Design and virtual prototyping of ergonomic driver's cabin of the Formula Student Vehicle

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Background

Formula student UK (FSUK) is a competition organized by Formula 1, in which over 100 university teams compete to design build and race a single seater race car. The cockpit is the area where the driver sits and contains all the components that the driver directly interacts with when the car is in use, such as the seat, steering wheel, pedal box and driver restraint. As such, the geometry and orientation of this hardware is vitally important from ergonomics standpoint.

Aims and objectives.

The Project is to design and prototype an ergonomic cabin for a Formula Student UK (FSUK) vehicle.

Objectives:

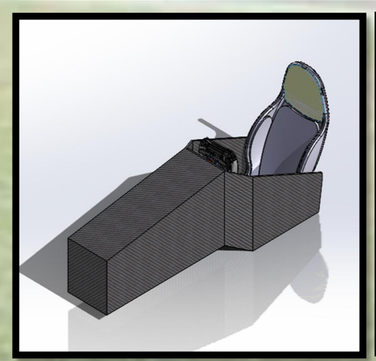
- Preparation of a set of input data for the design process for selected subsystems
- Development of initial concepts of 3D models of components
- Conducting analysis and optimization of vehicle subsystems using CAE tool
- Development of final CAD models of components
- Preparation of technical documentation of the project in the form of technical drawings, visualizations, and animations of vehicle components

Ergonomic assessment methodology

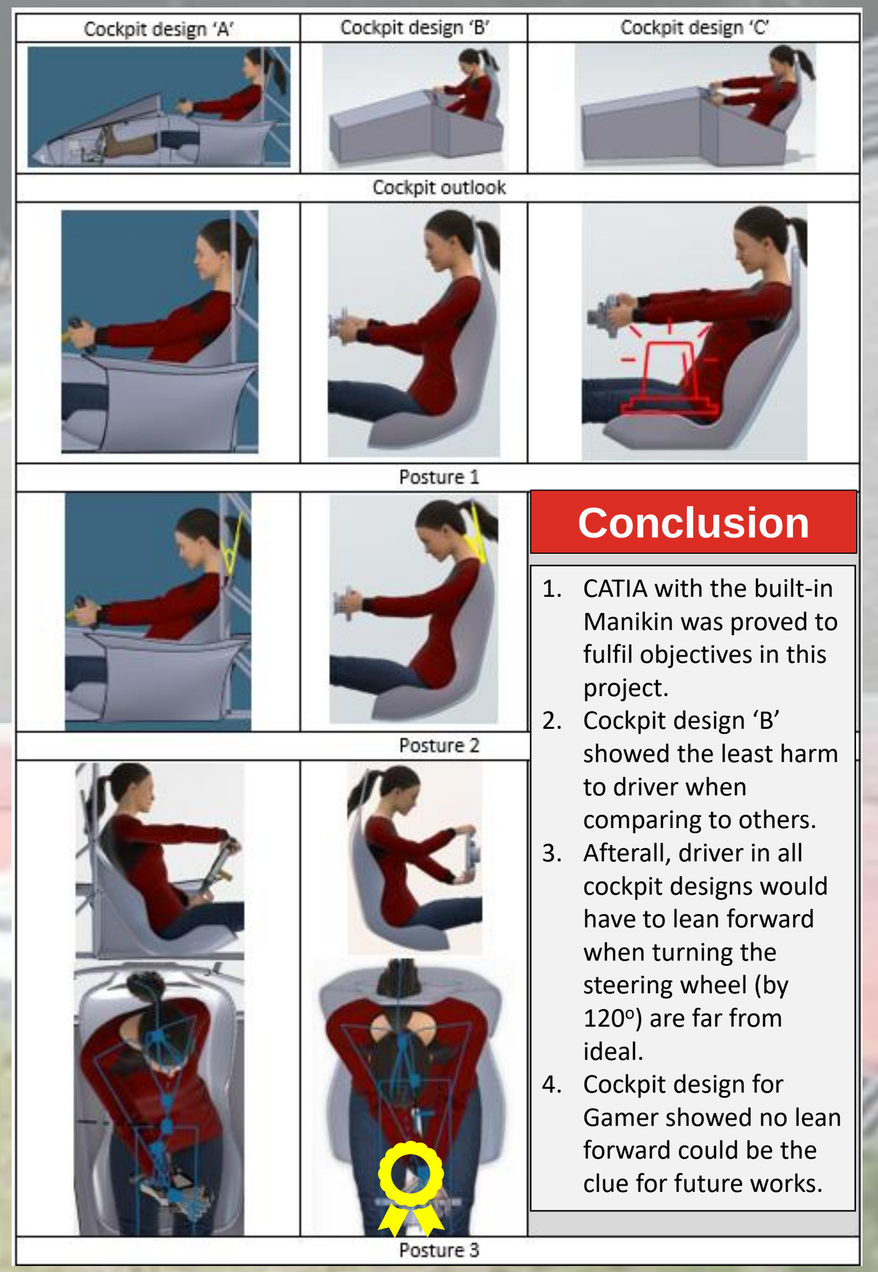
The final design was selected based on the ergonomic performance of each design, using CATIA and manual methods such as RULA and SAE standard JL1100. The design selection process was a modified version of the material selection process used in Granta EduPack. Key considerations are (joint angle, moment of forces).

Design Process

Majority of the design work was carried out on SolidWorks, several hardware components were found on-line and inserted, for the purpose of ergonomic analysis. A selection of these components are shown in the image below.



Results



Conclusion

1. CATIA with the built-in Manikin was proved to fulfil objectives in this project.
2. Cockpit design 'B' showed the least harm to driver when comparing to others.
3. Afterall, driver in all cockpit designs would have to lean forward when turning the steering wheel (by 120º) are far from ideal.
4. Cockpit design for Gamer showed no lean forward could be the clue for future works.