Introducing!
The Solar Panel Protector
An Automatic Solar Panel Protection System
Section 1
Product Overview
presented by John Seiver
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The Solar Panel Protector

What is the Solar Panel Protector?
The Solar Panel Protector or SPP is:

- a fully-automated
- self-contained
- solar panel protection system that will:
  - continually protect solar panel installations
  - with a minimum of expense
  - and a minimum of maintenance
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Why a Solar Panel Protector?

Solar panels are vulnerable to hail

A solar panel is a solar cell enclosed in a metal frame with a glass cover

During extreme weather conditions, the moderately impact-resistant glass cover will fail
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How does the SPP work?

• the SPP detects severe weather using the NOAA SAME weather radio broadcasting system

• Photo resistor monitors light conditions

• NASA - designed rain sensor monitors rain fall
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• Variation & Testing
  ❖ Set values for light conditions
  ❖ Weather radio triggering
  ❖ Rain triggering
  ❖ Motor system timing

• Full system test
  • Test light and weather radio gate triggering
  • Gate remains closed while in rain conditions
  • Motor timings
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• The Solar Panel Protector detects severe weather using NOAA’s SAME radio warning technology
• The Solar Panel Protector closes when it is dark
• The Solar Panel Protector is self-power; requiring no external energy use
• The Solar Panel Protector requires no regular maintenance
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Why a Solar Panel Protector?

• reduces moisture buildup by eliminating the complete enclosed construction design

• allows the use of tougher materials for the SPP panel

• allows more light by eliminating the permanent glass covering
Section 2
Construction and Cost Overview
presented by Justin Cegielski
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• Construction Overview

• Construction Stages
  • Framing
  • Protective Panel Installation
  • Equipment Installation
  • Final Testing and Adjustments
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Hardware Design Description

Microcontroller Block
- TB1
- 8051 Microcontroller
- Relay Board

Solar Panel Protector
- Solar Cell
- Batteries in series
- Power Supply
- Power Supply
- Weather radio

Rain Sensor
Photo-Resistor
Motor
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Construction Overview

Framing the SPP
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Construction Overview

Framing the SPP
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Construction Overview

Framing the SPP
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Construction Overview

Protective Panel Installation
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Construction Overview

Protective Panel Installation
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Construction Overview

Equipment Installation
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Construction Overview

Equipment Installation
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Construction Overview

Final Testing and Adjustments
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Construction Overview

Final Testing and Adjustments
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Construction Overview

Final Testing and Adjustments
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## Parts Total Cost

<table>
<thead>
<tr>
<th>Bipom products</th>
<th>Total Cost</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8051 Microcontroller</td>
<td>$69.00</td>
<td></td>
</tr>
<tr>
<td>TB-1</td>
<td>$39.00</td>
<td></td>
</tr>
<tr>
<td>RELAY-2</td>
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<tr>
<td>LCD242</td>
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## Labor Total Cost

<table>
<thead>
<tr>
<th>Names</th>
<th>Hours Work</th>
<th>Labor Cost at $25 an hour</th>
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<tbody>
<tr>
<td>Justin</td>
<td>478</td>
<td>$11,850.00</td>
</tr>
<tr>
<td>John</td>
<td>527</td>
<td>$13,000.00</td>
</tr>
<tr>
<td>James</td>
<td>562</td>
<td>$14,025.00</td>
</tr>
<tr>
<td>Total</td>
<td>1567</td>
<td>$38,875.00</td>
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</table>

## Batteries

<table>
<thead>
<tr>
<th>Type</th>
<th>Total Cost</th>
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<tbody>
<tr>
<td>12 volt</td>
<td>$12.00</td>
<td></td>
</tr>
<tr>
<td>6 volt</td>
<td>$11.00</td>
<td></td>
</tr>
<tr>
<td>6 volt</td>
<td>$11.00</td>
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## Total Cost

<table>
<thead>
<tr>
<th>Total Cost</th>
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<tbody>
<tr>
<td>$39,087.00</td>
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## Cost to University

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<td>$200.00</td>
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## University saves

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<tbody>
<tr>
<td>$150.00</td>
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</table>

## Donated Part Cost

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<tr>
<th>Item</th>
<th>Cost</th>
<th>Donated Cost</th>
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<tbody>
<tr>
<td>solar panel</td>
<td>$60.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Wood</td>
<td>$20.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Cabinet liner</td>
<td>$7.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Weather radio</td>
<td>$55.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Gear system</td>
<td>$12.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Power Strip</td>
<td>$6.00</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

## Cost of Donated Parts

<table>
<thead>
<tr>
<th>Cost of Donated Parts</th>
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<tbody>
<tr>
<td>$160.00</td>
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</table>
Section 3
SPP Function and Software Overview
presented by James Milling
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- **SPP Function Overview**
  - Continually monitors the NOAA SAME broadcast
  - Closes the protective panel when severe weather is detected
  - Closes the protective panel when darkness is detected as a backup in the event of SAME system failure
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Design Alternatives

• Crop protection
• Roof protection
• User settings for light and other weather conditions
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• Hardware Component Testing
  ❖ Sensor Testing
    ✓ Light tests for photo resistor
    ✓ Water tests for rain sensor
    ✓ Voltage output test for weather radio
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Prototype Product Requirements:

- weather radio to monitor severe weather
- microcontroller-based gating system
- back up sensors to detect severe weather in event of weather radio failure
  - ✓ Rain sensor
  - ✓ Photo resistor
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• Software
  ❖ Timing control for motor
  ❖ Sensor calibration
  ❖ Relay activation
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Software Design Description

Start

Loop

Alarm Off

Light Sensor

Dark

Light

Has it alarmed?

Alarm Sensor

Is gate already open?

No

Rain Sensor

Rain

Is gate already closed?

No

Yes

Is gate already closed?

No

Yes

Already Alarmed?

No

Gate Open

No

Gate Close

No

Alarm on

No rain

Done
C++ Programming Advisor
Dr. Farrokh Attarzadeh
Hardware Technical Advisor
John Seiver

- THIS HAS BEEN A TEAM 6 PRODUCTION -
Questions