Title: Beehive Health Monitoring with .NET Gadgeteer

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Author: Ben Lee-Rodgers

Supervisor: Dean Mohamedally

Abstract

Beekeeping is a crucial activity that concerns the management of colonies of honeybees, which are the primary pollinators of the UK's crops. However, monitoring the health of these colonies is difficult to do manually. By bringing the world of internet-connected embedded electronics to beehive management, it is hoped that this process will become both easier and more effective. This ultimately may help arrest the alarming decline in colony numbers that has seen a 30% decrease in their number over the past few years.

In this project, I set out to develop an extensible system to enable beekeepers to monitor the health of their honeybee colonies with greater ease and frequency, and more robustly. The system comprises software for an embedded device to automate and transmit sensor readings, a web API for collection and distribution of the data, and a front-end for live monitoring. This functionality was achieved with a range of technologies: Gadgeteer, an open-source toolkit for developing small electronic devices; a Node.js-powered API; Windows Azure Storage for the database; and a thick-client JavaScript web application for the front-end.

With over a quarter of million beehives in the UK, the market for such systems could be very significant. Despite considerable research activity in monitoring honeybee colonies, the majority of beekeepers are amateurs and they are currently poorly served, with only inextensible commercial solutions and limited hobbyist attempts that only cover small parts of the system.

By building an extensible system of independent components, this project achieved its primary goals of demonstrating how automated beehive monitoring could be useful, and of providing a platform for future development in this area. Significantly, through provision of the data in cloud-based services, it is feasible that when scaled to multiple beehives across the country, the wealth of data that would become available for analysis about bee colonies could be of significant research value.