ADAPTIVE SOLAR AWNING

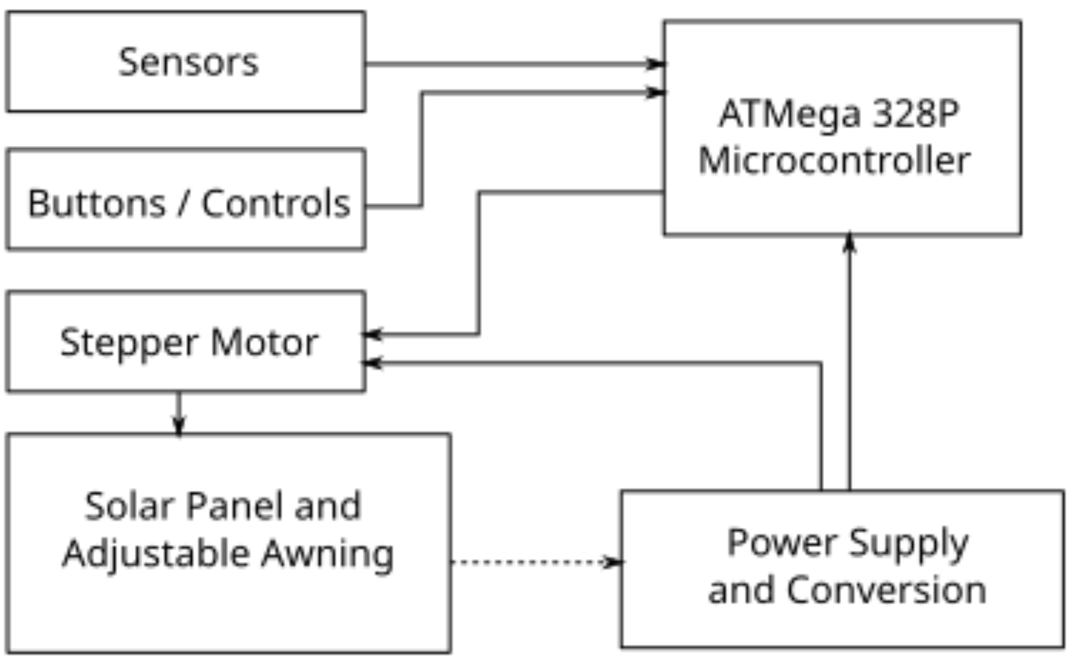
Wil Norton Kaila Neigum

Background

- Adaptive awning desired to help large buildings with internal temperature regulation
- Objective was to reduce rate of heat transfer through windows by offering shade/insulation while simultaneously generating electricity via solar panel
- Required two modes: automatic to optimize electrical generation and manual to optimize room occupant light and temperature satisfaction

Methods

- Gathered light level data from an office in the Education building at the University of Regina to study final deployment conditions
- Assembled a small scale model using a 20W solar panel, 0.65A stepper motor, gearbox, and gas piston
- Developed control circuit and input conditioning to allow algorithmic setting of panel angle
- Implemented controller circuit consisting of an ATMega328p microchip, photocell sensors, strain gauges, limit switches, pushbuttons, and a motor driver
- Wrote software for ATMega328p to optimize panel angle in real-time based on measured light levels



Results

- Model system is able to move panel to maximal light level through 45 degrees of motion in automated mode
- Panel is able to retain set angle without consuming system power in idle states
- User able to control precise angle of panel via manual inputs

Discussion & Future Work

- Further improvements to reliability/robustness of mechanical parts through consultation with mechanical engineers
- Conduct cost-benefit analysis for full scale system on basis of lifetime costs, net energy savings, and user satisfaction
- Implement full scale system consisting of microinverters on each panel, connected in parallel, to optimize the power production for non-uniform panel output

References & Acknowledgements

Douglas Wagner - Advising and Component Donations

Paul Fisher - 3D Printed Gearbox Design

University of Regina Facilities Management - Power Usage Information

Dr. David Gerhard - Component Donations

Brent Veitch - Donation of Solar Panel

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