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| **Laboratory Experiment No. 6** | |
| **CUSTOMIZING COMPONENT AND PROPER PLACEMENT IN PCB** | |
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| **1. Objective(s):** | |
| The activity aims to let the students create a customized component using software drawing and simulation tool. It also aims to let them know the proper placement of each component using ExpressPCB. | |
| **2. Intended Learning Outcomes (ILOs):** | |
| The students shall be able to:  1. Create a new component based on its specification using ExpressPCB software.  2. Create a PCB layout using ExpressPCB software.  3. Learn to arrange the components placed in the PCB layout in such a way that it lessens the length of connection lines.  4. Learn to connect the schematic diagram to PCB layout. | |
| **3. Discussion:** | |
| Create a buzzer given the dimension below given in millimeter (mm).  buzzer  How the components are placed on the board is dependent on how they are connected. They must be placed such that the wires that link them together can be routed as efficient as possible. Efficient wiring is as short as possible and uses as few layers as possible (which also keeps the number of bias at a minimum), but we will come back to this under Routing. | |
| **4. Resources:** | |
| * PC * ExpressPCB Software | |
| **5. Procedure:** | |
| **A. Customizing Component**   1. Open **Experiment5 – B** and add a customize buzzer. To create this part, we will start with a capacitor base again, this time with a lead spacing of 0.6 inch (15 mm). It’s best to use a polarized capacitor, as the buzzer is polarized. Let’s use “Capacitor – Axial electrolytic – Lead spacing 0.6 inch.” After placing this part, the display will be as follows:      1. Ungroup the component, delete the rectangle, and add a circle in the silkscreen layer that has a radius of 0.5 inches. Move other components out of the way if they are too close. Your display will then look as follows:      1. Now we need to check that the pads are large enough for the buzzer, which has fat leads. Double click on one of the pins to pull up its properties:     The holes have a diameter of 0.035”, which corresponds to 0.89 mm. This could be a little tight for our buzzer, where the pin diameter is specified as 0.8 +/- 0.1 mm. Pull down on the “pad type” menu and select ‘0.100” square pad with 0.046” hole’ which gives us a little clearance. (You need to make the pad and hole large enough that it the part will fit considering tolerances on pin dimension and placement, but if you make the holes too big it will be harder to solder the part in place --- a beginner should err on the side of making the hole too large).     1. Repeat this process with the other pad to make it ‘0.100” round pad with 0.046” hole’      1. Select all the parts of the buzzer, group it as a component, and give the component part ID “BZ1” to match the schematic. Save your component as “buzzer” to use again later. (If someone else has already completed the tutorial on this computer, the part may already exist, in that case you should either save this component with a unique name)      1. Save your work as **Experiment6**.   **B. Proper Placement of Components**   1. Open **Experiment6** and arrange the components for final design layout. Finally, we need to add in the battery, which is going to be connected by a battery strap to the circuit, and therefore requires only two pads (the battery will lay off of the board). This is a good opportunity for us to create a part from scratch. Use the pad tool to place a pad with the description ‘0.150” square pad with 0.079” hole’ to be the positive battery lead.      1. Make this pad correspond to pin 1 for the battery by choosing it with the select tool, and assigning it to be pin 1.      1. Create another pad, this time round, using the description, ‘0.150” round pad with 0.079” hole,’ near the first pad, and assign it to be pin 2. Then select both pads, and group them to make a component. Label the component with the Part ID “B1.” Save the part as “battery strap connection” in the component library.      1. Now (Finally!) we have all the components on the board. You can now link in the schematic file. To do this, select “File” -> “Link schematic to PCB…”      1. Select your schematic file. You should then get a message like this:      1. Now if you select the net tool, and click on a pin, Express PCB will highlight all of the pins that should connect to that pin. For example, select the net tool and click on the + terminal of the battery, you should see something like this:     Click on some of the other pins to check your work and to get a sense of how the parts will connect.   1. Now, we want to arrange our components in a logical fashion. Your goal is to minimize the length of connecting wires. You also would like (ideally) to have a single ground plane on the back and all of other connections on the front surface, which means that you want to avoid having to cross wires over one another (this can’t always be avoided). To rotate a component, right click on it and select the desired rotation. For example, here it might be nice to rotate R4:      1. Rotate the transistor and arrange the other parts until your board looks like this: | |
| **Course:** | **Experiment No.:** |
| **Group No.:** | **Section:** |
| **Group Members:** | **Date Performed:** |
|  | **Date Submitted:** |
|  | **Instructor:** |
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| **6. Data and Results:** | |
| **DATA AND RESULT:**  1. What is the importance of knowing how to customize a component in PCB Lay-outing? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  2. What is the importance of proper placement in PCB Lay-outing?  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |
| **7. Conclusion:**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | |
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| **8. Assessment (Rubric for Laboratory Performance):** | | | | |
| **CRITERIA** | **BEGINNER**  **1** | **ACCEPTABLE**  **2** | **PROFICIENT**  **3** | **SCORE** |
| 1. **Laboratory Skills** | | | | |
| Manipulative Skills | Members do not demonstrate needed skills | Members occasionally demonstrate the needed skills | Members always demonstrate the needed skills |  |
| Experimental Set - Up | Members are unable to set-up the materials | Members are able to set-up the materials with supervision | Members are able to set-up the materials with minimum supervision |  |
| Process Skills | Members do not demonstrate targeted process skills | Members occasionally demonstrate targeted process skills | Members always demonstrated targeted process skills |  |
| Safety Precaution | Members do not follow safety precautions | Members follow safety precautions most of the time | Members follow safety precautions at all times |  |
| **II. Work Habits** | | | | |
| Time Management/ Conduct of Experiment | Members do not finish on time with incomplete data | Members finish on time with incomplete data | Members finish ahead of time with complete data and time to revise data |  |
| Cooperative and Teamwork | Members do not know their tasks and have no defined responsibilities. Group conflicts have to be settled by the teacher | Members have defined responsibilities most of the time. Group conflicts are cooperatively managed most of the time | Members are on tasks and have defined responsibilities at all times. Group conflicts are cooperatively manages at all times |  |
| Neatness and Orderliness | Messy workplace during and after the experiment | Clean and orderly workplace with occasional mess during and after experiment | Clean and orderly workplace at all times during and after the experiment |  |
| Ability to do independent work | Members require supervision by the teacher | Members require occasional supervision by the teacher | Members do not need to be supervised by the teacher |  |
| Other comments/observation: | | TOTAL SCORE | |  |
| RATING = (total score) x 100%  24 | |  |

Evaluated By: Date: