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MASSEY UNIVERSITY
NEW ZEALAND

DEVELOPING A BACKPLANE SOLUTION FOR THE TCS PCC

MASTERS THESIS

Thesis submitted in complete fulfilment of the requirements for the Master of Engineering

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Abstract

TCS is company that specialises in systems integration and development of products for industrial application. Their flagship product for distributed control is the CPU5. This project covers the design and development of a backplane solution to solve the limitation of the CPU5 that it only has a limited number of inputs and outputs. The next iteration of the CPU5, is to be called the PCC.

Background research was carried out into the needs of TCS and their target markets. The IEC61499 standard, Windows CE platform and ISaGRAF software environment were also investigated.

The project planning was analysed to gain an understanding of R&D project planning. This project concluded that it was important to be able to make changes to the plan as the project proceeds so that it can still be completed by the deadline.

TCS had set the limitation that the backplane protocol must be a serial bus. Various different types of serial bus were investigated including CAN, USB, Light Peak (optical) and EIA485. The bus selected was a CAN bus with a custom protocol.

Research was carried out into the operation of existing bus drivers and protocols such as DeviceNet and CANOpen to determine an appropriate protocol for a serial bus based backplane. Software was developed to manage devices attached to the backplane.

Hardware and software for a digital I/O module was developed. Various ways of updating the I/O were investigated, an event-based and cyclic updating method was implemented with an adjustable debounce time to maximise performance and robustness.

Hardware and software for a serial port module was developed. A major challenge faced was to transmit a stream based protocol across a frame based CAN backplane.

Software for an Ethernet module was developed. Software design included development of an NDIS compatible miniport driver for Windows CE and software for the slave module.

To demonstrate that the PCC is an effective platform for distributed control, a test setup was created to be shown at a trade show in Nuremberg. The trade show setup was fully programmed in compliance with the IEC61499 standard and demonstrated the power of the PCC.

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