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Department of Mechanical and Aerospace Engineering

# Auto Windshield Reflector

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## Motivation

- Shade can alter temperatures from  $10^{\circ}\text{F}$  to  $60^{\circ}\text{F}$
- Car interiors exposed to UV light release a toxic chemicals such as benzene  $\rightarrow$  known to cause Leukemia
- UV exposure on humans leads to skin cancer
- Interiors exposed to UV radiation become damaged through photodegradation
- It is illegal to tint windshields in many states



*Photodegraded leather*



*Photodegraded plastic dashboard*



## Features

- System only works when the engine is off.
  - Prevents the cover from coming down while driving
- Detects light intensity from the sun via a phototransistor and accordingly lowers the cover
- Detection stops when the cover is activated and in the down position
- Unlock button raises the shade back up and turns off the system in anticipation of user driving.
  - Is also operated remotely through infrared transmitter and receiver.
- Override function allows user to manipulate the cover



## Advantages

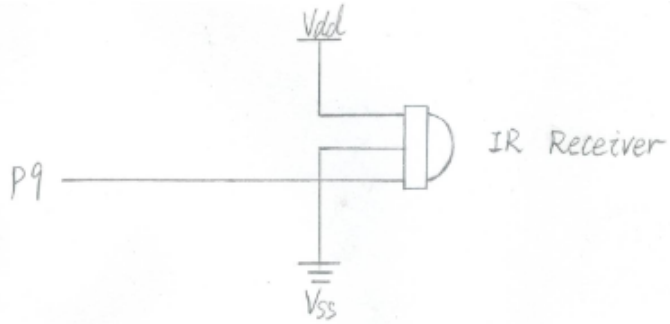
- Manual windshield reflectors can be cumbersome and difficult to install.
- There is the risk of forgetting to put it in place after leaving the vehicle
  - Our system eliminates this issue
- Automatic options on the market can only be actuated remotely.
  - Lacks sensing/detection capabilities. Not intelligent



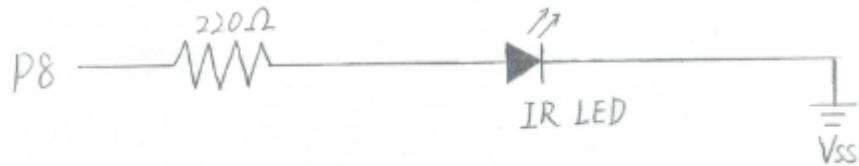


## Schematics

*IR Receiver  
Circuit*

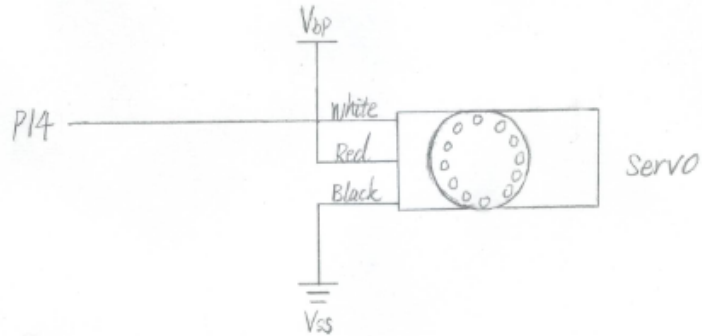


*IR Transmitter  
Circuit (on remote)*

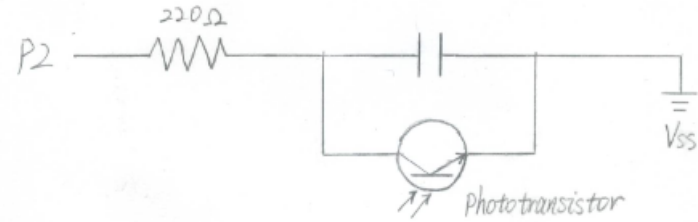




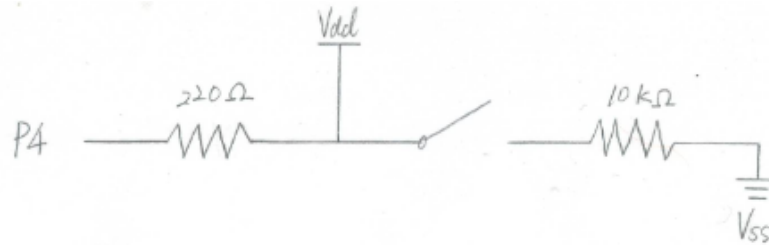
## Schematics



*Continuous  
Servomotor Circuit*



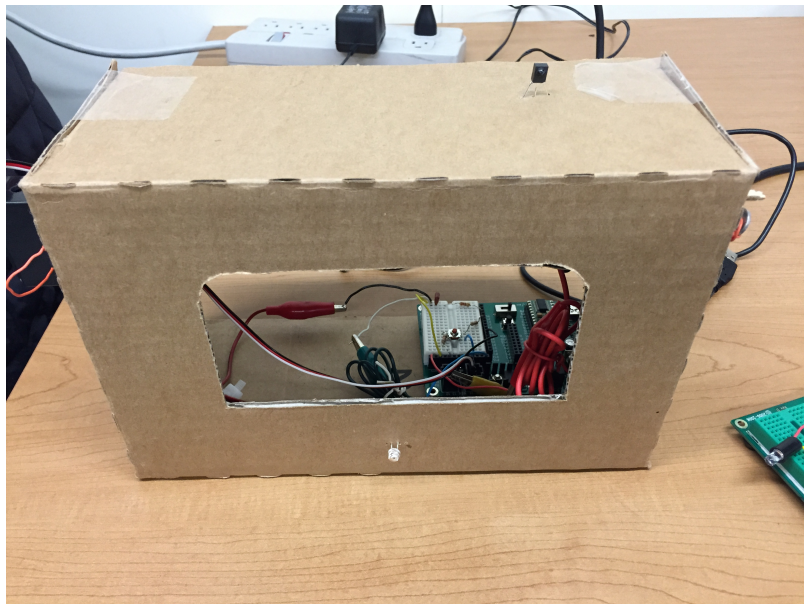
*Phototransistor Circuit*



*Button Circuit*



## Model



Front View

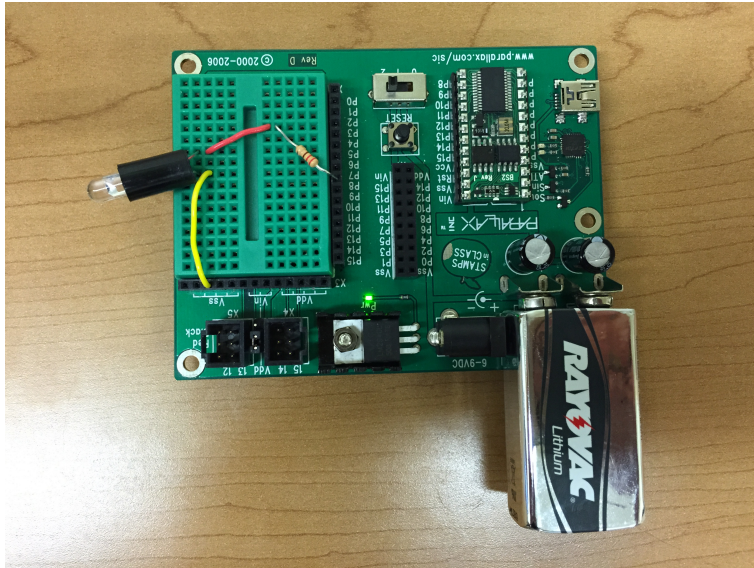




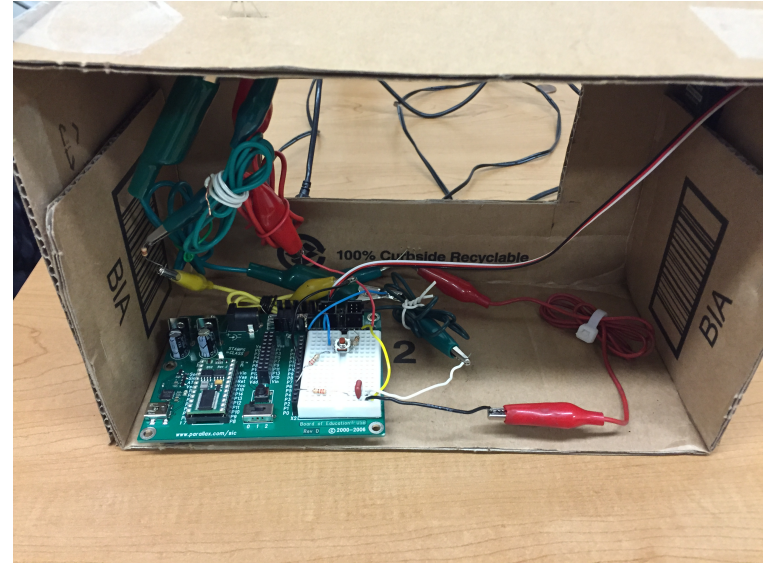
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## Model



Remote Control



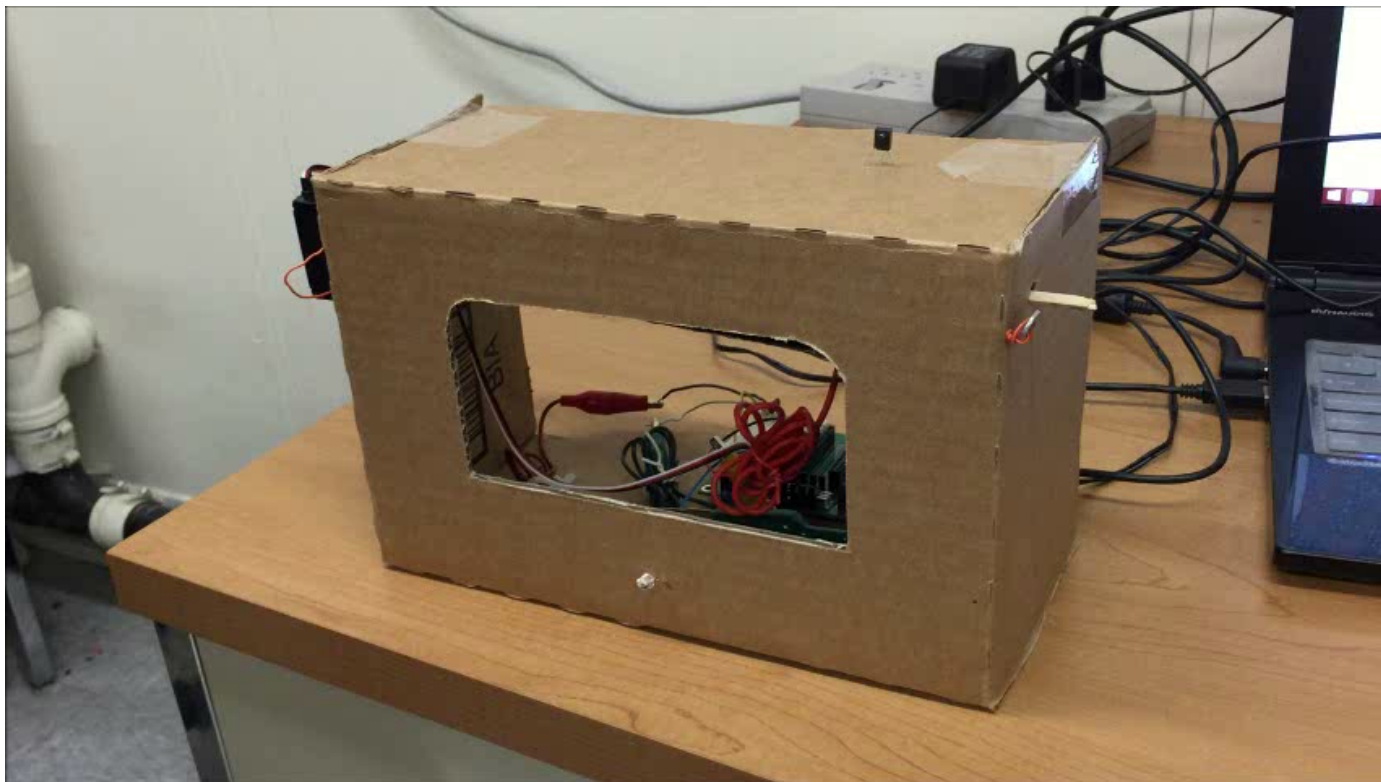
Inside View



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## Demonstration





## Parts/Cost

Component	Quantity	Cost
BASIC Stamp 2 module	2	\$73.5
Board of Education Development Board-USB	2	\$125.98
Infrared Receiver	1	\$2.69
IR Transmitter	1	\$2.16
Phototransistor	1	\$1.34
Servo	1	\$12.59
Button	2	\$0.9
Battery	1	\$5
Wires, Resistors, Capacitor		\$1
	Total	\$225.12





## BS2 Code

```
' ($STAMP BS2)
' {$PBASIC 2.5}

intensity VAR Word
status VAR Word
counter VAR Word
engine VAR Word
psys VAR Word
IrDetPin PIN 9
irPulse VAR Word
manual VAR Word

engine = 1

DO

IF IN4 = 1 AND engine = 1 THEN
engine = 0
ELSEIF IN4 = 1 AND engine = 0 THEN
engine = 1
psys = 0
ENDIF

DC WHILE ( engine = 0 )

HIGH 2
PAUSE 100
ACTIME 2, 1, intensity

PULSIN IrDetPin, 0, irPulse

IF status = 0 AND psys = 0 AND intensity<50 THEN
FOR counter =740 TO 1000
PULSOUT 14, 1000
PAUSE 20
NEXT
status = 1
```

```
'Variables declared

'Engine is on when the program starts

'If the button is pressed and the engine is on, the engine turns off
'If the button is pressed and the engine is off, the engine turns on
'Light detector permission is enabled next time engine is off

'The system is running when the engine is off

'The light sensor is on to detect any sunlight

'Key remote detects

'If the shade is off and permission is on and light is bright, the shade is on
```



## BS2 Code

```
ENDIF
```

```
IF status = 0 AND psys = 1 AND manual>15 THEN
FOR counter =740 TC 1000
PULSOUT 14, 1000
PAUSE 20
NEXT
status = 1
manual = 0
ENDIF
```

```
PULSIN IrDetPin, 0, irPulse
```

```
IF status = 1 AND irPulse < 600 THEN
FOR counter =715 TC 1000
PULSOUT 14, 20
PAUSE 20
NEXT
status=0
psys = 1
manual = 0
ENDIF
```

```
DC WHILE irPulse < 600 AND status = 0
manual = manual +1
PULSIN IrDetPin, 0, irPulse
LOOP
```

```
LOOP
```

```
LOOP
```

```
'If the shade is off and permission is off, but unlock button is pressed twice, shade is on
```

```
'The unlock button memory is set to 0
```

```
'Key remote detects
```

```
'If the shade is on and unlock button is pressed, the shade is off
```

```
'Light detector permission is off
```

```
'The unlock button memory is set to 0
```

```
'When the shade is off, the number of unlock button pressed is detected
```





# BS2 Code

## Remote Code

```
' {$STAMP BS2}
' {$PBASIC 2.5}

' Declaring Variables
IrLedPin    CON  8
IrFreq      CON  38000
StartBitTime CON  3

'When the reset button is pressed, the infrared transmitter sends infrared light
FREQOUT IrLedPin, StartBitTime, IrFreq

STOP
```



## References

- <http://www.ggweather.com/heat/>
- <http://www.shadetreeonline.com/theshade/theshade.htm>
- <http://healthypets.mercola.com/sites/healthypets/archive/2010/08/10/dead-in-minutes-dogs-and-heatstroke.aspx>
- <http://www.ecvv.com/product/176217.html>
- <http://www.bt.cdc.gov/agent/benzene/basics/Facts.asp>
- <http://pubs.acs.org/doi/abs/10.1021/es0617901>