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MASSEY UNIVERSITY
ENGINEERING

SCHOOL OF ENGINEERING AND ADVANCED TECHNOLOGY

Design and Development of a Modular Framework to Integrate Sensors and Actuators

A thesis presented in partial fulfilment of the requirements for the degree of

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Abstract

This thesis details the research and development of a versatile electronic monitoring and control platform, influenced by the Internet of Things (IoT), mass configurability, modularity, expandability and ease of use. The generic framework which has been designed and tested aims to provide a platform to build a wide variety of specialised systems to integrate sensors and actuators.

A central processing unit manages modular hardware devices connected by a serial network. Only the required hardware units are chosen to constitute a system for an application. The processing unit uses modular task handlers to manage the system. The web-based user interface provides multi-platform system access using a web browser. The website is dynamically generated from the system configuration.

While the framework is generic, for testing its efficacy, it was applied to a seed and fertilizer spreader to monitor and control the application rate. This application requires coordinated control of actuators using inputs from multiple sources, including sensors, machine states, a database, other processing tasks, and the operator.

The implementation was successful in achieving reliable control of the seeding rate, based on the tractor ground speed. The practical implementation exhibited a high level of expandability and modularity. The prototype system has also highlighted a few issues which can be addressed in future revisions to improve the versatility and robustness of the framework.

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