Example of a practical UV Index display

J. Robinson, R.L. McKenzie
National Institute of Water and Atmospheric Research (NIWA), Lauder, Central Otago, New Zealand

Introduction

A UV Index display meter, which shows the current level of sunburning UV radiation, has been developed by the National Institute of Water and Atmospheric Research (NIWA) in consultation with the Cancer Society of New Zealand.

A detector senses the amount of sun-burning UV radiation present and the information is displayed in terms of the UV Index, which is the internationally-agreed scale for reporting UV to the public, on a large board rather like the fire danger signs we see around the country. The main difference is that the pointer moves automatically in response to the changing UV, for example as clouds move overhead. As well as displaying the actual UV Index, additional information about appropriate behavioral responses is also provided, which should be displayed nearby (figure 7)

These prototypes have operated successfully over several summers. The first prototype was installed in November 2003 at the Molyneux Aquatic Centre in Alexandra Central Otago and continues to give good service. The unit on display here was deployed at the Goldrush multisport event in March 2003 (figure 1), and has since been deployed at a number of similar outdoor events. Similar units are now in place around New Zealand at other locations including Geraldine Public Swimming Pool, Blue Skies FM Radio station in Alexandra, and St Canices Primary School in Westport.

Figure 1. UV Index display at Goldrush multisport event.

Technical details (Sensor)

A photodiode and preamplifier are housed in a weather proof PTFE diffuser (figure 2). The design of the diffuser is important to produce an true cosine response to the sun's elevation (figure 3).

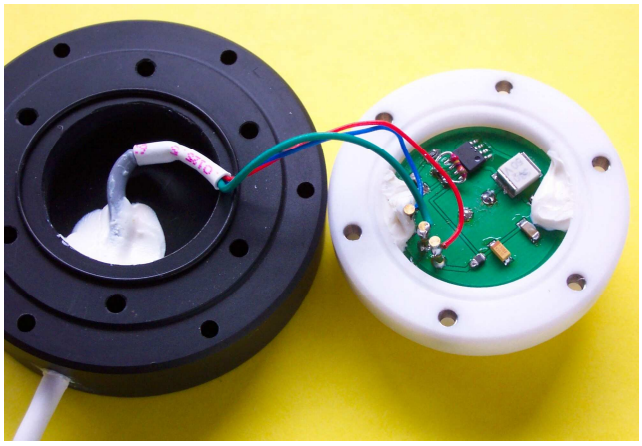

Figure 2. Inside view of sensor showing preamplifier and diffuser (left).

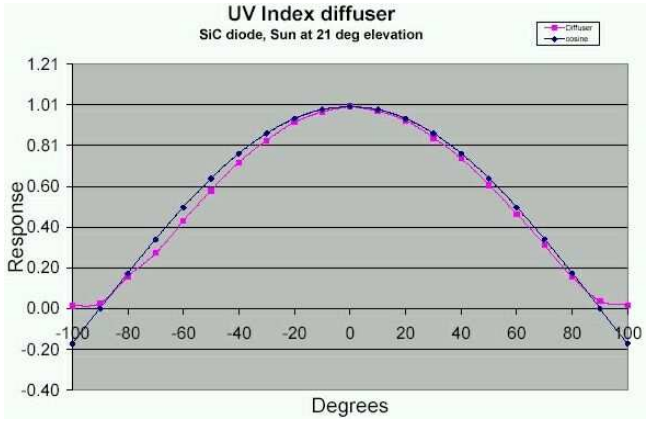

Figure 3. Typical Sensor cosine response

The diode choice is also crucial as it needs to mimic the action spectrum of the skin. We use either a Aluminium Gallium Nitride (AlGaN), or Silicon Carbide (SiC) diodes.

Either diode has a very small output signal requiring considerable amplification using a dual stage LMC6062 amplifier with approx 20M feedback resistor. The buffered output signal can now be feed down a screened 2-core cable for some tens of metres to the display itself.

Technical details (Display Electronics)

Low cost and robustness resulted in the choice of a standard “model aircraft” servo unit for moving the indicating arm. The servo is driven by a simple electronic circuit based around a popular microcontroller, the PIC12F675.

The sensor analogue voltage signal is converted to an 8-bit value within the microcontroller. This is scaled by the internal software for correct calibration, then averaged over 10 seconds to produce a suitable PWM signal to drive the servo. Internal software also allows for external connection to calibration hardware to set initial zero position, span, and gain.

The completed circuitry is encapsulated in resin and mounted inside a water-tight plastic box attached to the rear of the display panel (figure 4).

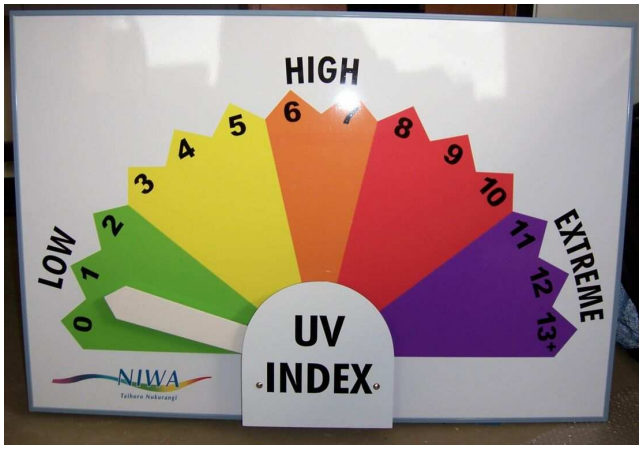

Figure 5. Basic version of the UV Index display

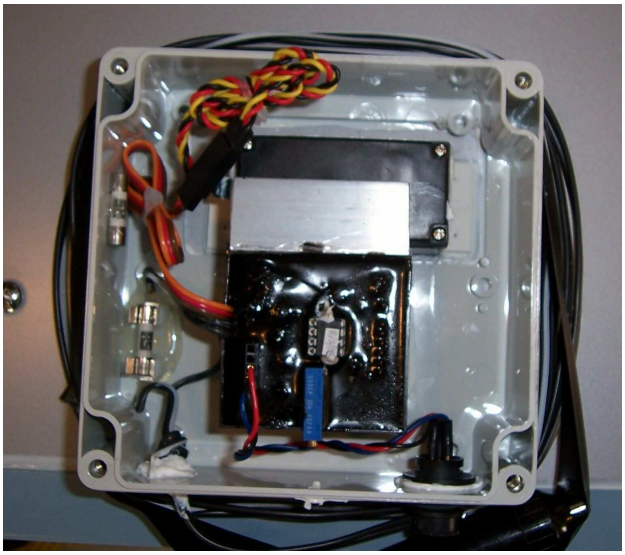

Figure 4. Completed electronics

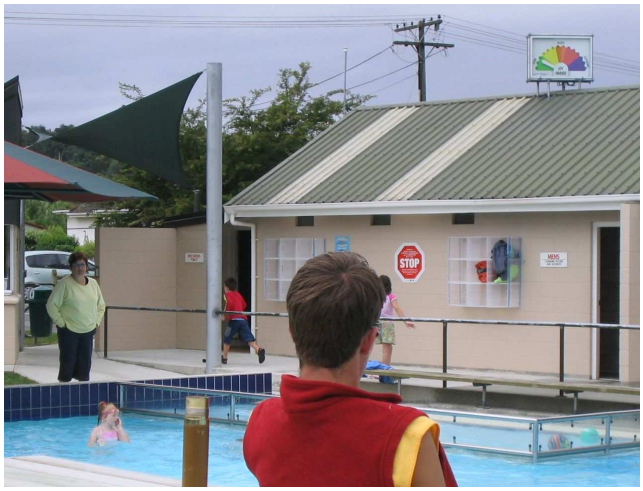

Figure 6. Display at Geraldine Public Pool

Future Developments

To date each display is “hand made” to order. We would like to see these units made in bulk and thus available at a reduced price, making them more affordable to the Public.

Both the sensor and display electronics could be further developed to make bulk production and calibration easier.

Figure 7. Example behavioral message