UNIVERSITI PUTRA MALAYSIA

DEVELOPMENT OF VIRTUAL REALITY FRAMEWORK IN MALAYSIAN AUTOMOTIVE MANUFACTURING INDUSTRY

MARYAM MOUSAVI

DEVELOPMENT OF VIRTUAL REALITY FRAMEWORK IN MALAYSIAN AUTOMOTIVE MANUFACTURING INDUSTRY

By

MARYAM MOUSAVI

Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the degree of Master of Science

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DEDICATION

Dedicated to my beloved parents, and my dear sister who their love and encouragement are the most wonderful of the many blessing that god has given to me

Abstract of thesis presented to the senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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Chairman: Faieza Abdul Aziz, PhD

Faculty: Engineering

Automotive industry is considered as initial group to use Virtual Reality (VR) technologies. VR provides new opportunity to improve productivity and enhances quality of manufacturing. Malaysian automotive industry also adopted VR and Three-Dimensional (3D) modelling at different stages. The industry mainly uses VR and 3D for production planning, prototyping, styling and designing, testing and manufacturing. Due to technological advancement, the industries are keen to adopt new technologies for its development.

It is always difficult to choose the right technology at the right time and at the right place. There is no clear guideline among automotive industry about technological causes behind their success and failure. Most of the time, automotive industry is confused to choose which technology is most appropriate for their technology-based industrialization and improvement. However, without adopting advanced technology, the automotive industry cannot compete with its global competition. They need to

choose the right technology for the right purpose. Users of technologies also need to select the appropriate technology according to the requirement of the industry. There is a gap in the selection process of technology, i.e. 3D, VR for the industry and who uses technology.

In order to come-up with solutions to these problems, this research aims to reduce the mentioned technological gap and provides a guideline for choosing the appropriate technology for industrial development, and give a clear picture about the use of VR and 3D in vehicle manufacturing industry. It is important to conduct the research on VR and 3D used in industry to have a complete overview of the technology for the industrialists, researchers and developers.

Six automotive companies in Malaysia were selected as case studies to develop future model of VR, which are namely Proton, Perodua, Toyota, Honda, Nissan and Naza. A total number of 240 questionnaires were distributed between these six automotive companies and 153 people responded to the questionnaires. Based on the questionnaires, this research analyses the existing VR systems, verifies VR adoption capability in automotive industry, identifies the opportunities of VR in the industry and its constraints, as well as develop a VR framework for automotive manufacturer industry in Malaysia. From the statistical analysis, it was found that 54% of respondents agreed and stated that the existing technology is not enough and also 83.7% respondent replied to adopt and improve new technology. Majority of the respondents showed common agreement (up to 60%) that VR can be appropriate to be adopted as an advanced technology in different sections of automotive manufacturing industry.

Finally, the research provides a framework for automotive industry adoption with VR technology. This framework recommends the VR technology adoption to the automotive industry based on its remarkable points in each department of the industry. The framework will help policy makers, managers, designers, engineers, and researchers to make a decision more easily and efficiently for technology implementation in VR. The developed framework was validated using another set of questionnaire survey. Overall, it is supported by more than 90% of respondents that the framework is easily understood, feasible, applicable, comprehensive approach, which covers all major aspects of VR adoption in Malaysian automotive industry, and it provides a straightforward guidance even to beginners.

Abstrak tesis dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

PEMBANGUNAN RANGKA KERAJA REALITY MAYA DALAM INDUSTRI PEMBUATAN AUTOMOTIF DI MALAYSIA

Oleh

MARYAM MOUSAVI

Januari 2011

Pengerusi: Faieza Abdul Aziz, PhD

Fakulti: Kejuruteraan

Perusahaan automotif merupakan antara industri pertama yang menggunakan teknologi realiti maya (VR). Dengan menggunakan realiti maya, produktiviti dan kualiti pembuatan dapat dipertingkatkan. Industri automotif di Malaysia menerapkan penggunaan realiti maya dan model tiga dimensi (3D) di pelbagai peringkat, antaranya ia digunakan pada peringkat perancangan, pembuatan prototaip, rekaan, ujian dan pembuatan. Selari dengan perkembangan teknologi, industri ini berminat untuk mencuba dan memuatkan teknologi baru untuk terus berkembang maju.

Adalah amat sukar untuk memilih teknologi yang tepat untuk diaplikasikan pada sesuatu masa dan tempat. Ini adalah kerana tiada garis panduan yang jelas tentang kejayaan mahupun kegagalan sesebuah syarikat disebabkan teknologi yang digunakan. Kebanyakan industri automotif keliru dalam membuat pilihan teknologi yang tepat untuk industri mereka berdasarkan kemajuan teknologi. Sekiranya mereka tidak menggunakan kemajuan teknologi, industri automotif tidak mampu untuk

bersaing di peringkat global. Mereka perlu memilih teknologi yang bertepatan dengan tujuan teknologi tersebut. Pakar teknologi juga perlu memilih teknologi yang bersesuaian dengan keperluan industri hari ini. Ini adalah kerana terdapat ruang di antara proses pemilihan teknologi seperti realiti maya, model tiga dimensi dan sebagainya untuk industri dan pemaju teknologi tersebut.

Untuk mendapatkan penyelesaian bagi masalah ini, kajian ini bertujuan untuk mengurangkan jurang teknologi dan menyediakan garis panduan untuk memilih teknologi yang bersesuaian untuk kemajuan sesebuah industri dan memberi gambaran yang jelas tentang penggunaan realiti maya dan model tiga dimensi di dalam industri pembuatan kenderaan. Kajian terhadap realiti maya dan model tiga dimensi yang digunakan dalam industri adalah sangat penting untuk memberikan gambaran menyeluruh mengenai teknologi ini kepada para industrialis, penyelidik dan pemaju.

Enam industri pembuatan automotif di Malaysia iaitu Proton, Perodua, Toyota, Honda, Nissan dan Naza yang dipilih sebagai bahan kajian bagi membina model pemilihan realiti maya dan model tiga dimensi di masa hadapan. Sebanyak 240 borang kaji selidik telah diedarkan kepada enam industri pembuatan automotif yang tersebut di atas dan menerima maklumbalas sebanyak 153 terhadap borang kaji selidik tersebut daripada mereka. Kajian ini menganalisis sistem realiti maya yang digunakan, mengesahkan penggunaan realiti maya di dalam industri dan mengenalpasti peluang untuk penggunaan realiti maya di dalam industri serta halangan yang dihadapi untuk penggunaannya. Dari analisis statistik, didapati bahawa 54% responden bersetuju dan menyatakan yang teknologi sedia ada tidak

cukup dan juga 83.7% responden bersetuju untuk menggunapakai dan meningkatkan teknologi baru seperti 3D, VR dan lain-lain. Majoriti responden menunjukkan kesepakatan umum (sehingga 60%) bahawa VR sesuai untuk diterima sebagai satu teknologi maju dalam berlainan jabatan di industri pembuatan automotif.

Akhirnya, kajian ini menghasilkan rangka kerja untuk memilih sistem realiti maya yang bersesuaian untuk industri automotif. Rangka kerja ini mencadangkan penerimaan teknologi VR bagi industri automotif berdasarkan keputusan yang amat baik dalam setiap jabatan di sesebuah industri. Rangka kerja ini boleh membantu pembuat polisi, pengurus, pereka, jurutera dan penyelidik untuk membuat keputusan dengan lebih mudah dan berkesan mengenai penggunaan teknologi di dalam realiti maya. Rangka kerja yand dihasilkan telah disahkan menggunakan satu set kajian soal selidik yang baharu. Secara keseluruhannya, lebih daripada 90% responden bersetuju bahawa rangka kerja yang dihasilkan mudah difahami, boleh dilaksanakan, pendekatan komprehensif yang meliputi semua aspek utama VR dalam industri automotif Malaysia, dan ia menyediakan satu panduan termasuk kepada pekerja yang baharu di dalam bidang VR.

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Your nice help, I would never forget.

I certify that a Thesis Examination Committee has met on 19 January 2011 to conduct the final examination of Maryam Mousavi on her thesis entitled " Development of Virtual Reality Framework in Malaysian Automotive Manufacturing Industry" in accordance with the Universities and University College Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The committee recommends that the student be awarded the Master of Science.

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This thesis was submitted to the senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the supervisory committee were as follows:

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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or other institutions.

MARYAM MOUSAVI

Date: 19 January 2011

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