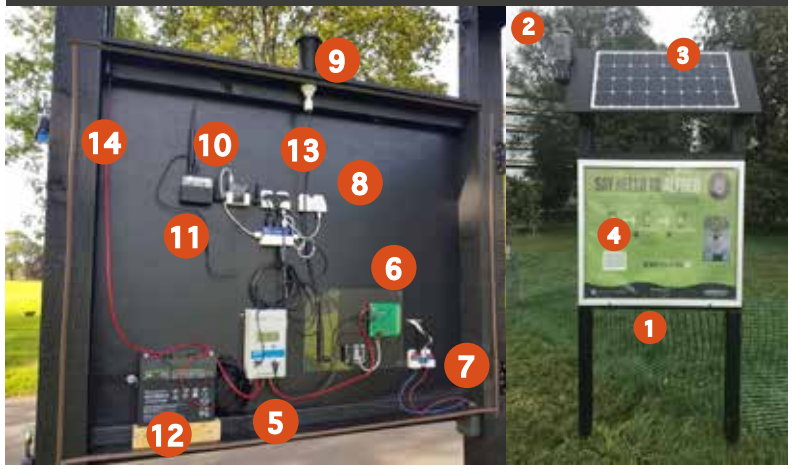
THE FINAL PROTOTYPE



The Charge Controller 5 manages the flow of power from the solar panel to recharge the battery and is monitored by the Board Controller 6 for power generation and battery temperature and consumption levels, which then sends this information, separately from the summary sensor data, every 5 minutes. This information is important to help us understand the power profile of all the equipment on the board and that the system is working correctly. The Board Controller contains logic for the control of power consumption by the various sensing components and has the capability to turn off sensors when power levels are low.

The wireless connectivity relies on additional networking infrastructure. In Edinburgh we are able to make use of a dedicated Low Power Wide Area Network (LPWAN) provided by the University of Edinburgh based on LoRaWAN. The network is ideally suited to IoT sensor applications that transmit small amounts of data every few minutes. If you are not able to access LoRaWAN in your locale, then an alternate is to utilise a mobile telco equivalent such as the new NB-IoT 5G standard currently being rolled out at the time of writing across the UK. These solutions will require a SIM card to be installed with paid monthly subscription.

The Bat Detector is implemented with a USB connected Ultrasonic capable microphone 9 and a Raspberry Pi Zero W 13. The microphone we used is the Ultramic192K (cost around £200). It presents as a standard USB microphone device to the host operating system making it easy to work with. The presence sensor utilises an Infra-Red LIDAR type sensor (cost around £50) which can reliably measure the distance from 0.1 to >10m to an object within its narrow field of view. The Presence Sensor is an accurate proximity sensor that has the key advantage of operating from a single point directly attached to the Noticeboard, rather than requiring a beam break style separate emitter and receiver placed on either side of a path which would require significant additional kit to be installed including the disruptive laying of wiring under the path itself.

A seven-inch monochrome EPaper display 4 similar to the type of display found in digital book readers such as the Amazon Kindle. Unlike LCD or LED based display panels, EPaper and EInk displays consume very little power, essentially only requiring a small amount of energy when changing the rendered information they show.