ECE405 / ECE406 SENIOR DESIGN: PROPOSED PROJECT

Automated Head Positioning ("Setworks") for a Portable Sawmill

Sponsor: Joe Smith, Huntertown, IN · Target parts budget: about $200 for the electronics (lift motor and battery supplied by the sponsor)

The problem

A Woodland Mills HM126 portable band sawmill cuts lumber by passing a saw head along a log. Before every cut, the operator raises or lowers the head by hand to set the board thickness. An iGaging digital readout (DRO) shows the head's height, but the operator still cranks, watches the number, overshoots, and corrects. It is slow and tiring, and small errors show up as uneven boards. Large commercial mills solve this with "setworks," which move the head to an exact position at the push of a button. This mill has no such feature.

What the sponsor will supply

The mill and its iGaging DRO; a Woodland Mills Power Head 80 (a 12 V motor and gear drive that replaces the hand crank and moves the head up or down with a simple switch); and a 12 V battery. The mill's gas engine is recoil-start, so it has no battery or charging system of its own.

The project

Design a control system that moves the saw head to a chosen position and stops it there accurately. The operator should be able to:

- **Step by a board thickness:** for example up or down 1″ or 2″, automatically adding the blade's kerf (the width of material the blade removes, which the operator can set).
- **Go to a height:** enter any position, such as 8″ or 20″, and the head travels there.

Limits and expectations

- **Accuracy:** the head stops within ±1/32″ of the requested position, every time, in both directions of travel.
- **Safety:** this system moves a heavy head carrying a running saw blade. The design must include an emergency stop, protection at the top and bottom of travel, and a defined, safe response to a lost position signal, a stall, or a dead battery.
- **Manual fallback:** if the controller fails, the operator must still be able to move the head without it.
- **Environment:** outdoors, with sawdust, vibration, rain, cold, and electrical noise from a running gas engine.
- **Power:** runs from the 12 V battery; the team decides how it stays charged at a mill with no charging system.
- **Equipment:** the Power Head 80 must not be damaged; the team should understand how their changes affect the manufacturer's warranty.
- **Schedule:** ECE405 carries the design through CDR; ECE406 delivers a working prototype installed on the mill and tested by cutting real logs.

Skills the team will use

Closed-loop motor control and positioning; reading a sensor whose data format is not officially published (the iGaging data port); DC motor drive design; safety interlocks and failure-mode analysis; operator interface design for gloved hands outdoors; protecting electronics from dust, water, and electrical noise; and verifying accuracy with repeatable measurements.

Site access: the mill is at the sponsor's home in Huntertown. Installation and testing will be scheduled with the sponsor, who will operate the mill during any cutting.