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INVESTIGATIVE DEVELOPMENT OF AN ACCESSIBLE LED MATRIX DISPLAY

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

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ABSTRACT

Display technology stands central to today's society, with many routine tasks involving at least one type of display. As LCDs replaced CRT monitors, LED-based displays are on course to replace LCDs as the main display technology. LED technology offers advantages across the board: Aside from their inherently greater efficiency, LED technology also brings gains in lifetime, colour gamut, and relatively environmentally friendly manufacturing processes.

While the technology still requires some development before it is to replace LCDs, widespread adoption in applications such as live displays and performances has already begun. This dissertation aims to investigate the foundations the development of LED displays through the development of a prototype implementation. A strong focus is placed on flexibility and accessibility of the design.

The prototype system utilises a simple PC software based video controller, which processes and distributes raw image data to a network of microcontrollers via a USB connection. Each microcontroller module contains circuitry to drive a 16x16 array of SMD RGB LEDs, and is addressable over the integrated I^2C bus.

This thesis describes the work completed towards the development of this prototype and steps taken to maintain alignment with outlined objectives. Development is broken down into the PC software development, electronics development, and embedded software development of the prototype.

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-Scott de Jong

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ABBREVIATIONS

ASIC .... *Application Specific Integrated Circuit*
CFF .... *Critical Flicker Frequency*
CMOS .... *Complementary Metal-oxide Semiconductor*
CRT .... *Cathode Ray Tube*
DAC .... *Digital-to-Analogue Converter*
DIP .... *Dual In-line Package*
FPGA .... *Field Programmable Gate Array*
GPL .... *General Public License*
GPP .... *General Purpose Processor*
GUI .... *Graphical User Interface*
I^2C .... *Two-wire Interface*
IDE .... *Integrated Development Environment*
ISP .... *In-system Programmer*
ISR .... *Interrupt Service Routine*
LSB .... *Least Significant Bit*
PCB .... *Printed Circuit Board*
PWM .... *Pulse Width Modulation*
RGB .... *Red Green Blue*
SMT .... *Surface Mount Technology*
TTL .... *Transistor-transistor Logic*
USB .... *Univeral Serial Bus*
VA .... *Visual Acuity*