**ECTE250 Deliverable 5 Perfoboard/PCB Prototype**

The fifth deliverable of ECTE250 is a Perfoboard/PCB-based Prototype and a Short Technical Report. Teams are requested to demonstrate a working prototype assembled, integrated, and soldered on a perfoboard/PCB and submit a report file (MS Word document) to the Tutor and Mentor. Teams have to build their tested circuits and electronic components by soldering them onto a perfoboard/PCB. IC (Integrated Circuit) should not be soldered but mounted on sockets soldered on the perfoboard/PCB. Arduino boards and other modules (e.g. LCD) should not be soldered but mounted using headers or other connectors. Also, sensors should not be soldered but interfaced using screw connectors. Teams should do final soldering and then plug in the IC and modules into sockets and connector, then repeat the tests done for the breadboard prototype. The deadline to show the perfoboard/PCB to Mentor and Tutor is during the laboratory session in Spring-W7. Teams are encouraged to book an appointment to demonstrate their work earlier than that and then focus on other project deliverables. The perfoboard/PCB prototype must demonstrate all functionalities of the proposed system in the final assembly with input and output devices properly interfaced with users and/or environment. Teams should demonstrate how the prototype reacts to inputs from user (local or remote via Internet) or from environment (sensors), changing state and eventually producing the necessary outputs (e.g. motors, LED, LCD, speaker, remote messages via Internet). Teams should also demonstrate a detailed power analysis (power measurement for each representative state of the system). The report must include a picture of the perfoboard/PCB prototype, the schematics of all the circuits implemented, an example timing diagram which shows multiple (2 or 3) system cycles against which to test the perfoboard/PCB design and detailed power analysis (typical and worst case).

Length should not exceed 1000 words. About 500 words should be spend discussing your testing results with respect to the required system functionalities. The remaining 500 words (unless otherwise communicated) of your report should address Mentor’s feedback on Deliverable 4. All team members must attend and participate in the demonstration. The Peer Evaluation session must be completed by 8:00 PM, one day after the demonstration.

*Checklist and Marking Criteria*

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| --- | --- |
| **Element team needs to demonstrate** | **Checked** |
| State machine with state signaled by LED, input from buttons/sensors/Internet |  |
| Arduino with Network I/O and LCD display |  |
| Sensor circuits |  |
| 4-bit Analog to Digital Converter |  |
| State Machine Clock/Oscillator |  |
| 555 Time Circuit (with triangular waveform and Arduino reset) |  |
| Switches/Push button de-bouncing |  |
| Motor driving circuit (with H-bridge or Optocoupler) |  |
| Power supply circuit |  |
| Example timing diagram and state chart to verify the system functionality |  |
| Detailed Power Analysis |  |
| Size do not exceed one large perfoboard/PCB plus Arduino small breadboard |  |
| All circuits except passive are mounted using sockets |  |
| Power supplied through +/- 15V only (except for Arduino subsystem) |  |
| Report files submitted |  |

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| --- | --- |
| **Marking Criteria on Deliverable 5 – Perfoboarding/PCB of the system** | **Score** |
| All of the previous sections’ conditions were satisfied. The perfoboard/PCB designincorporated extra functionality not defined in the requirements but that showed inventiveness and cleverness without sacrificing significantly (by more than 10%) the average power used over the cycles. | **10** |
| All previous criteria satisfied and the perfoboard/PCB design incorporates extra functionality  implied in the project brief but not expected for an ECTE250 prototype. | **9** |
| All previous criteria satisfied and power of designed system is clearly near or close to  minimum amongst other comparable ECTE250projects. | **8** |
| All previous criteria and the LCD and Arduino provide a standalone system monitoring  function using code written by the team to collect data from the prototyped system. | **7** |
| All previous criteria satisfied plus the perfoboard/PCB design does not exceed one ECTE250  standard sized perfoboard. | **6** |
| All elements of the checklist were satisfactory. The perfoboarded/PCB system appeared to function as per the project requirements for the state machines, and ALL modes were functioning as per example timing diagrams (which was definitely a good model for the  provided project brief) and also seem to be functioning in a logical manner given the  defined inputs and outputs of the system AND team was able to demonstrate ALL possible scenarios OR show that their system would cover (recover from) ALL possible fault states that may arise due to faulty external switches and sensors where it was physically practical to demonstrate this using the laboratory test equipment. | **5** |
| All elements of the checklist were satisfactory. The perfoboard/PCB appeared to function as per the project brief for the state machines, and most modes were functioning as per example timing diagrams and also seem to be functioning in a logical manner given the defined inputs and outputs of the system, no obvious glitches or circuit malfunction or noise seen on measurement devices (Oscilloscope). | **4** |
| All elements of the checklist were satisfactory, most functions of the perfoboarded/PCB circuit were shown to be working, but not all. There were discrepancies between the example timing diagram and the operation of the perfoboarded/PCB system, or there were obvious glitches (e.g. due to no use of decoupling capacitors? Or due to de-bouncing circuits not working?). Or it was clear that the provided timing diagram did not implement a system which was requested by the original brief. | **3** |
| All elements of the checklist were satisfactory, perfoboarded/PCB circuit could be powered up and some functionality was able to be shown, but clearly many functions are still not implemented in perfoboard/PCB prototype. System could not operate without supplies available only in the laboratory or constantly had power supply overheating or failure. | **2** |
| Short-report submitted, but team cannot show any significant progress on getting any  part of the perfoboarded/PCB circuit to function. Many sections of the checklist for deliverable 5 were incomplete or absent. | **1** |
| No student in team turns up to show perfoboarded/PCB circuit for Deliverable 5 – if here whole team needs to see Coordinator but subject outline specifies receive a mark of ‘0’ | **0** |

**Complexity Factor**: the complexity factor will award 1.5 extra marks if the complexity is 4 (or above) and the team score at least 4 (or above).

Name of Student(s) in team who were present at the Deliverable 5 demonstration: