Calculogger

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CALCULOGGER

Turning a calculator into a datalogger.

INTRODUCTION

A datalogger is a device that collects data from the environment and records it for further analysis. Dataloggers are often used by environmental engineers to record data such as temperature and humidity (for example, in weather stations).

Many dataloggers are not self-contained; this means that they need to be connected to a computer to record data. However, this reduces their portability and cost. Self-contained dataloggers also exist, but they are expensive.

MY PROJECT

I saw a need for a new type of datalogger – a self-contained, portable and inexpensive model. Ideally, it should also be able to carry out statistical analysis on the data collected by itself, completely eliminating the need for a computer.

I decided to use a CASIO graphical calculator to provide the statistical analysis capacity of my datalogger, the memory to store the data and the display to present it.

The calculator I used has a special port for communicating with a computer. This meant that in principle my idea could work. I would be able to make a 'black box' that plugged into my calculator at one end, and accepted data from sensors at the other – a CalcuLogger.

I tried to find out whether a similar device had ever been created before. I only found one such device - a CASIO datalogger. However, this is an expensive, self-contained datalogger which costs NZ$300.

My task was set: to create an inexpensive device that accepts real-world (analogue) data from various sensors and transmits them to the calculator.

The first challenge was determining how to transmit data to the calculator. I "only" needed to figure out how, volt for volt, bit for bit, the calculator communicates. Neither CASIO nor any other sources on the Internet provide any information about this. Eventually, after a lot of work, I managed to crack the code.

Next, I used a PIC and an ADC to create my CalcuLogger. A PIC is a single-chip computer that costs about $15. Just like a big computer, it has to be programmed to do anything useful. An ADC is a single-chip circuit that can convert analogue signals from sensors into digital data. I designed a circuit for the PIC and ADC and constructed it. I then wrote a program for the PIC to control the ADC and to communicate with the calculator.

This was a difficult and time-consuming task, but I finally got the CalcuLogger working. I tested it by carrying out a simple experiment, which it passed with flying colours.

As it stands, the CalcuLogger costs about $70 to make. However, this cost could be reduced if it were mass-manufactured. Its size is currently similar to that of the calculator, but it could be brought down to as little as two or three matchboxes. The CalcuLogger is powered by a 9V battery that lasts for about 5 days of continuous use. The CalcuLogger can sample up to 11 different sensors of 0 – 5V with an accuracy of 0.02V.

The CalcuLogger has significant potential for applications in both the environmental sciences and in education. This simple, inexpensive and reliable device would be a great addition to any environmental engineer's equipment and to any school's science department.