

## ABSTRACT

The SMART Glass RV Door team is collaborating with RV retailer Dexter Vent and Door. Dexter Vent and Door came to Innovation One and Trine University with a design problem in the company's door products line. The design problem was that a typical RV door has little to no privacy for the window compared to every other window in an RV. The sponsor requested that the door be assembled and sold as a standalone unit that can power itself. The team solved these problems with two external solar panels, interior lithium-ion batteries to power the electrochromatic SMART Film, and a self-sufficient electrical power grid, to ensure the door can function alone. The result of the Senior Design project is a fully functional stand-alone unit that the sponsor can modify and perfect to be sold to OEMs across the RV Industry.



Figure 1: Dexter RV Door Products

## CUSTOMER NEEDS/SPECS

Dexter Vent & Door stated that a typical RV door has little to no privacy for the window compared to every other window in the RV. The needs and specifications are shown in Tables 1 and 2.

Table 1: Customer Needs

### Customer needs

- SMART Glass is easy to install with current manufacturing processes and meets or exceeds industry standards
- The SMART Glass system/door is a standalone unit
- The SMART Glass has user friendly controls and adjustability
- The SMART Glass offers consumer privacy
- The SMART Glass RV Door utilizes solar powered energy
- The SMART Glass fits within a pre-existing RV door

Table 2: Product Specifications

### Product Specifications

- The battery can last 48 hours of constant use
- The modified adds no more than 5 lbs. of extra weight
- Minimal insulation will be removed
- Privacy will be achieved using electrochromic film
- Modifications will not reduce the original door functionality

## DESIGN CONCEPTS

The team created several concepts as seen in Figures 2 – 4. **Concept 1** had an internal motorized blind, adhesive solar panels, lithium batteries, and electrical junction box. **Concept 2** had an external motorized blind, inlaid solar panels, and lead acid batteries, while **Concept 3** had PDLC SMART film, screw-on solar panels, LiPo batteries and a control panel with timer.

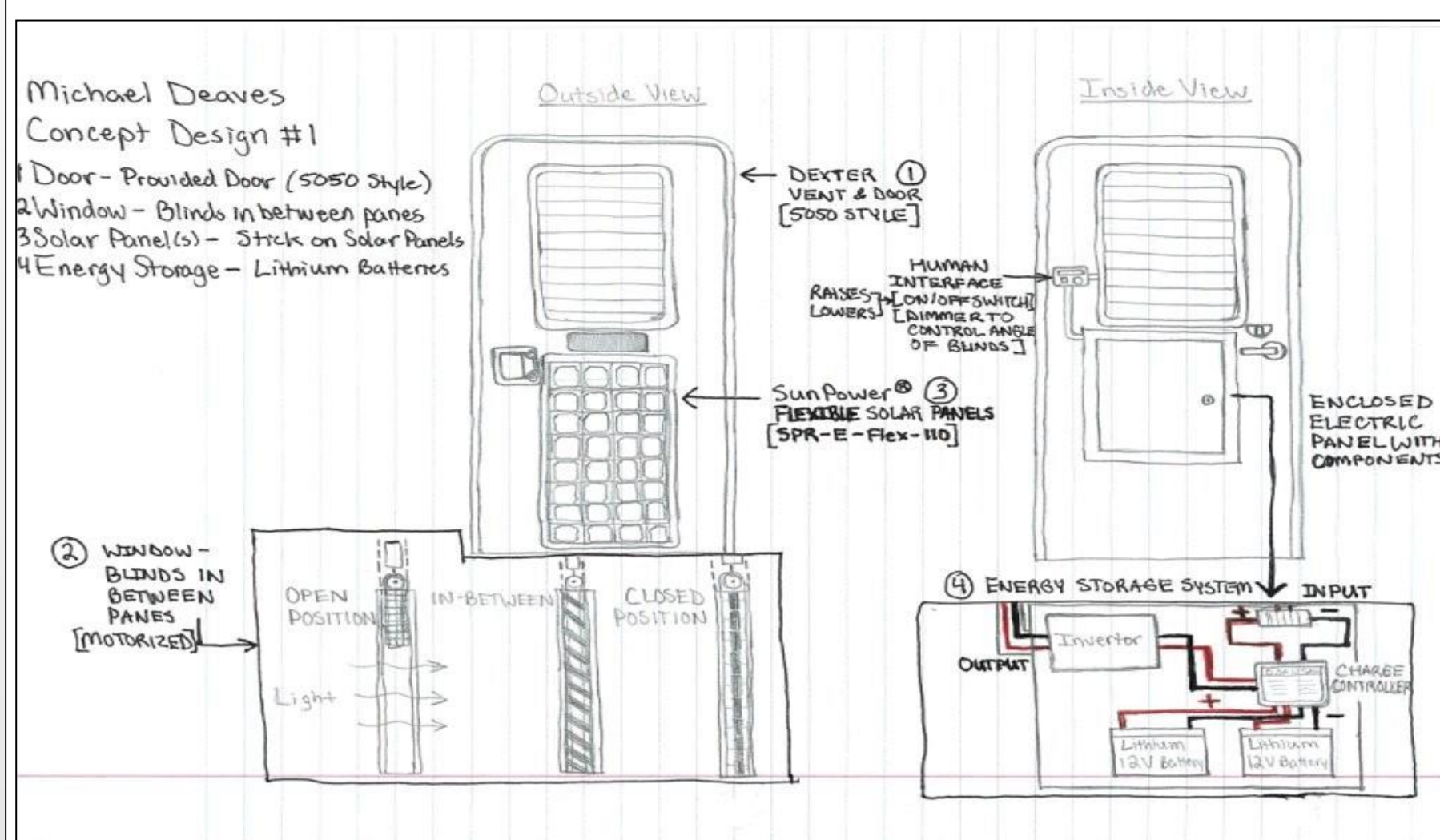


Figure 2: Design Concept #1

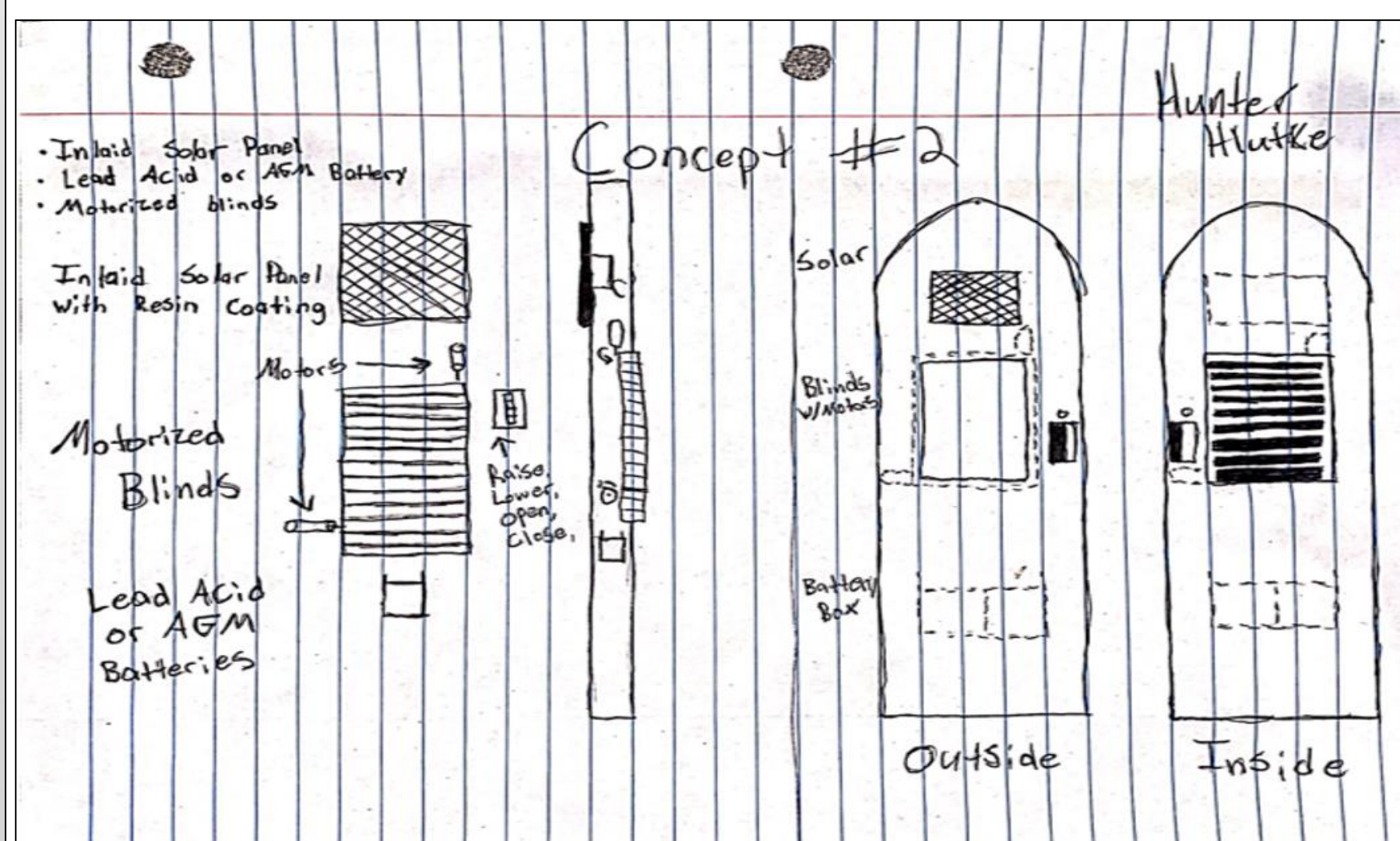


Figure 3: Design Concept #2

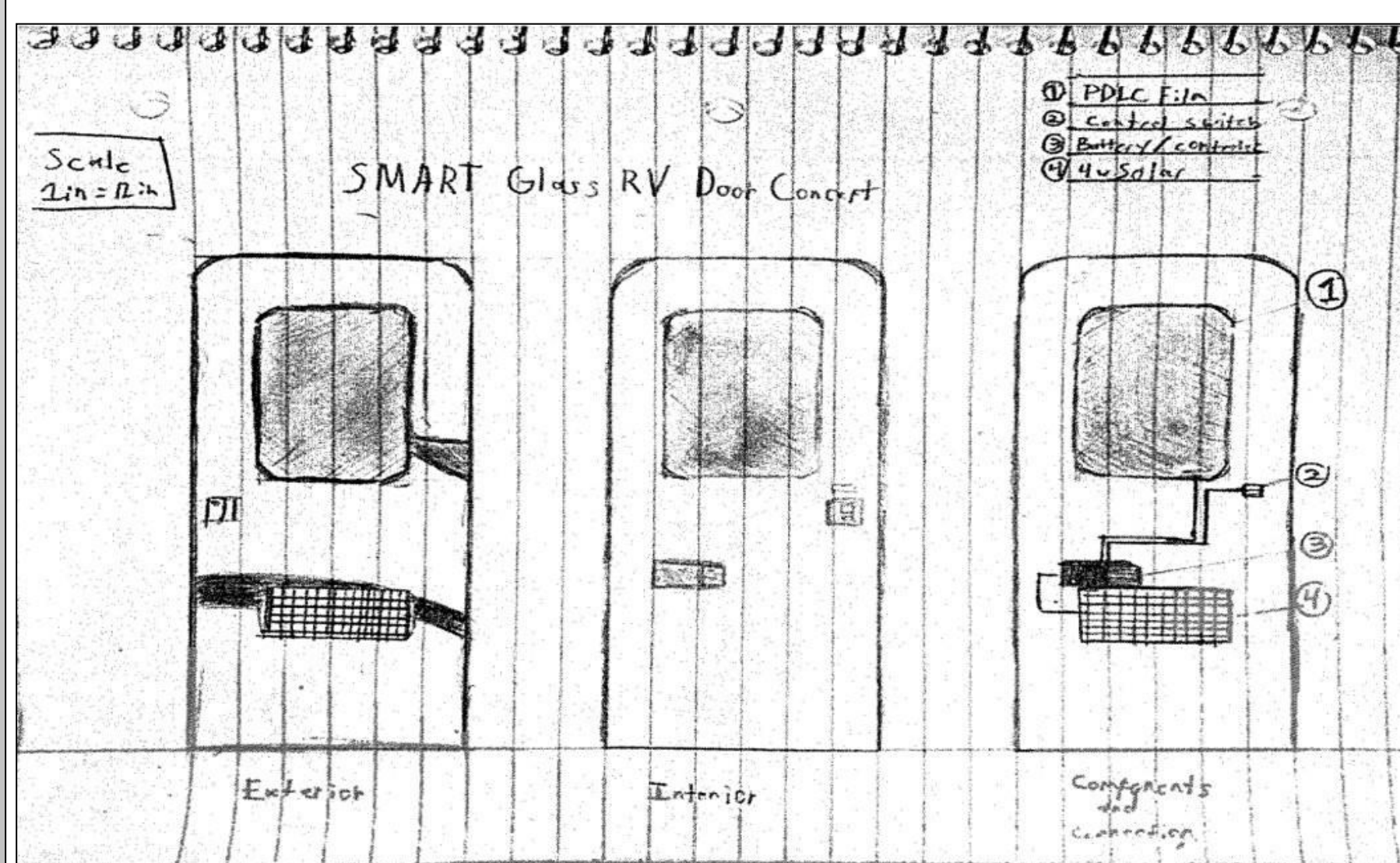


Figure 4: Design Concept #3

## TEST RESULTS



Figure 5: Grow Light Solar Panel Test



Figure 6: Sunlight Solar Panel Test

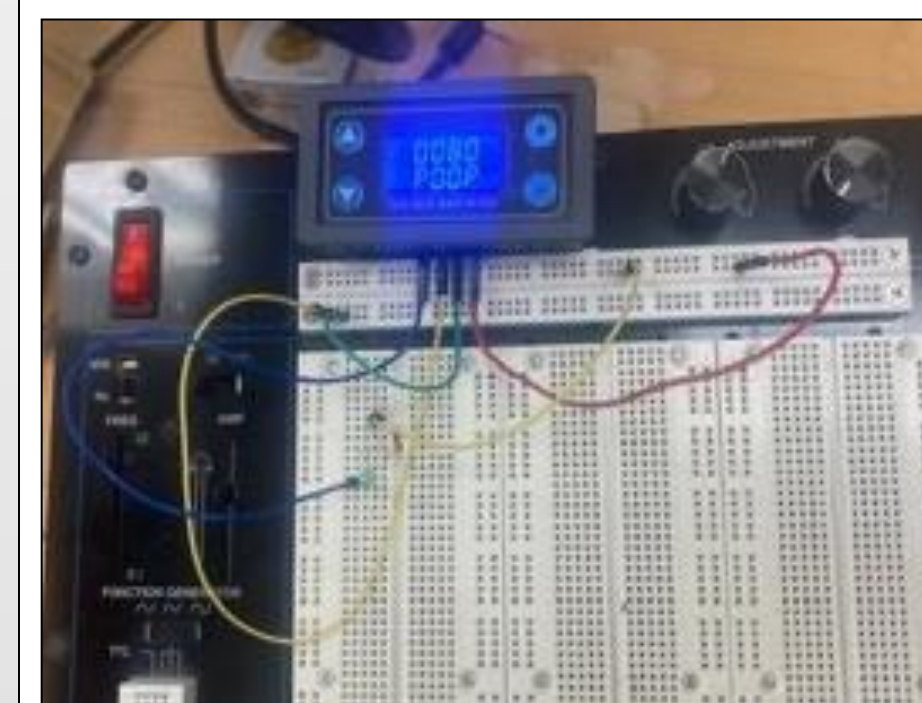


Figure 7: Timed Relay Module Test

The team completed a series of tests including grow light solar panel testing (Figure 5), sunlight solar panel testing (Figure 6), and a timed relay module test (Figure 7). The results concluded that the team had fully functional system components ready for assembly.

## FINAL DESIGN

The team's first completed prototype build with a fully functioning electrical system to show proof of completion to the sponsor in hopes to obtain a more visually pleasing final product can be seen in Figure 8.



Figures 8-9: Prototype #1 SMART Glass RV Door

## CONCLUSION

The SMART Glass RV Door team received a new RV door with a window cutout that was modified by the team to place the electrical components in like prototype #1. The modified door is shown in Figures 9 and 10 and will be on display at the Engineering Expo at the end of the month.



Figure 9: Final SMART Glass RV Door - Exterior



Figure 10: Final SMART Glass RV Door - Interior

## LESSONS LEARNED

Throughout this project this team has learned:

- The importance of time management
- Operating in a team dynamic
- Communication skills are essential in the workplace
- The importance of proper budgeting
- The ideas of the engineer and the marketing team are not always the same idea

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