DIGITAL ADDRESSABLE LIGHTING INTERFACE (DALI)

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Introduction
Digital Addressable Lighting Interface is an intelligent global standard and protocol for lighting control solutions. It was jointly developed and defined by key manufacturers of lighting equipment like Philips, Osram etc. Higher functionality, flexibility, easy installation and maintenance with increased efficiency, comfort and safety are major advantages of DALI interface. Nevertheless, DALI systems are less widely used due to large upfront cost and long term returns. This project aims at developing a LED based DALI system which is cheaper, more powerful and flexible than commercially available options.

Experimental Procedure
The Digital addressable lighting interface circuit is designed in the EAGLE PCB Design Software. Then the design is printed on 100*63mm printed circuit board through standard procedure. Further the PCB is populated with the components and soldered by the method of surface mount soldering. Each part of the circuit, i.e. the LED power stage, the 12V to 3.3V regulator circuit, and the DALI interface circuit is tested and diagnosed separately. The issues of inaccurate joints, burned components, faulty microcontroller, improper components etc. are pinpointed through continuous testing and inspection, and was revised successfully.

Fig 1. Completed PCB (Top View)

Programming LPC812M101JD20

Microcontroller
Instead of using an expensive dedicated programming/flash device for a microcontroller, an ARM LPC1768 mbed prototyping board is used to establish a serial interface between the computer and microcontroller. The freeware tool ‘Flash Magic’ is used to program hex code in EEPROM of microcontroller. The simple and less complex mbed compilers (open source C/C++ compiler) are used to code the IC as alternative to complicated professional developing tools like KEIL, which will consumes significant amount of time for coding and requires licence. On research it was found that the NXP LPC800-MAX mbed uses the same LPC812M101JD20 microcontroller, thus LPC800-MAX compiler is used to make the code for the IC. The simple utility ‘BIN2HEX’ is used to convert the generated binary file (.bin) by mbed compiler to Intel HEX file (.hex) for the ‘Flash Magic’

Fig 2. Serial communication setup

Controlling The Brightness Remotely
The LPC812M101JD20 microcontroller can be programmed to control the brightness of the LED’s remotely using a computer. The same procedure for programming LPC812M101JD20 is used here. A serial communication system is established between computer and microcontroller via mbed through the USB port and the microcontroller regulates the brightness according to the signals from the computer. It is designed such that the keystroke ‘b’ in computer increases the brightness by 5% and remains in that particular brightness value and the keystroke ‘d’ decreases the brightness by 5%. In this way the number of times the keys are pressed determines the brightness of the LED’s.

Fig 3. LED Dimming Curve

Conclusion
Successfully demonstrated the working of a DALI system. The designed DALI system with Luminous Flux of 645lm (3 LED*215lm) takes only 0.48W (12V*40mA at full brightness) input power. The total cost of construction falls under £20, which will be further dropped if manufactured commercially. The Philips CoreLine RC120B 37W, 3400lm LED lighting system with DALI interface available in market costs £170. If the designed system is upgraded for the Philips specification, same light output can be obtained with a much reduced cost and power.

References