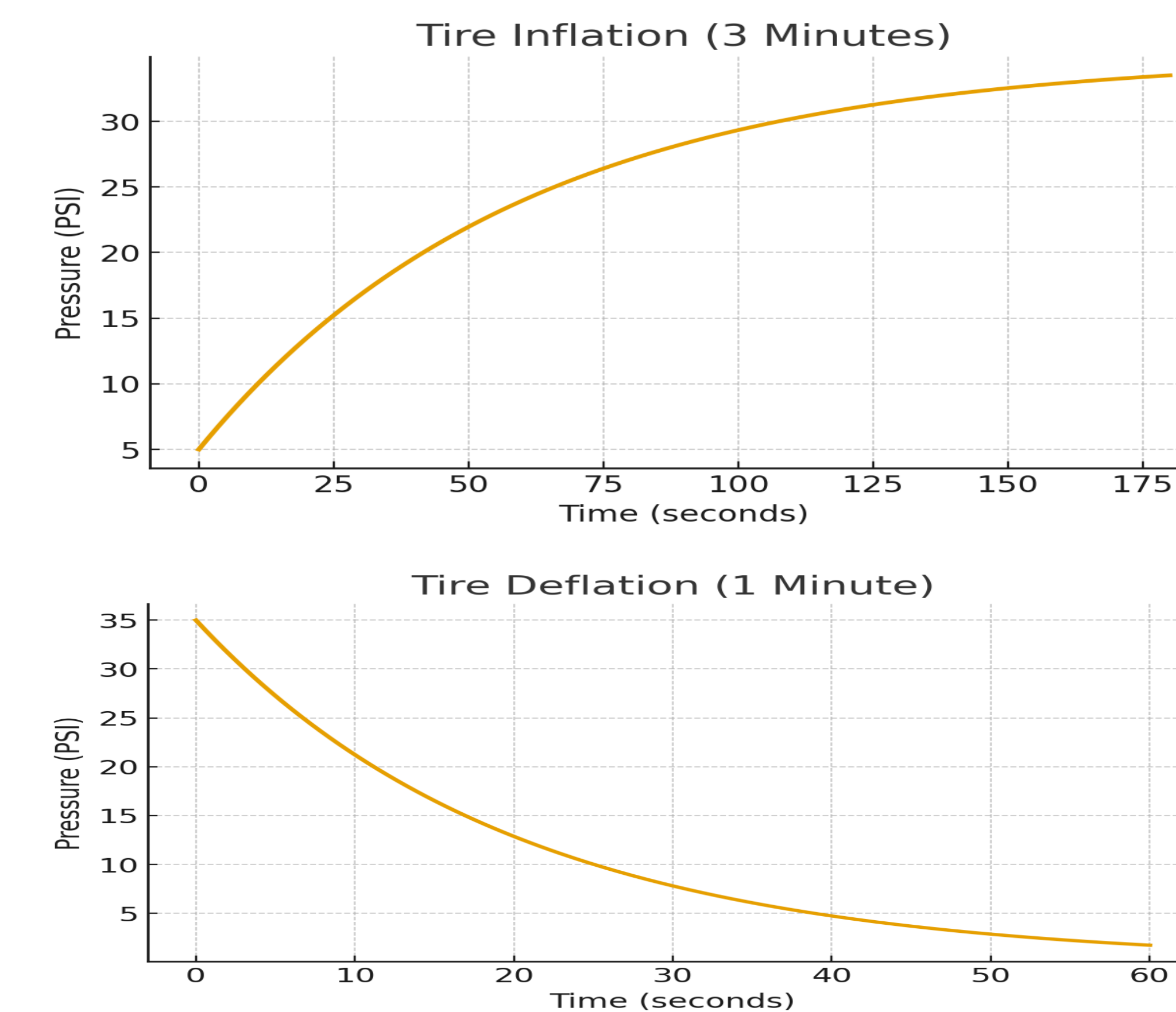
## Prototype Design



## Circuit Block Diagram



## Testing / Validation



## Conclusion

The system successfully delivers accurate, safe, and automated tire pressure control that works in real time and requires minimal user effort. Testing confirms reliable inflation/deflation, stable sensing, and secure Bluetooth control within the required limits. The prototype operates smoothly, fits the demo constraints, and provides a practical, scalable solution that enhances safety, convenience, and driving performance.