3D Graphics Engine Lab Requirements

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This lab counts total 10 points. Note hard copy of the cover page of the lab report has to be ready for the time to make in class demo, fail to bring the hard copy can result in 2 marks reduction. In addition, the soft copy of the report plus the source code exported as a project have to be submitted on line. This lab as a preliminary step to build vector graphics processing engine in software for LPC1769 ARM processor. In this lab you will

1. Design and prototype LPC1769 micro-processor system board, and enable one SPI LCD display by designated LPC1769 node as your choice. It can be either slave or master, which can be defined in the later labs. Let's define this LPC1769 as LPC1769 LCD node.

2. Generate 2D trees with its branches level no less than 10 or higher based on vector graphics formula discussed in the class (5 points)

(1) use $P(x,y) = P\_1(x\_1,y\_1) + lamda * (P\_2(x\_2,y\_2) - P\_1(x\_1,y\_1))$ with lamda = 0.8 by default for tree branch reduction;

(2) create patch of forest by modifying one parent tree;

(3) randomized location of the new trees by using rand() function;

(4) randomized reduction of the parent tree trunks and branches;

(5) randomized angles for the branches;

(6) continue to display trees without erasing till the keyboard input detected.

3. Generate 3D shadow by

(1) generate a data set and draw xw-yw-zw world coordinate system;

(2) generate a data set and draw a cube with side = 100, the cube should placed with one of the vertex equal to (100, 100, 100);

(3) elevate the cube along Zw axis by 10;

(4) use E(200,200,200), D=20, a point light source Ps(-50, 50, 300) as a initial reference to test out your design, you can choose other values if needed;

(5) compute and display lambda value on the NXP MCUXpresso console for each ray equation, which gives the intersection point of the ray with the Xw-Yw plane;

(6) compute and display all 4 intersection points on the console;

(7) draw darker color of the shadow first, then draw the “floating” cube.

4. Submit project report together with

(1) exported project, the submission is subject to testing and verification.

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5. Rubrics for lab demo

(1) Satisfies the requirements stated in 2018S-17-Lab-report-rubrics.txt;

(2) Bring a first page (hard copy) of the Lab report to the demo, fail to do so will result in 2 point deduction, this cover page will be used to record demo marks; and the report should cover the following material

(2.1) system block diagrams of the entire system setup including laptop computer;

(2.2) system block diagram of the SPI color LCD interface;

(2.3) Schematics of the LPC1769 interface to LCD color display panel;

(2.4) table(s) of the pin connectivity;

(2.5) photo(s) of the implementation.

(3) The software requirements of the lab report

(3.1) software part should cover

a. Algorithm description;

b. Flow chart(s);

c. Pseudo code;

d. testing and verification section;

e. source code listing (appendix).

(4) The demo requirements. Prepare your demo with each team of 4 persons as a unit, but each individual should have (1) individual board; (2) individual source code (no code can be shared among the team members); (3) be prepared to be called on to make a demo. Since the large class size, not necessarily each person from the team will have the opportunity to make demo, we will establish a rotation mechanism to provide opportunity for each individual to have a chance to make demo. But do prepare to be called on in a randomized order to make live demo.

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