

AutoCRC Undergraduate Research Projects 2008

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Engineering Knowledge Capture

UG7306 Justin Bishop

Abstract

The ability for an organisation to be able to identify and overcome issues associated with informal experience-based tacit knowledge loss, in order to give the business a distinct competitive advantage is at the forefront of recent commercial trends. It has been the primary focus for numerous contemporary studies as knowledge loss has been recognised as a significant problem for countless modern organisations. A formalised Lessons Learned (LL) process is one of the most essential components to a successful Knowledge Management (KM) system and has been identified through field research as one of the main areas at GKN Aerospace that requires improvement. To this point there has been no formalised framework at GKN to fulfil this requirement. The implementation of a standardised and constantly monitored LL system will add significant value to current work practices at GKN. The implemented LL system will occur both continuously as well as at the termination of a project where a thorough LL evaluation session will occur to ensure the continued improvement of services by all employees at GKN Aerospace and a sustained competitive advantage for the organisation.

Ambient Airflow

UG6008 Lawrence Spinozzi

Abstract

Industry innovations are imperative to the success and sustainability of companies within all industries, especially important within the automotive industry. Maintaining position in a competitive world is essential, thus placing importance on the research and analysis of potential improvements and new ideas. This report strives for innovation and is the first step in creating a foundation on the impacts of thermal comfort, visual appeal and climate performance.

Unconventional methods of airflow within automotive vehicle cabins are investigated in an effort to increase the visual appeal of the front interior. Initial background research is completed, which analyses the effects of thermal comfort on driving performance. This was essential in establishing that, performance of climate control systems was important to the driving safety of passengers. Through the use of a market survey, the actual preferences of occupants are discovered, allowing a greater scope of ideas for the project to explore.

A design methodology is followed, that was initiated with a brainstorming session with key project stakeholders. Concept generation is then implemented which provides a catalogue of concepts, in which each is evaluated and a final concept chosen to develop further. The final concept of a long thin slit across the front interior instrument panel was then constructed into a prototype. This was to enable experimental analysis, contrasting the performance of the new concept against the already used baseline system within the VE Commodore.

A range of tests were conducted to measure the temperature fluctuation of the effective heating and cooling of both an extreme hot and cold vehicle cabin. In effect, with the use of an anemometer, data logger and thermocouples, both temperature and velocity profiles are constructed to analyse the new concept of airflow against the baseline system.

Although being extremely effective, the new concept failed to satisfactorily meet the performance metrics of the baseline in three of the eight temperature sections. Yet, its ability to meet or exceed in the five other section outcomes provides a case for further development in this area of industry.

Older driver distraction: Risk factors and technology solutions

UG5008 Arpan Brahmhatt

Abstract

Cars have become a necessity rather than an accessory in the present developed world and driving is a part of everyday life. With the increase in the age of people in the developed countries the most important task for the road and safety department of these countries is to study the effect of the increasing age on the driver's ability to get distracted as well as their recovery from the distracted mode. Under this study the cases are also considered where the older driver are not the cause of the multiple vehicle crashes but, are involved in the crashes along with the cases where the older driver is the cause of the multiple vehicle crash. Along with this, the report has also taken into account the cognitive and physical capabilities of the driver changing with the age and its effect on his driving ability.

Under this project the basic literature review would focus on works done by other in the field and analyse the available data to put forward a clear picture of the standings of the older driver ability and after that what could be the viable solutions for the problem of ageing drivers getting distracted.

If the time and resources would be favourable the final stage of the project would be to make a physical system or a simulation for the suggestions made for the solution of the problem.

Application of Business Process Modelling Language to Virtual

UG4408 Zwikamu Dubani

Abstract

Business process management has evolved over the last decades. A number of different technologies have been proposed in order to cope with challenges that businesses face in today's business environment. Today's environments require flexible and adaptable business applications that can cope with and meet frequent changes in business conditions and policies.

Business process modelling and implementation are key activities in understanding business processes and in formulating competitive business process management practices. The Business Process Modeling Notation (BPMN) was developed by an international body called the Business Process Management Initiative (BPMI), with the aim of bridging the gap between business process design and its implementation. The strengths of BPMN include that it is easily readable and understandable, and could be transformed into the current widely used business process implementation language, the Business Process Execution Language (BPEL). However, there are some fundamental incompatibilities between BPMN and BPEL, which make it difficult to generate BPEL code for implementation from BPMN models.

The aim of this research is to investigate the synergic uses of BPMN and BPEL to model and implement executable business processes. To that end, we propose in this thesis a Business Process Modelling framework. Then we apply it to a real life business process scenario involving a typical vehicle manufacturing process in the automobile industry. From the case study, we are able to conclude that BPMN is suitable for modelling business processes and then implementing the model in BPEL in spite of the incompatibilities between the former and the latter.

Child Safety – Foreign Objects in Vehicles

UG3008a

Srinath Rakesh Mukkamala

Abstract

Cars have become a necessity rather than an accessory in the present developed world and driving is a part of everyday life. As the fact is that child playing a major role in family tours during seasons. According to census collected in the accidents aspect 42% of those are affected by children. This report is a detailed version of the child safety and foreign objects in a vehicle to entertain the child.

Under this project the basic literature review would focus on works done by other in the field and analyze the available data to put forward a clear picture of the standings of the child safety and after that what could be the viable solutions for the problem of children to get entertained so that they will not distract the driver or co-passenger.

If the time and resources would be favorable the final stage of the project would be to make a physical system or a simulation for the suggestions made for the solution of the problem.

First chapter deals with the introduction part where aspects like research question, applications, issues, project objectives are covered. The whole report outline is covered at the end of the chapter one.

A very brief literature review is written in the second chapter continued by dealing the problems which are mentioned in the literature review.

Third chapter covers the methodology where the aspects like modeling and how to implement that particular model are concentrated.

Design of the model done is shown and description of the simulation is done in chapter four.

Chapter five has the results and discussions obtained from the project.

The final conclusion is given in chapter six.

UG2306

Hamin Kim

Abstract

A commercial CFD code, FLUENT, has been used to analyse the performance characteristics of a nominated HVAC unit from Air Thermal Systems. The blower performance was quantified through static pressure, efficiency, power and torque performance curves. The performance curves obtained from the numerical solution were then compared against the actual experimental data. In the mesh generating process, proper level of grid refinement was decided by performing grid dependency test.

From the analysis, it was found that the numerical simulation is capable of predicting the general trend accurately in most performance parameters. However, magnitudes of error due to the under prediction tendency were not small to be ignored, and this phenomenon is observed to be greater in higher flow rate models.

In order to compare numerical accuracy and efficiency of two major $k-\epsilon$ turbulence models, numerical solutions were also conducted by adopting the RNG turbulence model. In comparison with the $k-\epsilon$ standard model, it was found that the result from the $k-\epsilon$ model is more accurate consuming slightly more CPU time. However, difficulties in convergence should be considered especially in high RPM rate.

The feasibility of CFD in optimizing a centrifugal fan is examined by creating several geometrical changes such as inlet cone, tip clearance, blade angle and location of cut-off. It was revealed that existence of the inlet cone has great influence on flow field in the inlet region by investigating considerable inactive zone decline for the cone adopted model. Furthermore, it has been found that the tip clearance and relative location of the cut-off are very important geometric features of the HVAC unit for acquiring optimized performance.

Future Engineering IT Infrastructure

UG1708 Christopher Traianou

Abstract

Future Engineering IT Infrastructure is a topic that concerns the enabling function of Information Technology for future Engineering IT Environments. That is, IT Infrastructure provides an Engineering Environment with IT services and functions to support and add value to key business processes. The key word “Future” is integrated into this topic as this research is aimed at forecasting IT Infrastructure needs within an organization, particularly an Aerospace Engineering organization. In the context of Engineering, IT Environments are very demanding and intensive. Work involving large data files and constant collaboration between separated teams is a part of everyday operation. Today’s technologies are being implemented quickly and IT Environments are changing rapidly. The concepts of SOA, Web Services, and open standards such as XML are being absorbed into Engineering IT Infrastructure with significant results. The increase in broadband web technology allows the internet to be used as a primary platform for communication, data sharing and even applications.

The applicability and process of this research will be directly related to a project at GKN Aerospace Engineering Services which is a subsidiary of a Global GKN Plc Group. The project will create a conceptual IT Infrastructure design that will outline possible new technologies and processes of a future IT Aerospace Engineering Environment in 5 to 10 years. The area of focus is the IT Environment’s growing needs in CAD and PLM Software tools that are primary to the business’ core process. This Thesis presents an overview of today’s concerns with IT Environments and Infrastructure relevant to a number of industries, while focusing on the particular needs of aerospace engineering firms. Presented is a conceptual design and vision that will depict the possibilities that Engineering IT Environment could entail for GKN in 5 to 10 years, based on findings from research on IT Infrastructure and the main software providers’ trends in relation to the Aerospace Industry.

A Cost Value Comparison of Domestic and International Supplies

UG6108 Charles R. Featherston

Abstract

Globalisation, overcapacity, variable growth, increasing customer demands and diminishing government protection are driving down the profit margin of firms in the automotive industry. To remain competitive, Australian firms need to be able to identify the most effective strategies to adopt. Given that 9% of Australian firms' expenditure is on logistics and supply chain management, it is important that the most cost effective strategies in these areas are selected. In this thesis a framework is created for firms to identify the cost impacts of different supply chain strategies, the Procurement Cost Analysis Framework. The framework's effectiveness is demonstrated through a case study on an automotive firm's product. The case study identified a 7 cent cost saving for a AU\$4.33 automotive component when its procurement was moved from Australia to China. This is consistent with the firm's cost model, which estimates a 16 cent saving, but does not include the administration and storage costs considered by the Procurement Cost Analysis Framework.

Future of Personal Transport in a Warming World

UG5508 Adam Cusick & Noel Kaso & Ashan Perera

Abstract

A sustainable transportation system requires more than simply minimising the environmental impacts of automotive travel; it must address all forms of personal mobility to balance the need for economic growth, environmental health and social equity. Mobility in Melbourne 2050 is a research and design investigation into the future of personal mobility. In examining why we travel and how we do so, it is clear that we need an intelligent combination of multi-disciplinary responses. There is no single or definitive cleaner, greener solution. All future vehicle and transit design must form part of a fully integrated, multi-modal mobility system. Such a mobility system will become part of a wider 'sustainable development model' - that considers the needs of a changing population and takes account of the social and environmental externalities. "...to realise a sustainable city there has to be a clear and common held concept of what it will look like" (Williams 2000; Buxton & Jenks, 2000). The intention of this project is to contribute to the ongoing endeavour of building this "common held concept" of our future.

The project objectives were:

To research and document the 'boundary conditions' of this sustainable mobility need - including social, technological and environmental factors.

To analyse qualitative and quantitative data to forecast a future scenario of mobility and metropolitan strategy.

To visualise and evaluate transit system and vehicle design concepts, and the wider system in which they might operate in a more sustainable manner.

From data analysis and trend forecasting, the Melbourne 2050 Scenario determined that there are significant benefits to a multi-nodal, transit oriented urban strategy. Within this strategy a need was identified for new vehicle and mass transit concepts to suit localised purposes and foster inter-modality, whilst employing new and emerging, sustainable technologies.

In designing for the forecast scenario, personal vehicles and transit system designs were generated to work within sustainable design constraints and the Melbourne transit city model.

The design outcome represents an overview of a new system - an Intelligent, Multi-Modal Transport Network (IMTN) characterised by the concept of Mobility on Demand (MOD). Demand responsive and adaptive functions within the IMTN encourage seamless inter-modality and foster a sense of total system ownership in Melbournians. There will be an on-going and expanded role for heavy rail, light rail, and bus transit, combined with new transit strategies including autonomous vehicles and community share schemes.

To complete the vision of a system that encourages sustainable travel behaviour, four classes of personal vehicle were conceptualised: Mobility in Melbourne 2050: Research and Design Visualisation ii

Small Personal Vehicles: compact vehicles for short distance and quick-trip travel.

Short Range Electric/ Human Assist Vehicles: ultra-light single or dual occupant vehicles with human power input.

Medium to Large Fuel Cell Vehicles: for family or group travel, with longer range requirement.

Modular Vehicles: interconnecting modules allow for flexibility in travel, and adapting vehicle spatial footprint and mass in proportion to the human load.

An intelligent, multi-modal transport network servicing an urban landscape of transit villages is presented in this investigation, as part of a sustainable scenario for Melbourne 2050. The vehicle and transit system designs contribute to the wider pursuit of sustainable change in our travel behaviour and planning of both journey and destination.

Automotive Interior Design – Theme 1 – Elegant Design – Theme UG3908c Kat–One Moo

Abstract

Product Description and Principal Function(s)

Sponsored by Auto CRC and Futuris to design a modular/elegance interior for a futuristic concept vehicle. The design of the Dashboard is focused on modularity and reflecting the beauty of Chinese culture in it's styling. There are four primary screw pillars and three secondary pillars holding the whole dashboard together, undo them to gain access into the dash where components can be upgraded and update software via wireless internet. The dashboard is operational via both driver and passenger side, with using new emerging technologies. Control of the dashboard designed for an autonomous vehicle in response to China's traffic conditions.

Why does the product represent design excellence and why do you believe it deserves an Australian Design Award?

The innovation aspects of this dashboard design encompass a new way of thinking about automotive design. The idea of a dashboard being upgradeable and customizable by the user opens up a whole new world for innovation around sustainability and technology. As technology is rapidly evolving and the cost of implementing new technologies in vehicles are great and time consuming the opportunity for taking an existing dashboard and merely undoing a few fasteners and installing a new component to keep up to date with the latest technology, instead of buying a whole new vehicle with those new technologies. Also the idea of one new technology combined with another rapidly evolving technology to create a viable solution within the vehicle, such as Up Head Display technology being combined with transition glass to make it more efficient.

The dashboard is operational via the driver or passenger side, with using new emerging technologies such as wireless drive by wire control and centralized touch screen. Control of the dashboard designed around the principles of Chinese culture it has symmetry and harmony being the main factor, thus it is styled and designed around the user and passenger. The dashboard is for an autonomous vehicle, two driving modes that allows the driver to drive or be driven.

As the dashboard has been design for modularity and upgradeability the aspect of design for dis–assembly has been addressed, the whole dashboard is being held together with the screw pillar system that sandwich the whole assembly together making it easy to assemble and disassemble. The choice of materials would be a grade of automotive polymer that would be available in the distant future as automotive polymers constantly evolve laminated bamboo and polypropylene. The manufacturing processes would be blow moulding, 3D

knitting with composite materials, and injection moulding.

The basic scenario for this design is that, the user is just getting in their vehicle after a long day at work, sitting on their preferred side of the vehicle. They turn the engine on and uses Google map on the center console touch screen, drag their finger roughly tracing their desired route to their destination and off it goes. The relay of information from the touch screen to the Up Head Display is confirming the vehicles data and the desired actions to the driver. As the driver feels the need to dive and take control of the vehicle he/she may do so via the touch screen or voice activation. The steering control would respond with rumble (like a PlayStation controller) as the driver grasps it and the dash readout would now display the information required for the driver.

Life Cycle Analysis of the Front End Carrier

UG5108a John Galvin

Abstract

The Front End Carrier (FEC) is located in the front section of the Holden VE Commodore. It supports the headlights, bonnet latch and various other accessories.

The FEC is to be modelled using LCA, this study will provide numerical data relating to the environmental impact of each aspect of the FEC's production, transport, assembly, use and disposal.

A comparison is to be made with the previous all-steel FEC design in terms of 5 environmental impact categories: Acidification Potential (AP), Eutrophication Potential (EP), Global Warming Potential (GWP), Ozone Layer Depletion Potential (ODP) and Photochemical Ozone Creation Potential (POCP).

The results show that the Use Phase was the largest contributor in terms of impact on the environment, as it produced the highest emissions in four of the five categories. The exception being the Ozone Layer Depletion Potential, this was due the amount of Chlorofluorocarbons or CFCs released during the recycling process turning the steel into billet form.

Several recommendations in regards to improvements and research to the future relate to the amount of raw material that goes into the production of the steel components for the composite Front End Carrier. The current configuration results in 80% loss of material as scrap. If this value of mass was reduced it would result in a decrease electrical energy consumed to power the stamping process. This, would in turn, have a positive effect on the environmental impact of the processes involved.

The possibility of reducing the component weight is thought to produce a positive influence on the environmental impact of the use phase of the component. This was not only applicable to the five categories analysed in terms of environmental impact, but also in regards to overall resource consumption.

Inclusion of Nylon in the current design also had several significant contributions when compiling the life cycle impact assessment (LCIA), mostly attributed to by the production of the raw material as it contains petroleum based products. The injection moulding process carried out at the Holden plastics facility was the largest consumer of electrical energy overall which therefore affected the environmental impact significantly.

One solution that was discussed while compiling this recommendation was the use of lightweight alloys such as aluminium in place of nylon. This would be a feasible option in relation to production but may incur additional costs which would need to be assessed in terms of cost vs. benefits.

HVAC Mode Doord Manual Operation System

UG0408 Haiping Wang & Lu Zhou

Abstract

Provided by Auto CRC, the objective of this project is to improve the performance of the current climate control system (a.k.a. the HVAC). The area of this research is to develop optimized and suitable mechanical structure which controls the mode of air-flowing in side the air conditioner. In the research, the consideration was given to available space for the device, simplicity, reliability and ergonomics aspects. The methodology is to take all of those concerns systematically into consideration and define the new type of the transmissions. The plan was to firstly organize several loading tests for each part of the existing system according to the problem listed (see APPENDEX 1) and find out the causations for each of those problems existing in the system to be optimized. When the origins of the problems were successfully mapped onto the system, two different plans were use to solve them: Plan A – introduce a new design that comes with a problem free result; and Plan B – keep the current design structure, and optimize the performance of it so as to minimize its drawbacks. These two plans were proceeded one after the other because Plan B was considered as the back up for Plan A in case it reaches the dead end. In Plan A, the thought was to remove all the parts away and keep only the output positions. The aim of designing the new mechanism is to satisfy the requirements from both manufacturer and consumers, hence to develop a user friendly transmission mechanism without increase much of the cost; while Plan B was taken into action to achieve a low risk and low cost optimization in a fairly limited time period. The outline of this project is as follows: 1 System analysis

This includes the effort and time spent on familiarization of HVAC system so that to be able to position where and how the system defects are. During this stage, some basic tests were performed to generate an approximate overview of this project. So the team members could prepare the preliminary plan for it.

This determined the method of how to finish this project and what the expected results from it were. 2 Methodology determinations Once our team members had the knowledge of locating the problems, a series of methodologies of solving them were proposed and method of the best fit together with a back up plan were selected from them. 3 Design process The initial idea of this project is to use a complete new design to replace the previous one. Hence, all defects on the system will be avoided. However this idea was given up after the first part of the design is finished because we realized that according to the calculated performance for the first half of the design, the room for the further design was insufficient. If PLAN A was completed without any further concern of the space, the shape of the HVAC system and some other devices around it would have to be re-design as well. This was out of the research area of this project so that PLAN B was taken over. PLAN B was considered as the back up plan in case of PLAN A reaches the dead end or not be able to finish in time. The object for PLAN B is to minimize the defects on the existing device while retaining the design itself the same and only judge the specifics such as linkage length, joints positions, linkage bending angle and the type of connections. 4 Conclusion and

suggestion for further investigation Based on PLAN B, the conclusion and suggestion were given stages this project was done. This may help the designers to have a better understanding of the manual control system of the HVAC.

An Application of CFD in the Design of Power-train Cooling Systems

UG0508 Nicholas Power

Abstract

Simulations utilising computational fluid dynamics (CFD) were performed on the power-train cooling components of a standard family sedan. As per the project creator's request, testing scenarios focused primarily on velocity and temperature behaviour in and around the vehicle's condenser, radiator, and fan module (CRFM) solely, whilst operating at idle within a wind tunnel test facility.

To further understand the flow characteristics surrounding the CRFM, AVL Fire 8.5 CFD was used to conduct numerous tests involving both idle and windy conditions within the wind tunnel domain. Results revealed the presence of hot-air recirculation around the CRFM during idle conditions, which contributed to the formation of thermal hotspots across the internal faces of the unit's shroud. Follow-up tests found the strength of such recirculation to be relatively weak, concluding that low ambient winds and the incorporation of additional shrouding would be sufficient to eliminate this concerning behaviour whilst the vehicle operates at idle.

The effects of straightening-vanes also represented a significant area of interest during CFD simulations. Results concluded that rotational velocities, induced on flowing particles by the spinning fan blades, could be efficiently converted into translational movement in the primary flow direction of the fan units through the installation of straightening-vanes. Elimination of these rotating particles reduces the level of dispersion which occurs once heated air enters the vehicles engine-bay.

Pressure variations associated with the flow over straightening-vanes were not included in the present study, though this and additional recommendations were documented for future work conducted by the project's creator Air International Thermal Systems (Melbourne, Australia).

Interior Design for Nomadic Devices

UG5308 Joshua Saling

Abstract

This project was initiated by the perceived need for the adaptation of the automotive interior to the growing use of multiple nomadic devices by all occupants. Nomadic devices are defined here as any self contained electronic mobile device such as mobile telephones, mp3 players, PDAs, and the like. A key theme running through this project was the safe use of nomadic devices during driving.

An Industrial Design solution to the problem was adopted. The first phase involved extensive research into the sociology of human-machine interaction, the real world utility of the interaction, behavioural trends in the use of nomadic devices, the demographic aspects of potential demand, and the technological basis of the concept. The second stage involved brainstorming activities which lead to concept development, while the third phase consisted of design refinement and construction of a visual prototype.

The design process generated a cutting edge reconceptualisation of the interior automotive interface, termed the Nomadic Device Integration System (NDI). The NDI System integrates nomadic devices with the car interior, creating an electronic conduit to the spheres of entertainment, professional activity, and social engagement. It transforms a transitional non-space into a multimedia enabled extension of our domestic and occupational worlds, achieving complete mobile utility without compromising safety.

Uncertainty in Measurement for Automated Engine Testing

UG1108 Anthony Larkins

Abstract

The objective of this project was to develop an efficient methodology for estimating, analysing and improving the uncertainty in the automated engine testing equipment at GM Holden Ltd. The report provides a review on some of the uncertainty estimation techniques available, providing a recommendation of the better suited methods for future uncertainty estimation. It also covers an uncertainty estimation of the ECE corrected power; taking into account uncertainty due to measurement repeatability, noise and quantisation, signal calibration, and instrument accuracy. The method used was a first order Taylor series analysis, modified to correct for slight nonlinearity.

The Schenck T2000 Test Automation System (TAS) is used to control, test and tune engines. It measures around 240 different parameters relating to the engine operating conditions, from this a large range of information about the state of the engine can be derived. This includes; power, correction factors, volumetric efficiency, mechanical efficiency and BSFC to name a few. Some of the measurements or derived parameters made are actually performed by standalone units, with the result passed to the TAS. The TAS can alter the engine parameters directly or through standalone units to change the operating condition, this is an essential part of the engine development process.

The corrected torque and power obtained had expanded uncertainties less than 1% for a 95% confidence interval, indicating that the testing procedure is sufficiently accurate. However some of the uncertainties in the calculations used to obtain the ECE correction factor were quite large, the uncertainty in the correction factor was 47.7% of the correction made. Even though it has little effect on the corrected power and torque, the correction is highly inaccurate and attempts should be made to improve its reliability. This uncertainty in the correction factor occurred due to the large signal calibration uncertainties, which were a dominant source of uncertainty in the measurements and calculations analysed. It was also the area in which the most improvement could readily be achieved; with improved calibration the total uncertainty would be significantly reduced.

The signal calibration in the worked example accounted for approximately 90% of the type-B uncertainty (non random component) in nearly all parameters, whilst the type-B uncertainty accounted for around 90% of the total uncertainty of most measurements. The calculations involving torque had approximately 55% of the uncertainty due to the variability in the torque; it was the largest source of uncertainty in the corrected and uncorrected torque and power measurements. Instrument accuracy was the second largest type-B uncertainty source, accounting for approximately 50% of the corrected torque and power type-B uncertainties. This was followed by noise and quantisation effects, which represented a maximum of 20% of the type-B uncertainty for the fuel flow meter, but for most instruments it normally accounted for 0.5% or less. This indicates that the TAS is not causing any undue uncertainty in the measurements, or calculations.

The analysis highlighted the need for improved signal calibration, as it contributed significantly to all the measurement and calculation uncertainties. With additional signal calibration the uncertainty in the measured and calculated parameters could be reduced to acceptable levels in nearly all of the measurements and calculations. Improving the quality of the test results, in particular those related to the ECE correction factor.

Child Friendly Rear Seat

UG3008b Huishi Liang (Joyce)

Abstract

Car has become a necessary part of people daily lives in most of the developed countries. Although the population of child passengers has kept growing since last decade, car design and its relevant safety concerns are still adult-oriented. Children passengers' needs for comfort and safety have been disregarded in the main trend of car market. Therefore, families yearn for a new car design that takes account of all passenger's well-being, especially children users' needs.

This project sets the scene in next five year's global market and calls for a children-friendly design in a vehicle, which provide children occupants with optimal protection in a car accident and, comfortable and pleasurable solutions in a daily trip.

Since children's safety and comfort are the primary considerations for this project, comprehensive researches contribute to understanding the needs of both parents and children, identifying the critical problems and technical specifications of current design associated with child safety in a vehicle, and defining target users and project scope.

Target users are finalized to be booster-seat age group, that is, children at around 4-12 years old who out-grown of Forward-facing Restraint System. The new design focuses on the whole rear seat compartment in a common family car and aims to encourage more children to be appropriated restrained in the rear seat.

The proposed rear seat design is child-safety-focused. It approaches to the design objectives from the functional and emotional aspects. Functional features focus on the need of target users in terms of safety and comfort. Design features addressed to the safety concerns includes applying the world safest Integrated Booster Cushion System, incorporating with international Child Seat System and, creating intuitive and innovative interface. Users' concerns on comfort devote to building seat contour comply with users' anthropometry. Emotional features of the design tend to strengthen the bond between the product and its users by creating user's unique experience. Child-oriented functions (such as entertainment system incorporating with game player, storage) and aesthetic (such as simple form and colour) are promoted by the new design. It is attractive, exciting, and allow the user to personalized his/her own space.

The rear seat design, from the standpoint of industrial design, promoting child-friendly features which intend to make the users smarter and more safety-conscious.

HVAC components mass reduction – plastics

UG1308 Liu Pengfei

Abstract

This paper details a framework named the Motor Advisor System (MAS) which aims to make precise and accurate recommendations for accelerating company growth and to assist the company to avoid mistakes in the motor industry. In our MAS, the three common problems relating to CF, which are company bias, non-transitive association and empty start problems, have been addressed and solved, and an efficient factor-based probabilistic model for collaborative filtering has been proposed. We categorized factors into groups and made prediction for companies (users) by considering the Gaussian distribution of users' rating scores. Our results and work firmly show that our probabilistic model has a favorable performance and that our system is able to produce highly accurate and precise predictions on input rating data and the proper application of factor features (item attributes) information can improve the recommendations.

Regarding future work, first of all, we will try to establish a proper and meaningful evaluation method for our motor advisor system. Secondly, our current work only focuses on the numerical ratings, whereas, binary ratings are widely used on the internet and have been studied by many researchers. Therefore, we will probably extend our approach to binary ratings. Thirdly, extending the second idea, to deal with many more different types of input data in recommender systems in real life, we are planning to investigate the possible integration of other text retrieval techniques, more specifically, relevance feedback and query expansion.

Telemetry System for the Formula SAE Electric Car Conversion Project

UG1608 Con Petropoulos

Abstract

This project began with a project plan titled Latrobe University Telemetry System Project. In that document I outlined the scope of this project and what I would achieve. Briefly just to recap, the data logger was to be designed with two Z8 controllers, one being the data logger, and the other the bus master in charge with all communications. This unit was to communicate via an RF link to a remote PC running dedicated windows software, and all logged parameters by the data logger were to be sent over the link to the PC, where it would be formatted and displayed in a usable format. The sensors monitored as listed in the project plan were, battery voltage, vehicle speed, temperature, acceleration forces, and throttle position. All the above planned design requirements have to date been completed, as documented in my project plan version number 2.0 dated 13/5/2008. This of course is only the core functionality of such a system, and if this was to be developed further there are a number of extra features I would include in my design as to make it much more flexible and useful. Below is a list of items that I consider important to be added to this design.

- Replacing the I/O connector from the DB37 pin version used, to a more flexible, and more robust commercial type of connector, designed for rough and rugged use.
- Combining both Z8 CPU's all on the one PCB board. This would also allow better noise immunity from the operating environment.
- Adding flexibility in the way the I/O ports are configured. Currently they are designed and dedicated to the task at hand. This does not leave too much flexibility when different types of signals are monitored.
- Lastly more work needs to be done in filtering the power supply from external noise. This is very complicated because this noise is not consistent across all types of environment.

Influence Of Heat Eexchanger Airflow Distribution on Excgabger Effectiveness

UG2108 Hannah Kitchin

Abstract

This project requires a series of CFD and physical tests to develop an association between the KPI and actual measured output of the heat exchanger. Tests will be conducted with a evaporator and heater core supplied by Air International Thermal Systems. The project output is recommendations for the minimum KPI required to achieve 90% of the rated heat exchanger performance. The air distribution characteristics that have the greatest influence on performance reduction are to be documented. The project has been divided into ten stages:

1. The first step is to become familiar with a CFD program (in this case Fluent). Some knowledge of Fluent was gained while undertaking Thermo-Fluid Mechanics 3, but this was only a basic introduction and more research will have to be done to familiarize ourselves with CFD code. A simple evaporator and heater core must be modelled to reflect the air side pressure drop.
2. Introduce baffles to the airflow stream to distort the velocity profile before the air hits the heat exchanger face. This will be done in Fluent so that it can be compared more accurately with experimental tests later.
3. If heat exchanging can be modelled, then the above can be carried out and a relationship between KPI and heater core output can be developed.
4. Undertake physical and numerical tests to explore the influence of nonsymmetrical flow patterns on the heat exchanger performance.
5. Arrange a system of baffles to reproduce a known velocity profile pattern and non-uniformity. Test this experimentally and numerically and determine change in capacity.
6. Document findings and write a detailed report. Summarize findings for AutoCRC and RMIT presentations.

Active Head Restraint Designs

UG3508 Gyutae Kang

Abstract

Head and neck injuries happen frequently in car crashes. The one of the common injuries is a whiplash injury that tends to bring about serious after-effects with sometimes lifelong lasts, especially by a car rear end collision. Thus, this thesis is intended to review the current active and passive head restraint designs that address the problem of whiplash injury. It introduces a lot of efforts of international car regulations and automobile companies to solve the problem for whiplash injury. Due to find the problem and solution of whiplash injury, the thesis finds a number of books, library categories, and the current technique of head restraints. It outlines alternative designs with prospects of them, and suggests the best design among the alternatives as a new solution for the thesis. And then, the thesis introduces the new design with its principle and the predicted outcomes, and demonstrates it by the draws of the new model on 'Inventor'. The thesis analyzes and discusses the new design. The aim of this thesis is to address the problem of whiplash injury in dynamics and kinematics for better safety and introduce a new design. The expected outcome of the thesis is that the new design is better the current active head restraints. Lastly, this thesis gives the readers a recommendation for further works in development of active head restraints.

Comfort Analysis of Seating

UG3708 Rohan Murray

Abstract

Although the vehicle manufacturing industry is one of the largest in the world, vehicle seat comfort remains a controversial and miss-understood topic. The comfort of a vehicle's seat can help distinguish the final product in the eyes of the consumer, however designing a comfortable seat is a demanding task given the many direct and indirect factors that need to be considered. Currently there are no universal definitions of comfort, nor any finite relationships to connect the subjective and objective measurement methods that are used to evaluate comfort of a vehicle's seat.

There are currently no universal definitions of vehicle seat comfort of seat, nor any finite relationships to connect the subjective and objective measurement methods. Objective and subjective measurement methods were used to analyse the potential for a relationship between one another in a vehicle's seating. Eleven participants were involved in the project by subjectively assessing the comfort of the vehicle's seat, whilst a pressure distribution mat was used to obtain objectively the data, such as forces, contact area and pressure, relating to the seat.

There is no doubt that the level of pressure applied to a vehicle seat is a crucial aspect in the seatings comfort, however there were no absolute examples found in this study. Further research is required to allow participants to more precisely provide their feelings towards their comfort.

Ingress/Egress Seat System For the Elderly

UG3808 Chris Hill

Abstract

The global elderly population is growing rapidly, there are currently 2.75 million people aged above 65 years old in Australia and it is predicted that this will rise to 9.352 million by 2051. There is a huge social need to cater for these people. 95.4% of people surveyed so far have said that they are very or totally dependent on cars.

Independence is of great importance for elderly people, they need to be mobile to perform everyday tasks such as the grocery shopping or going to see the doctor. A lack of independence also has a tendency to cause depression and a reduced feeling of self worth. Therefore new innovative products are required to improve the driving experience for the elderly and keep them independent for longer.

Elderly people have difficulties entering and exiting cars, they have less muscle strength and less movement in their joints. The Elderly market also has less balance and therefore can't use momentum in the ingress/egress processes. My product will remove much of the force needed to lower the body into the car and rise out of the car, as well as eliminating any balance issues. It will also take into consideration that the elderly don't like to be seen as "disabled" or even elderly and therefore the product needs to be inconspicuous.

To keep the cost down the system will be incorporated into a current or future seat eliminating the need to manufacture a whole separate assembly. The seat will incorporate a stability handle that slides out from the back of the seat. The seat base will have an adjustable bolster to make it easier to turn and face the exit. Another function of the seat will be that once facing the exit, the base of the seat will slide the user over the door sill. The seat will be driven by an electric motor, which will be quiet, reliable and result in a smooth movement. The controls for the seat will be easily accessible for an elderly person and require minimum force to operate.

As well as these features the seat must also meet the needs of the car company, such as low cost and minimal weight addition. The Seat will be simple to use in all the environments that elderly people typically encounter. This will hopefully improve independence, which will improve the depression rate among the elderly. It will also reduce the risk of a fall or accident in the ingress/egress process, removing some of the strain that the current hospital infrastructure will feel in the upcoming years.

Autonomi

UG3908c Franze Anthony

Abstract

Based on detailed consumer research there is evidence of a niche market that requires the design of an inner city corporate vehicle that can be used in multiple scenarios including the use by persons of the ages of 25–35 living in Shanghai or Beijing, China in the year 2015 .

- The vehicle will be designed from the inside/out and the focus of the design will be the occupant packaging. It will be designed with the aspects of Personalisation, Entertainment, Chinese corporate Culture, Comfort, Sustainability, Luxury, Safety and Status.
- The design must be more sustainable than is currently available in all aspects, it should eliminate add- on trim and where possible structural elements should form part of the functionality, aesthetics and comfort of the said interior, Innovative sustainable materials, processes and finishes should be employed.
- The design should also be modular and easy to upgrade or renew for future technologies and reconfigurable for different occupant needs, situations and preferences.
- The interior package is comprised of occupant seating for 5/7passengers, including steering, control panels, headliner trim, door trim, flooring. The said design must include the latest in technological features that are possible and must be focused on the specific requirements of the target demographic.
- The interior and exterior styling of the vehicle shall reflect Chinese aesthetic influences and cultural values the power plant should also be a sustainable solution and aide the interior packaging solution.
- The said vehicle must adhere to the GB regulatory framework and should aim to possibly supersede these requirements if possible.
- The said interior must be technically feasible , consumer input from the Chinese market segment shall be used throughout the course of the project
- Innovative IP should be protected and patented through the correct means. The vehicle's exterior and interior will be modeled in a 3d computer application, whilst certain key functional elements will be simulated with physical models

Life Cycle analysis Door Trim Holden Statesman

UG3308a C Ellis

Abstract

THE REPORT

It will act as a tool to provide insight into the current systems and trends, with the report offering recommendations on how Futuris can steer its company into a more sustainable manufacturing business – a market leader in environmental change within the interior automotive industry.

The key stakeholders concerned with the environmental impact of the current door frame are initially the design, manufacturing and logistics departments with Futuris, However, stakeholders extend to the University of South Australia, car manufacturers, the consumer and the recycling industry.

The report is to provide Futuris and the Auto CRC Forum with information on the embodied energy within the Left hand Side Car Door Trim of the Holden Statesman, I have concluded that the most efficient way to report the findings is to break down each component and provide graphical information based on these findings. Therefore each component will be reported on and then a final write up on CD will be given based on the component's embodied energy impact pertaining to the whole door trim assembly.

THE PROCESS

This study used the Simapro 7.1 Software by PRe Consultants Holland. The data reported on is based on information given by Futuris in Adelaide at their Manufacturing plant in Edinburgh Park and information received via e-mail from Jason Miller via the Melbourne plant. Information that was not provided was estimated and given average quantities.

The door trim was disassembled and then each part was weighed individually to give an accurate indication of impact, The information was then entered into Simapro and analysed, The final findings and information was checked by an independent Lifecycle Assessment Consultant who is currently working within Australia on similar studies,

THE CD COMBINED WITH THIS REPORT

The CD included with this report has the information that was shared at the AUTO CRC Forum in Melbourne on the 21.t of October 2008. It details the information that was found from the study and the recommendations that have been made by the study. It forms the tool in which to use the information within this report and gives information for Futuris to proceed with for the future.

Simulation of Cold Flow in an Internal Combustion Engine using a Moving Mesh in Fluent

UG4608 Aidan Depetro

Abstract

Computational fluid dynamics (CFD) has become capable of addressing the specific areas of performance, efficiency and emissions in engineering design of internal combustion engines. The effects of structured in-cylinder flows like swirl and tumble have a significant effect on engine performance and are now an integral part of engine design. The use of a CFD model utilising a moving mesh in Fluent is explored in this project to discover the potential of CFD in this application. A three dimensional model of a single engine cylinder with geometry based on a standard four cylinder engine was developed in conjunction with user defined functions to control piston movement and valve lift. The CFD model simulated cold flow which is typically the induction and compression strokes of the four stroke engine cycle. Simulations were run over a variety of inlet pressures and engine speeds with the objectives of measuring mass flow, quantifying swirl and tumble and studying the behaviour of in-cylinder flow simulated by the model. Most importantly the mass contained within the cylinder was well conserved. The main source of tumbling flow was a result of fluid flowing off the tip of the inlet valve and recirculating into the low pressure region that developed underneath the valve head. Results indicated that the effect of increasing inlet pressure and engine speed was cumulative and enhanced rotational flows within the cylinder. The model revealed that the positive scaling of swirl and tumble with increasing engine speed was not only due to increased mass flow and fluid velocity but is also attributed to the energy contributed by the reciprocating components inside the cylinder; namely the piston head and inlet valve. The post-processing methods investigated in this project revealed the main flow structures well and enabled the isolation and analysis of swirling and tumbling flows throughout the cold flow cycle. Although the accuracy of results cannot be validated without the experimental testing of a prototype engine, the behavioural characteristics of the CFD model replicated practical engine operation consistently and accurately.

Life Cycle Analysis of a Composite Front End Carrier

UG5108a Josh Thompson

Abstract

The composite Front End Carrier (FEC) refers to a system component located at the front of the Holden VE Commodore. The Front End Carrier supports the headlights, bumper, bonnet latch, horn and various other components.

Using Life Cycle Analysis all phases of the Front End Carrier's life cycle were modelled. The results from this study provided numerical data and outcomes related to the environmental impact of each area of the Front End Carrier's existence, through raw material production, various transport stages, manufacturing, usage and disposal.

A comparison between the original all steel Front End Carrier and the new composite Front End Carrier was made while also identifying any 'hotspots' adding to the components carbon footprint. Five categories of environmental impact were analysed while interpreting results. These are Acidification Potential (AP), Eutrophication Potential (EP), Global Warming Potential (GWP), Ozone Layer Depletion Potential (ODP) and Photochemical Ozone Creation Potential (POCP).

It was found that the use phase held the largest contribution to environmental impact, in the category of Global Warming Potential, for the composite Front End Carrier (62.61kg of CO₂). Although during comparison, the use phase of the all steel design was significantly larger (85.91kg of CO₂).

The presences of Chlorofluorocarbons or CFCs that accumulate to Ozone Layer Depletion were aided mostly by the recycling of the steel components when returning the steel to billet form. Even after comparison the value obtained for kilograms of R11 equivalent for the composite Front End Carrier far overshadowed the value obtained for the all steel design. This is thought to be mostly due to the recycling of the 80% of scrap that result from the stamping process.

The major cause for concern is the amount of CO₂ that contributes to the Global Warming Potential related to the Front End Carrier. This value dominates all other emission values by approximately ten fold. Therefore future focus should be directed at reducing these CO₂ emissions if further research and refinement is to be done.

Several recommendations in regards to improvements and research to the future revolve around the amount of raw material that goes into the production of the steel components for the composite Front End Carrier. The current configuration results in 80% loss of material as scrap. If this value of mass was reduced it would result in a decrease electrical energy consumed to power the stamping process. This would in turn have a positive effect on the environmental impact of the processes involved.

The possibility of reducing the component weight is thought to produce a positive influence on the environmental impact of the use phase of the component. This was not only applicable to the five categories analysed in terms of environmental impact, but also in regards to overall resource consumption.

Inclusion of nylon in the current design also had several significant contributions when compiling the life cycle impact assessment (LCIA), mostly attributed to by the production of the raw material as it contains petroleum based products. The injection moulding process carried out at the Holden plastics facility was the largest consumer of electrical energy overall which therefore affected the environmental impact significantly.

One solution that was discussed while compiling this recommendation was the use of lightweight alloys such as aluminium in place of nylon. This would be a feasible option in relation to production but may incur additional costs which would need to be assessed in terms of cost vs. benefits.

Pedestrian Impact modelling using Maydmo

UG3108 Robert Michaels

Abstract

The aim of this research project is to use the MADYMO software package to recreate a real world pedestrian impact. The results of this will be used to both further the knowledge base of pedestrian impacts and also to gain a greater insight into the advantages and limitations of pedestrian impact computer simulations. The project is run in conjunction with industry partners AutoCRC and Holden Innovation. The case to be replicated was provided by Hunan University in China with the co-operation of the Monash University Accident Research Centre (MUARC).

Initial research involved establishing the kinematics involved in a pedestrian impact. Further research stemming from this included investigating the various injury scales such as the Head Injury Criterion (HIC) and the Abbreviated Injury Scale (AIS), as well as the MADYMO manuals, which describe the numerous injury parameters the program is capable of replicating. This knowledge would be used to assess the results from the dummy model that was utilised, the standard TNO pedestrian model – a dummy model specifically designed for pedestrian type impacts. Additionally, research was undertaken into the behaviour of vehicles in pedestrian impacts, including force-deformation characteristics, suspension behaviour and road condition effects.

The case that was simulated had the added complication of the pedestrian riding a bicycle at the time of impact. Further more, details of the crash and the subsequent injuries suffered by the pedestrian (cyclist) are minimal. Using the details that were provided, a similar vehicle was found and measured in order to create an accurate car model using the MADYMO multi-body method. The dummy model used was of a significantly different size to the cyclist in the case, but this was a limitation forced by MADYMO's range of available dummies. Initial replication of the case was conducted without a bicycle to establish the correct motion of the car. A fully validated bicycle model was then sourced and inserted into the model.

The model was run multiple times, refining the car and cyclist motion by comparing the throw distance and injuries sustained by the dummy to the conditions in the real world case. This led to an optimal simulation, which gave similar injuries and final resting position of the dummy cyclist to the actual cyclist. The replication of this case resulted in the demonstration that computer modelling can give a solid representation of a real world collision, even with the added complication of the collision involving a cyclist. However, there were numerous limitations, particularly in regards to the size and motion of the dummy which reduce its effectiveness and limited its capability to be considered a definitive simulation with near exact results.

Automotive Interior Design – Theme 1 – Elegant Design – Theme

UG3908b Michael Luzar

Abstract

There is underlying issue as to why we generate so much automotive and electronic waste in our landfills. The issues of a 'fast-changing-high-technology-market' and 'planned obsolescence' which greatly stimulate demand of more and superior products by encouraging consumers to buy again quicker, creating a vast amount of obsolete products which eventually turn up in our landfills. In terms of vehicles, we can observe these trends by analysing the average time periods between the initial purchase and re-purchase of a new vehicle. For example, families traditionally will make a purchase decision highly based on safety and convenience features on the vehicle. Once the vehicle ages and features like airbags, curtain airbags, ECS are not integrated in the vehicle, the consumer, who's not able to update or upgrade, will look to switch to a newer vehicle. Other, image-conscious consumers based consumers would make a repurchase to keep up with aesthetic trends. Business-orientated consumers look to stay active and work efficiently in the world of fast changing high technology market. Often the lack of being able to update their products it forces them to repurchase a similar product although with enhanced technology.

The Traditional three R's are recycling, reduce and reuse and are already being implemented. Recycling is a huge contributor to the sustainability of our environment and ensures that materials are salvaged wherever possible. There is however usually a drawback, when considering some of the energy outputs in recycling certain materials involved within an automotive system. Equally, the idea of reducing the amount of material used in products has become an inevitable fact of any sustainable design approaches. Minimizing number of components and decreasing overall volume of material evidently helps to reduce weight on a vehicle, with leads to more efficient use of fuel and abridged manufacturing and design processes. Although, it is not always feasible to reduce material usage and components as it can conflict with desired design specifications for a design outcome, consequently it will not always have a major environmentally sustainable impact on the products. Both, recycle and reduce, make economic and financial sense by reducing cost for manufactures, hence are usually introduced into a product's lifecycle.

The idea behind this project is to maximize the use of products and their components. It is also trying to give users the ability to personalize and customize their vehicle so they accomplish a greater bond with the product to encourage an extended lifecycle. Essentially, it is meant to extend and broaden their capabilities shifting the paradigm of their usually lifecycle into a whole lot of new directions where obsolete products/components are not necessarily considered useless, but form part of the system and are considered beneficial and, contribute to external products by separate integration. Creating alternative lifecycles for both the product and its components, similarly to Product Service Systems will contribute to ensure the consumer is being kept updated to suit his/her need and assist in making the product environmentally credible.

Future of Personal Transport in a Warming World

UG5508 Luke Holt & Brenton Cruickshank

Abstract

This project addresses the issues of greenhouse gas mitigation, climate change and the implications for the future design of mobility. The predominant driver for the development of vehicle efficiency is the reality that human activities are contributing to climate change and urban smog, and that vehicle emissions make up a significant proportion of activities having an adverse effect on the environment. The Greencar design tackles these issues by re-evaluating the conventional vehicle drive-train and concepts of vehicle design. The Greencar drivetrain consists of a two-cylinder compressed-air engine with two compressed-air storage tanks, electric motor with batteries, configured as a series-parallel hybrid through the automatic transmission. The vehicle is rear-wheel drive but could be adapted to be front-wheel drive. The expected range of this configuration lies somewhere between 109 and 142 km depending on the driving conditions, while running costs are estimated to be 2.6 cents per kilometre. All components of the Greencar are designed to suit an urban driving cycle carrying two people. A speed limit of 50 km/h is set to allow the vehicle to be significantly smaller than conventional vehicles and hence much lighter. The combined weight of vehicle and passengers is forecast to be 600kg. The use of compressed-air as an alternative fuel source is deemed viable and could be the primary fuel used in the future if storage and compression technologies permit. It utilises technology that has been refined over the past five decades and is easily accessible.

Future of Personal Transport in a Warming World

UG 5508 Himashini Jayaratne

Abstract

Transport energy use is expected to grow rapidly in the next few decades. At the same time there is increasing concern over growing levels of urban congestion, depletion of the world's oil supply and the impact of CO₂ emissions on climate change. While a range of solutions aimed at increasing vehicle efficiency and developing alternative energies are being investigated, worldwide adoption of new technologies may prove problematic. Similarly, drastic modal shifts to public transport modes may be difficult to achieve given the attractiveness of the personal car and reliance on improvements to infrastructure.

This research proposes a solution aimed at increasing car occupancy rates to assist in bridging the gap between today's transport sector and the many technological solutions anticipated. Increasing occupancy is of particular relevance given that it has the potential to significantly reduce congestion; it is highly influential on the intensity of transport emissions and has not inherent reliance on advances in technology. This research presents the outcomes of a detailed analysis of the structural limitations to increasing occupancy during the journey to work in Melbourne, the reasons that influence the decision to carpool and the impact of measures aimed at improving the attractiveness of carpooling.

For work related journeys in Melbourne, public transport modes are almost exclusively patronised by Central Melbourne workers. Similarly, only travels to the Central Business District (CBD) are associated with a higher occupancy rate due to congestion and parking costs. Cross town travels therefore present a significant potential for increasing occupancy. However this potential is drastically reduced when scheduling limitations are considered implying that the improved success of carpooling is likely to be reliant on matching work hours.

Efforts to increase occupancy have also been met with much resistance given the desire for the positive attributes of single occupant travel. The flexibility, convenience and personal space associated with travelling alone is significantly compromised by carpooling. These flexibility and personal space concerns of users are underpinned by a desire for control and the positive journey based effects of travel. It is the symbolic benefits of car travel that enhance these desires and therefore require changes in attitude and subsequently behaviour.

This research suggests that the formation of social networks consisting of known individuals for carpooling could provide the security desired by car drivers. By providing individuals with a social identity and therefore an alternative symbolic experience, goals pertaining to an individual's social network could drive their behaviour. To improve the likelihood of continued participation, social networks could actively participate in developing its own set of commitments including a commitment relating to the level of travel reductions achieved by carpoolers. Organizations to manage and facilitate carpooling, especially in terms of supporting work hours, could then be motivated by coupling the travel reductions of carpoolers with purchasable offset carbon credits.

Social networks are also likely to increase the flexibility of carpooling. Especially when combined with dynamic Traffic and Traveller Information Systems (TTIS) that provide real time connectivity between members of a social network. This level of connectivity is proposed by this research to enable the dynamic formation of carpools and therefore reduce scheduling limitations and increase the flexibility of carpooling. This research also asserts that a range of incentives tailored specifically for travellers to certain destinations or specific social networks be implemented. Since inherent benefits of carpooling are devalued by the attractiveness of single occupant travel, incentives such as access to HOV lanes are likely to provide a more compelling reason to engage in carpooling.

Emergency Vehicle Interiors

UG4008 Sam Kaudinya & Bhagya Weerasinghe

Abstract

Australian police officers can spend up to 9 hours a day patrolling in their patrol vehicles while on the job, trying to protect our community 24 hours a day 7 days a week. Even though the patrol cars that they use are fitted with the best technology that we have, 80% of the police officers finish their day with agony and pain after a day out patrolling. The vehicles that they use are only technologically retro fitted and fail to provide the comfort or support that the officers need for them to be able to sit in their vehicles for a prolonged period of time. Officers complete their day with complaints about back pain, hip pain, headaches and leg cramps. The issue that causes these problems is the holster and the gun clashing with lower back of the seats, disabling the officers from sitting comfortably on the seats. This report attempts to solve the long standing issue in the Police vehicles.

This project has only come so far due to the support from Futuris who are a pillar of car interior manufacturing in Australia. We have taken a step by step approach to solve the problem; this report shows the research that was undertaken to find the issues within the police and other emergency services vehicles shows the selection process of why this problem was chosen over the other and provides a few conceptual solutions to this problem.

The report attempts to show in detail the problems and constraints that will be faced in creating a prototype for the chosen conceptual solution and sheds some light on the domestic and international market for this high potential product.

This report is written in a simple and in a step by step method to avoid confusion in an endeavour to put some much needed light on the matter. We have also included a project plan, and initial product specification target table to keep the project on target during the process in the appendix.

Sebastian Mackiewicz

Danny Josevski

Occupant Classification through image sensing Integrated with occupant supplementary restraint device

Abstract

This project aims to create an occupant classification system to be used in automobiles which provides a method of classifying an occupant within a vehicle through image acquisition that will be performed by a specific camera. The acquired image will then undergo analysis (to be performed by custom compiled software) to determine the classification of the occupant which will consist of the occupant's dimensions including height and weight. The result of the image analysis will determine the deployment of the occupant restraint device where there will be three expected stages: suppression of deployment, depowered deployment and full powered deployment.

Technical knowledge will be required of staff, PHD students, and company appointed personnel to assist in the development of the system, which is already possessed by certain members of this project.

Market research is being completed, but the needs for this system have been established. Preliminary testing has begun. To date the results have been varied and various software and hardware configurations are being further tested to determine which is suitable for final product. The system implementation will be completed in mid 2008 (estimated).

The end results will be a highly marketable system, which shall lead the way in innovation and affordability. Similar products presented by other manufacturers are not financially viable for current commercial deployment hence lacking in public interest. The completed product will be competitively priced and in line with current recommended retail prices. It is also expected to have high compatibility with current and future automobile instruments and systems making integration effortless.

Jamie Haider

Pedestrian Impact modelling Using MADYMO

Abstract

The project is aimed at reconstructing and modelling a real-world vehicle-pedestrian collision case provided by GM Holden. In addition it is also aimed at increasing the knowledge, skill and ability of the students involved in utilising the MADYMO software to model impact scenarios. Industry participants at GM Holden provided three real-world pedestrian impact cases to be reconstructed, one of which was simulated in this research paper. All three accident cases were briefly analysed and the selected case for modelling analysed in greater detail and documented in this report. Additionally the project aims to investigate the influence of the simulation parameters on the injuries sustained by the pedestrians. The effects of simulation parameters such as impact speed, vehicle stiffness and pedestrian posture are varied to demonstrate their impact on the results. Firstly MADYMO training tutorials and exercises were conducted in order to build the ability of the students in modelling the real-world cases. Additionally a preliminary practice impact scenario was created and simulated using the software in order to enhance output data analysing ability.

The approach taken in reconstructing the vehicle pedestrian collision initially involved analysing the case information, in particular the injuries inflicted on the pedestrian and the approximated impact speed of the vehicle and the point of impact. The case information indicated that the pedestrian was thrown an approximate distance of 6.4m, estimated vehicle impact speed of 22km/h or 29km/h and that the pedestrian did not suffer any serious head injuries but sustained fractures to the right tibia and humerus. The vehicle specifications were obtained from manufacturer's information and also by dimensional measurements taken from a vehicle of the same make and model.. The rigid multi-body model of the vehicle was created utilising a series of rigid ellipsoids to represent the front curved structure of the vehicle and surface planes to represent the vehicle's flatter surfaces such as the bonnet and windscreen. The TNO 5th percentile pedestrian dummy was utilised to model the pedestrian involved in the real-world collision.

The pedestrian throw distance produced by the simulation along with various impact speeds and posture. Additional simulations were conducted each with an altered collision parameter in order to demonstrate the effect of each parameter. A comparison of all the results obtained from the simulations is discussed in correlation to the case information and previous results. The simulation that exhibited the greatest accuracy was run with a vehicle impact speed of 30km/h, producing a throw distance of 5.79m and a HIC value of 1168.3. The findings of the project will be provided to GM Holden in order to aid in the design of new vehicles which will ensure that the injuries inflicted on pedestrians in a collision are minimized and fatalities reduced.

UG

Alaa Jamis

Pedestrian-Vehicle Impact Simulation using MADYMO

Abstract

The research studies the advantages of simulating a pedestrian mathematical model of real-world case, and the effectiveness of its contribution in deriving a uniform standard in car design. MADYMO is a multi-body and finite element interfaces, allowing recreating a wide range of crash simulations as a means of assessing safety performance of vehicles in a cost and time efficient manner, possible through the use of integration techniques, time domain variance and multi-body algorithm that yield secondary time derivatives for the degrees of freedom. Applying technical mechanical knowledge of basic human biomechanics, vehicle dynamics and collision kinematics to that of simulation processing, a desirable case was programmed to analyse the efficiency of the software's use, effectiveness of results sustained, and a means of assessing physical variables largely affecting such front-end collisions.

The case, assessing the fatality of a 57kg and 158cm female, estimated to be struck at over 80km/hr by a 2006 BMW 318, was confirmed to impact down the centre of the vehicle, causing flight distance of 17.4m, Wrap Around Distance of 2100mm and initial head contact to ground after impacting the windscreen. The impact caused AIS6 injuries to the head region along with several other fractures and contusions, which were all assessable points of information. Applying the information granted, many hypotheses were made to provide a reasonable scenario or the incident. A simulation of three independent system models were developed as means of applying standard physical and materialistic properties, to independent components, and networking them through logical characteristics of contact; three models being vehicle, dummy model and reference space. Two dependent systems were produced varying the vehicle hood, firstly based on a flat planar surface, and secondly a convex curved surface, with equal properties remaining throughout.

Findings assisted that the assumptions made, although uncertain, were reliable and produced results within accurate proximity of those sustained in real-world scenario, in which the curved planar hood produced more precise results. A throw distance of 17.15m corresponding to a Wrap around Distance of 2155mm caused a definite fatality as head impacted ground initially at a speed of approximately 25m/s resulting in a reading of over 8.0×10^5 , along with a sufficient lateral force applied to the tibia's to cause fracture. The research met all desired aims, concluding that the interface is a cost and time efficient tool with the ability to filter the vast possibilities possibly responsible for an impact.