

Clogged Nozzle Detection System

Sponsor: The Toro Company

Sponsor's General Mission or Business Statement: The Toro Company starts each day with a commitment to help customers beautify and preserve the outdoor environment. We make landscapes green, healthy, and safe with superior, innovative, and environmentally sound products, services and systems.

Sponsor's Advisor, Title, and Phone Number:

Timothy Sosnowski, Project Lead, (952) 887-7168;

John Weber, Engineering Manager, (952) 887-8695.

Sponsor's Address: 8111 Lyndale Ave S., Bloomington, MN 55420

University of St. Thomas School of Engineering Academic Advisor: Dr. Greg Mowry

Team Member Names: Andrew Fried (EE), Michael Hines (EE), Aaron Knuttila (ME),

Jacob Weinmann (ME).

Senior Design Clinic I-II (ENGR 480-1) 2005-2006 Project Mission Statement: Design a system that will detect plugged and partially plugged nozzles. The system must have a way to display nozzle status to the sprayer operator.

Major Design Requirements:

1. Cost: Less than \$350
2. Operate within standard flow rates and pressures
3. Detect and alert user
4. Withstand environmental extremes
5. Withstand chemicals used in application
6. Work for complete line of Toro nozzles
7. Weight compliance (45 lbs total, 1 pound per boom)
8. Robust, predictable, repeatable

Senior Design Project Summary: Toro is requesting the development of a clogged/partially clogged nozzle detection system. The team's first semester involved concept development and especially focused on sensor design and selection. Toro provided the team with very detailed requirements, which were converted into engineering specifications. Using these specifications a list of sensor concepts was generated. From this list, four sensors were chosen for research and development. The recommended sensor design uses a paddlewheel design and optical electronics. This designed sensors output a signal, which is conditioned and in turn fed into a microprocessor. The microprocessor compares frequencies and determines if a nozzle is performing outside of the average flow across the boom. The microprocessor then signals a lighted display to alert the driver of an issue. Added features include a learn function along with sensitivity adjustment. The end result is a detection system, which meets all of the outlined requirements while alerting the operator of any clogged or partially clogged nozzles. This results in a system that saves the customer money while making the job safer and easier.



Paddle Wheel Sensor



Toro Multi-Pro Chemical
Sprayer