International Journal of Electrical and Electronics Research ISSN 2348-6988 (online)
Vol. 3, Issue 2, pp: (128-133), Month: April - June 2015, Available at: www.researchpublish.com

Real Time Implementation of Digitally Addressable Lighting Interface (D.A.L.I)

[1]Anand M S, [2]George Kurian, [3]Manu G, [4]Vineeth Narayanan

[1,2,3,4] under graduate students, M.A. College of Engineering, Kothamangalam, Kerala, India

Abstract: **Digitally Addressable Lighting Interface (D.A.L.I.) is a technical standard for network-based systems that control lighting in buildings. The aim of this project is to design and implement DALI in a real time environment. In this project, the work is carried out using a system consisting of a PSoC microcontroller and a PIC microcontroller. The PSoC controller performs the main function, receiving & processing the input and sending the data to the PIC controller. The PIC microcontroller performs the function of controlling the brightness of the bulb. A Zero Crossing Detector (ZCD), used to read the frequency of the microcontroller and trigger the circuit, is connected to the PIC microcontroller for operation of the system. The bulb i.e. the load, which is an A.C load and the controllers, which operate on a D.C supply are separated from one another using an isolation circuit. The input from the user to control the brightness levels is done using a 4-wire resistive type touch screen as the digital communication device. This entire system is incorporated twice for the control of two different loads, or incandescent lamps.**

Keywords: **D.A.L.I., PSoC, PIC, Touch Screen, Zero Crossing Detector.**

1. INTRODUCTION

D.A.L.I stands for Digitally Addressable Lighting Interface and is a protocol set out in the technical standard IEC 62386.A D.A.L.I network consists of a controller and one or more lighting devices that have interfaces for the same. The controller can control each light by means of a data exchange. The D.A.L.I protocol permits devices to be individually addressed and it also incorporates Group and Scene broadcast messages to simultaneously address multiple devices. There was the need to save energy and I have decided to work on this latest technology, where I believe that energy saved is energy gained. This also incorporates the use of the touch screen which is an insulator and is free from electrical shocks and easy to maintain and operate and hence I have decided to interface the D.A.L.I to a touch screen for the real time environment demo. The main objective of this project is to design and develop D.A.L.I protocol in the real time using the micro controller along with the touch screen interface. We also learn the power electronics and communication between the micro controllers in real time applications.

2. TOUCH SCREEN AND ITS PARAMETERS

In this system, the input is received from the user through a 4-wire resistive type touch screen. The schematic is very simple.The touch screen is directly connected to the PSoC device ports. Resistors R_1 and R_2 are used as pull downs to terminate the PSoC inputs when the plates are not drivenResistive-type touch screens are pressure-sensitive display overlays that are widely used for many applications. Touch screen construction is simple and operation is easy for users to understand .Schematic is shown below.

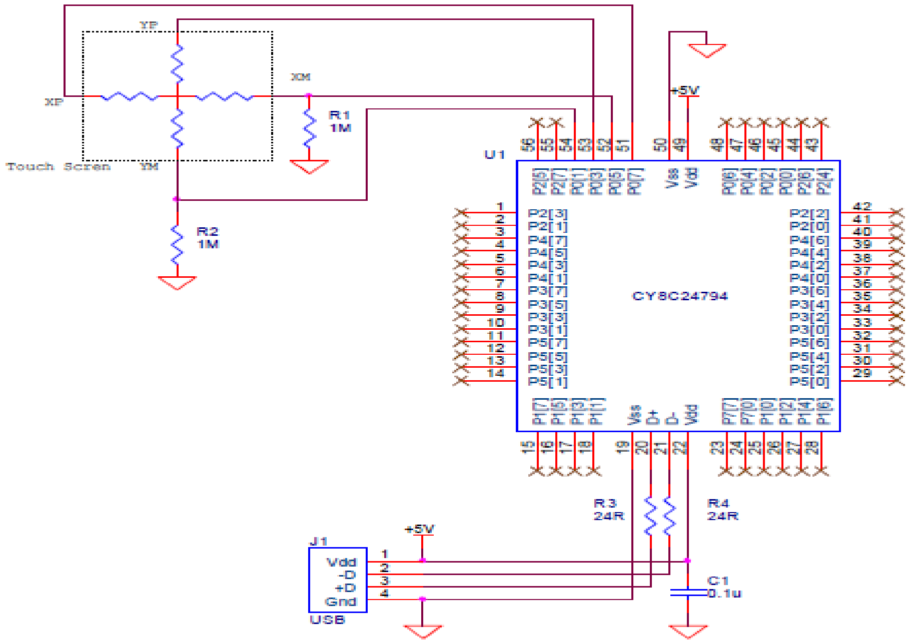

Figure.1 Schematic of Touch Screen

2.1 Measurement of Parameters:

The figures i, ii, iii, iv show how the PSoC pins are set to measure touch parameters. To measure parameters, the PSoC pin drive modes are adjusted as shown in figures and an Analog to Digital Converter (ADC) is connected to the corresponding pin. The Delta Sigma ADC User Module is used with 10-bit resolution and 64x over-sampling rate. This allows all four measurements, including two dummy measurements, within 0.3 ms after changing ADC input. The first two parameters measured are the touch position X and Y coordinates. The second two parameters allow calculating the resistance of the touch zone to determine touch pressure. This allows the application to differentiate between a touch by a finger and a touch by a stylus. There are two methods of performing the touch pressure measurement. The first method requires knowing the X-plate resistance, the X-position (X) and two additional cross-panel measurements (Z1 and Z2) of the touch screen. Equation (1) calculates the touch pressure using this method. The second method requires knowing the X- and Y-plate resistance, and both touch coordinates, but requires only one cross-panel measurement, Z_1. Equation (2) calculates the touch pressure by the second method. The touch screen controller measures both Z_1 and Z_2 and sends both to the PC by USB. You can select the appropriate method of touch pressure calculation for your application.

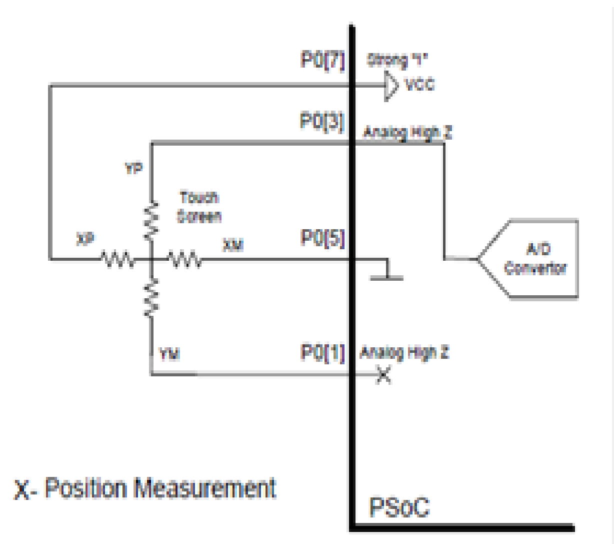

Fig i

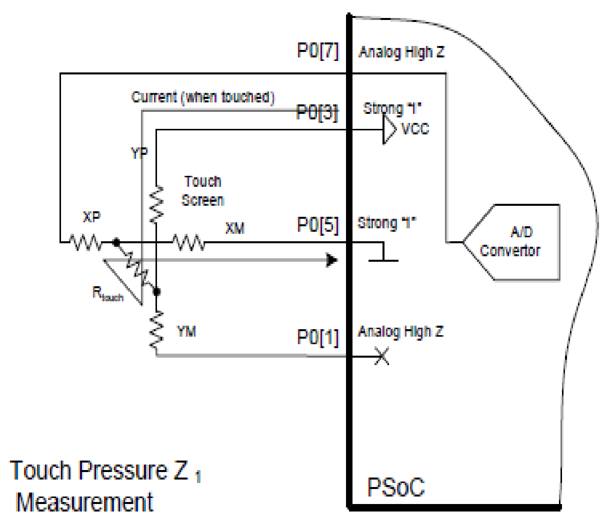

Fig ii

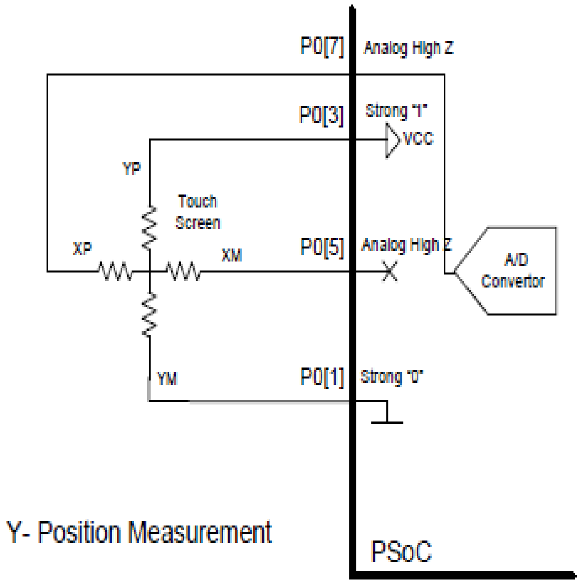

Fig iii

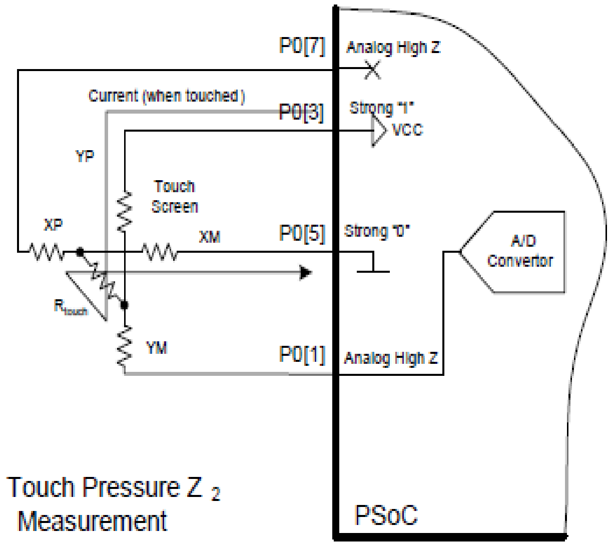

Fig iv

3. FUNCTIONAL BLOCK DIAGRAM

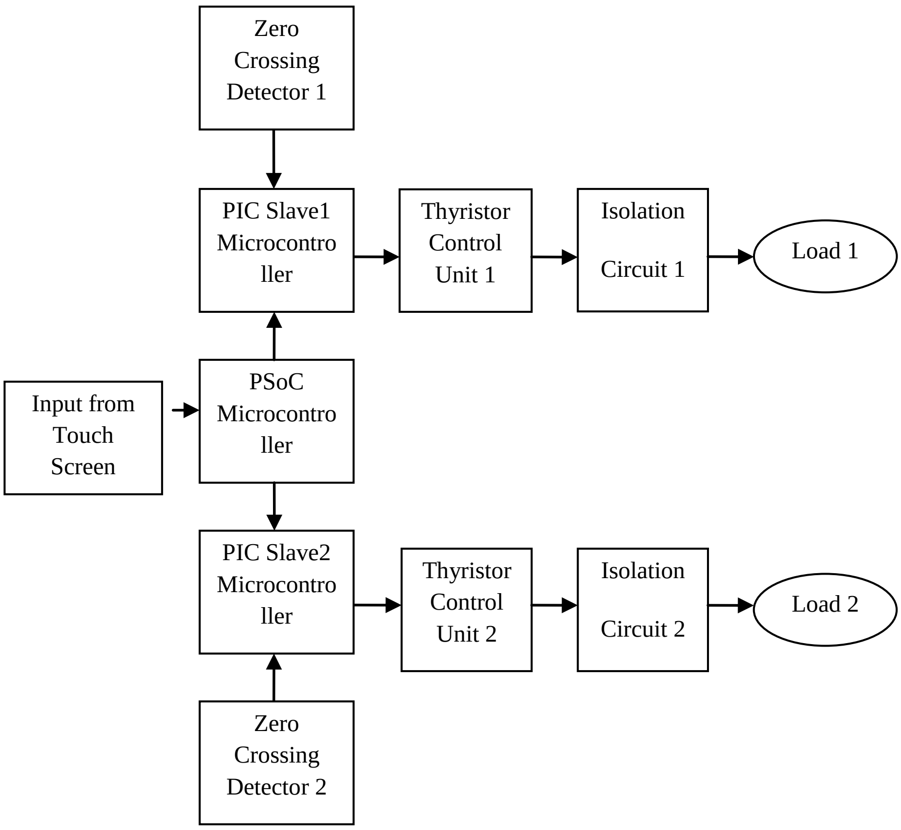

Figure.2 Block Schematic

The block diagram of the system is shown in Fig. 2. This functional block comprises of a 4-wire resistive type touch screen which is used as the input for shifting control from one load to the other and controlling the brightness of each load. Using this system only one load can be controlled at a time. This particular touch screen functions mainly as a two dimensional potentiometer with the value of the resistance being transmitted to the PSOC microcontroller.The PSoC microcontroller is the main component of this block. The controller houses the main control program of the system. It

International Journal of Electrical and Electronics Research ISSN 2348-6988 (online)
Vol. 3, Issue 2, pp: (128-133), Month: April - June 2015, Available at: www.researchpublish.com

processes input received from the touch screen and based on the input, it shifts control from one load to the other and also passes the information required to the PIC block for control of the brightness of the bulbs. The main function of PIC is to control the brightness of the bulbs. The PIC microcontroller forms the main component of this block. It is programmed to receive the processed information from the PSoC microcontroller and based on the information received, it varies the value of the firing angles and hence controls the brightness of the bulbs.This functional block mainly comprises of a zero crossing detector (ZCD). Its main function is to read the frequency of the microcontroller and trigger the operation of the circuit. A thyristor control block is used to control the thyristor used, which operates the circuit. It varies the delay angles in the supply and hence varies the brightness levels in the bulbs.

4. CIRCUIT DIAGRAM

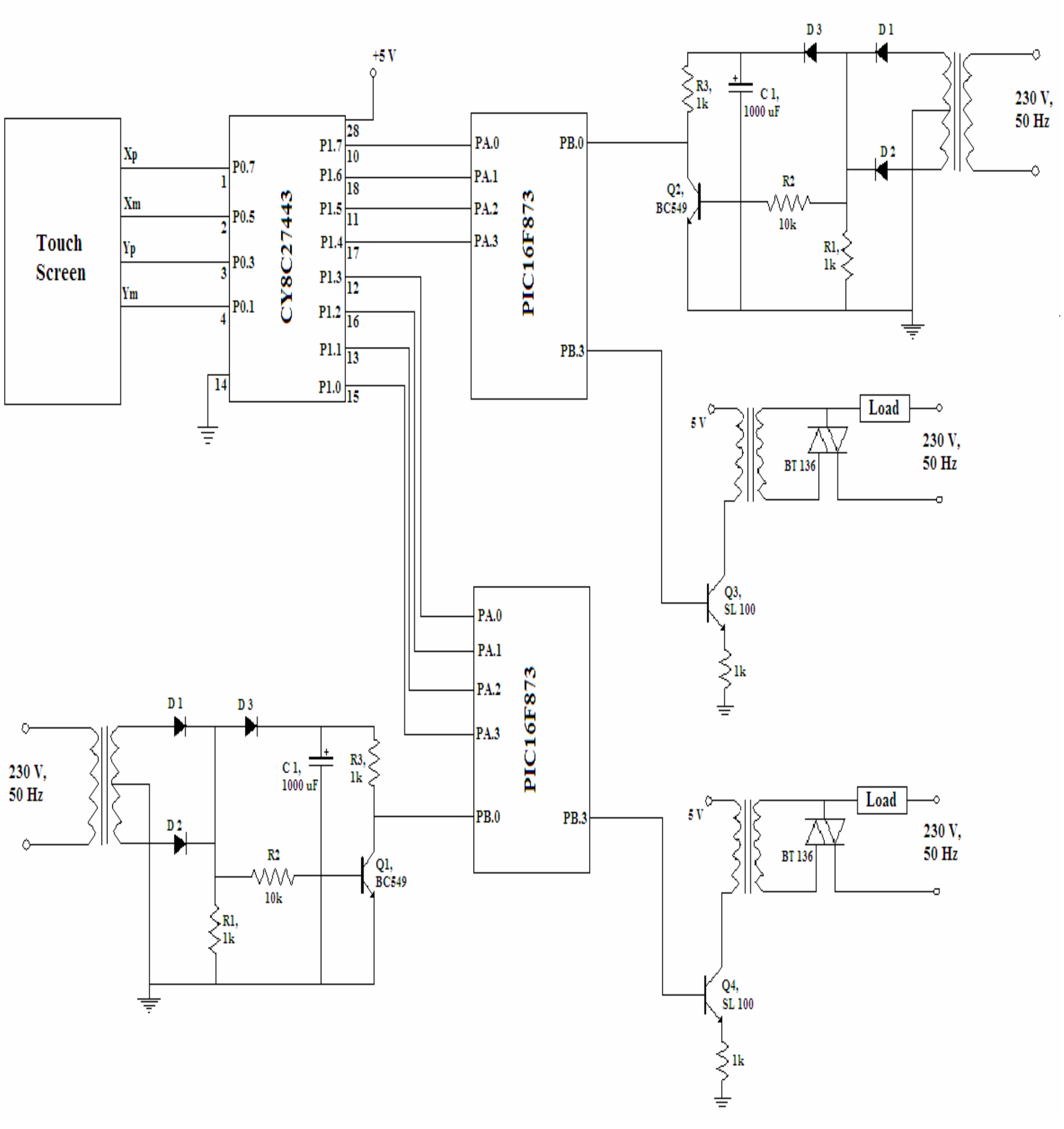

Fig.3 Circuit diagram

The circuit diagram of the D.A.L.I. is shown in Fig 3. The PSoC microcontroller is the main component . The controller houses the main control program of the system. It processes input received from the touch screen and based on the input, it shifts control from one load to the other and also passes the information required to the PIC block for control of the brightness of the bulbs. The PIC microcontroller will receive the processed information from the PSoC microcontroller and based on the information received, it varies the value of the firing angles and hence controls the brightness of the bulbs. The zero crossing detector(ZCD) reads the frequency of the microcontroller and trigger the operation of the circuit. The thyristor used varies the delay angles in the supply and hence varies the brightness levels in the bulbs.

4.1 Operational flow chart

The operational flow chart for the real time implementation of D.A.L.I. is as shown below in Fig 4.

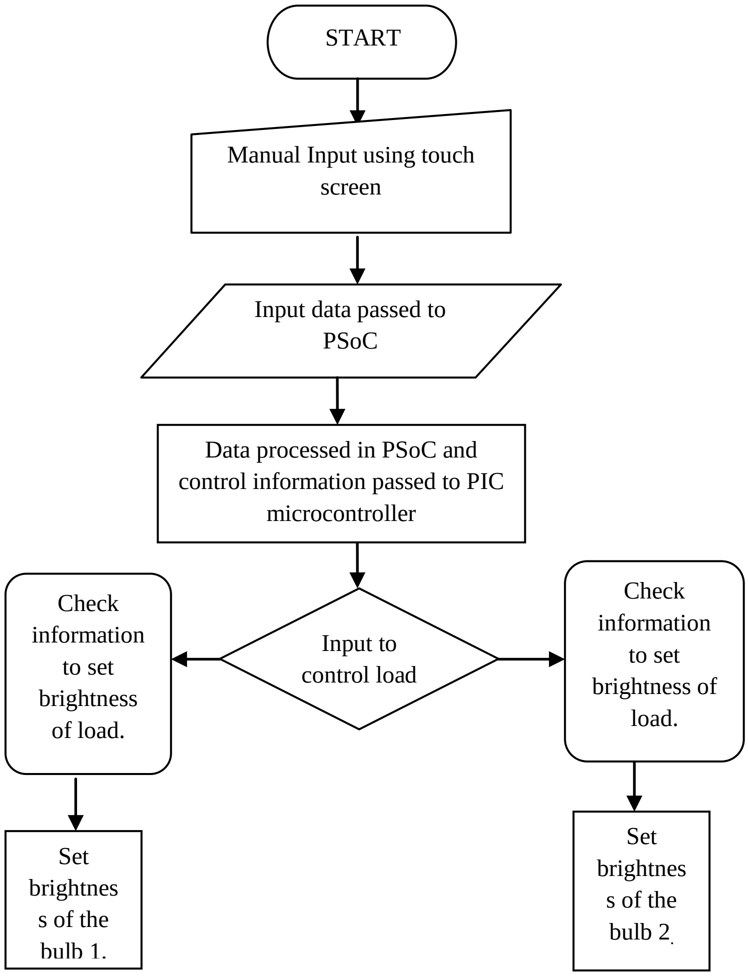

Figure.4 Operational Flow Chart

5. CONCLUSION

The use of thyristor circuit makes the D.A.L.I system suitable for use in other applications such as speed control, PWM generation, light intensity control, motor control applications and others. In D.A.L.I, when the numbers of bulbs are more, single end control for all the bulbs is provided to the user through a micro controller. This facility hence incorporates easy handling. Also, it finds application in all fields which incorporate analog control with some advantages. For example, if fluorescent dimming is desirable for a given application, D.A.L.I can offer distinct advantages related to intelligence, flexibility and two-way communication as it uses as digital system. The thyristors used in the circuit mainly function to trigger the operation of the circuit. Based on the input from the PIC microcontrollers, the thyristors trigger the circuit at various firing angles to vary the voltage across the bulb. As the firing angle is increased, the voltage across the bulbs is reduced. Consequently it was also observed in the experimental procedure that the efficiency of the system reduces as the delay angle is increased. This is mainly because unlike analog control where the resistance is controlled for the control of the load output, the digital control used in this system varies the angle of the supply itself and hence, the output from a single load is reduced. This is probably one of the only advantages of analog systems over digital systems. This is because in analog systems, the total output from the controlling resistance and the load is almost the same at any level, which is not the case in digital control. One of the main advantages of this system is that the control of the loads can be done through a single user interface. In this case, a touch screen is used. By programming the touch screen to have more number of buttons, interfaced with a single PSoC microcontroller, control of a large number of loads is possible.

REFERENCES

[1] Chin S. Moo, Hung L. Cheng, Tsai F. Lin, Hun C. Yen, "Designing a Dimmable Electronic Ballast with Voltage Control far Fluorescent lamp," ISIE'99-Bled, Sloveniil, pp.786-791.1999.

[2] Hopkins. D.C., Moronski. J, “Partitioning digitally programmable power-control for applications to ballasts,” Applied Power Electronics Conference and Exposition, 2002. APEC 2002. Seventeenth Annual IEEE vol. 2, pp. 931 – 935, March 2002.

[3] Bofu Huang, Kai Liu, Mingguang Wu, “Lamp Digital Dimming Ballast based on KA7543,” China Light and Lighting, pp. 23– 25, June 2002.

[4] Hein, P.F, “DALI-a digital addressable lighting interface for lighting electronics,” 2001 Thirty-Sixth IAS Annual Meeting,Conference Record of the 2001 IEEE. vol. 2, pp. 901 – 905, 30September-4 October .

[5] Gao Xichang, Jiang Xiaoping and Li Deyong, “Advanced Lamp Current Feedback Dimming Ballast Controller KA7543 and ItsApplication,” Oversea Electronic Components, pp. 16 – 19, September 2000.