Part C Project Overview	
Project Title (in English): **Development of Virtual Reality Teaching Tools for Science and Engineering Education**	Project Title (in Chinese): 開發虛擬現實工程科學教學軟件

Executive Summary

(Please provide, within this page, an executive summary of the project.)

Project Aims - The major aims of this project is to design and implement new Virtual Reality (VR) teaching tools system for improving the teaching quality.

Project Objectives - In order to achieve the above aims, the objectives of the project are to:

1. Design the system architecture, hardware and software specification of the systems
2. Integrate various VR components into the teaching tools systems
3. Identify the area of teaching courses in which the VR teaching tools can be applied
4. Using the VR software package to develop teaching tools for the course in step 3
5. Evaluate the effectiveness of the VR teaching methodology and to investigate the possibility of extending the coverage of the project in other faculties of our College

Resources Required - In this project, new VR hardware and software will be purchased and new project staff in the field of Computer Science or Information Technology will be recruited for the design and implementation of the VR teaching tools system

The Project team

The project implementation team will responsible to:

- Design the specification and architecture of the VR teaching tools systems
- Monitor the project staff purchase appropriate equipment and integrate various components into the VR teaching tools systems
- Monitor the project staff to develop and implement new VR teaching tools packages for the selected courses offered by faculty of Science and Engineering in the Chu Hai College of Higher Education

On the other hand, the project evaluation team will responsible to:

- Organize training workshops to academic staff for the uses of the VR teaching tools
- Evaluate the effectiveness of the new VR teaching tools for improving the teaching quality
- Provide comments and advices to the Senior Management for the feasibility of extending the project to other faculties and sustaining the project by using College resources after the completion of this QESS project.

Project phases- The project duration is two years and it consist of the following stages

Phase 1 – Design the architecture and specification of the VR teaching tools systems

Phase 2 – Purchasing appropriate VR equipment and systems integration and identify

Phase 3 –Development of VR teaching tools software package for selected courses in Faculty of Science and Engineering

Phase 4- Provide training workshop to the academic staff and the students for the uses of the VR teaching tools systems, the workshop will also be opened to all other institutions

Phase 5 – Evaluation of the effectiveness of the new teaching tools systems

Part D Problems Identified

(Please provide your assessments to the problems / needs identified.)

Research and development in virtual reality methodology has attracted attentions from computer science researcher and professionals in industrial sectors. Research outcomes in VR research has found many practical applications such as VR product design, interior design, engineering evaluation, game development and animation. The application of virtual reality in education is relatively new to the tertiary education sector. We have foreseen the potential of applications of the VR teaching methods in various courses of the faculty of Science and Engineering. We also identify the following problems that can be solved by the proposed teaching tools system:

Improvement of teaching quality Improving in the area of Architecture Studies

- We found the needs for 3D illustrations for a virtual environment and the outcomes of the building design after architecture outlooks and interior design.
- Three dimensional animations and illustration can give the students a better understanding of the effect of air ventilation flow, outlooks and external features of the building from different perspectives.
- Furthermore, the outcomes of the interior design can also be illustrated by using a first person viewpoint perspectives when the animation shows the effect when a person travel in different internal parts of a buildings.
- Effect of natural light illumination, evaluation of the livability can also be illustrated in a better way.

Improvement of teaching quality Improving in the area of Civil Engineering Studies

- We have also found that the VR technology can also improve the teaching quality of various courses in the area of civil engineering.
- 3D animations can provide a better illustration for the courses of structural analysis and cracking formation in a three dimensional senses from various perspective. Various part of a structure subjected to different stress can be illustrate the effect of a particular design method and how the structure can be strengthened by using different design method.
- VR teaching methods can also be used in fluid dynamics studies and to give a better 3D illustrations of laminar flows.
- The VR animations can also show the effects after different stages of highway and road construction from a 3D perspective.

Improvement of teaching quality in the area of Computer Science Studies

- VR technology has been widely used different area in IT industries such as computer games development and digital entertainment. The Computer Science students can gain the experience of using VR teaching tools system to generate computer animation and graphics. These learning experience is useful to their future career development as IT professionals
- Computer Science Student can use the VR teaching tools systems as a platform for the software development of computer games and for their multi-media and computer vision projects

Part E Project Objectives and Deliverables	
Measurable Objectives	**How it can be achieved**
1. To enhance the students' learning experience in the area of architecture studies, civil engineering and computer science. **Measured by** statistical count and number of usage by students for the proposed VR teaching tools system	• Develop a well design VR teaching tools system, design and implemented an appropriate system content database • Conduct questionnaire survey to collect the comment and feedback for the students' experience of using the VR teaching tools systems, collect comments and feedback from students for the design and specifications of teaching content database • Analyze the comments and feedback and the survey results
2. To enhance the teaching quality in the area of architecture studies, civil engineering and computer science. **Measured by** statistical count and number of usage by teaching staff for the proposed VR teaching tools system	• Develop a well design VR teaching tools system, design and implemented an appropriate system content database, collect comments and feedback from teaching staff for the design and specifications of teaching content database • Conduct questionnaire survey to collect the comment and feedback for the teaching staffs' experience of using the VR teaching tools systems • Analyze the comments and feedback and the survey results
3. To develop the VR teaching tools systems align with the needs of industrial sectors **Measured by** collecting feedback and comments from External Examiners, programme, industrial advisors and **users from other institutions** for their experience in using the VR teaching tools systems	• Design an appropriate system specifications by considering the comments from industrial sectors • Analyze the comments and feedback and the survey results to evaluate whether the teaching tools systems can be able to illustrate the problems encountered in practical environment of the industrial sectors
4. To provide a VR platform for the research activities in the faculty of Science and Engineering **Measure** the research outcomes by counting number of submitted journal and conference papers and the number of seminar and workshop activities in which the VR teaching tools system has been utilized.	• Conduct questionnaire survey for the research staff • Analyze the comments and feedback and the survey results

5. Evaluate the effectiveness of the teaching tools systems **Measured by** the statistical results of the survey conducted in items 1-4 Comments and feedback from all users in items 1-4	• Prepare a summary reports that including the outcomes and findings from items 1-4 • Give suggestion to the College Senior Management how the VR teaching tools system can be further enhanced in the future after the completion of the project

Project Deliverables

(Please list out all the deliverables to be achieved and how they can be shared with, if possible, other institutions.)

Deliverables	Sharing mechanism
1. Develop a well design VR teaching tools systems with the functions that can provide visualization of a virtual environment for architecture studies courses, civil engineering courses, computer animation graphics and games development courses	Invite academic staff, students from **all other institutions** or IT professionals from industrial sectors to attend seminar and workshop activities to have experiences of using the VR systems
2. Design and implemented a system content database for the VR teaching tools system	Invite academic staff, students from **all other institutions** or IT professionals from industrial sectors to attend seminar and workshop activities organized by project team to have experiences of using the VR systems
3. Organize workshop and seminars activities for the teaching staff, students and other external stakeholders for the uses of the system	**Workshops and seminars organized by project team are also be opened to the academic staff and students from all other institutions**
4. Share the information about the outcomes of the VR teaching tools system in the College website	Project Information in the College website are shared with the public and public has easy access to this information

(Please indicate the information that can be uploaded onto relevant EDB websites during and after the project period.)

- The progress report and final evaluation report will be uploaded onto relevant websites during and after the project period.
- The progress report will summarize the current progress for the design and implementation of the system every six months of the project period
- The final evaluation report will summarize all the project outcomes and findings after completion of the project
- Evaluation on the effectiveness of the proposed VR teaching tools system, summary of the workshop and seminar activities will also be included in the final evaluation report

Beneficiaries	
Expected type and number of beneficiaries of the project	**350**
(Please provide justification to support the above estimation and explain how they can be benefited from the project.)	
Students can gain VR learning experience from the proposed system during class While academic staff can improve their teaching quality by using the VR teaching tools Users from other sectors can gain experiences in using the proposed system during workshop and seminar activities **Students from the Chu Hai College of Higher Education** Faculty of Science and Engineering No. of students in the department of Architecture = 120 No. of students in the department of Civil Engineering = 35 No. of students in the department of Computer Science = 25 Total Number of students expected to be benefited from this project is 180 **Academic Staff from the Chu Hai College of Higher Education** No. of Academic Staff in the department of Architecture = 15 No. of Academic Staff in the department of Civil Engineering = 8 No. of Academic Staff in the department of Computer Science = 7 No. of Academic Staff in other faculties = 20 Total Number of Academic staff expected to be benefited from this project is 50 **Other users of the VR teaching tools systems** No. of External Users (e.g. External Examiners, Programme Advisors) = 30 **No. of users from all other institutions (students and staff)=90** Overall Total = 350	

Implementation Schedule *(Please list out the implementation schedule and key milestones to be achieved on a half-yearly basis.)*	
Estimated start date of the project (month/year)	Dec 2017
Estimated end date of the project (month/year)	Nov 2019
Project duration (months)	24 months

Month	**Key milestones**	
	In terms of project activities and deliverables	**In terms of monitoring and evaluation**
1-6	• Design the system architecture, Investigate the design specification of the VR teaching tools system so as to match with the teaching methodology in faculty of Science and Engineering, purchase and order the system hardware and software	• Project implementation team meeting with project staff • Monitor of project progress by the Project Implementation Team and the Project Evaluation team

7-12	• Build up a VR teaching tools systems by integrating various hardware and software components into the system • Identify the lists of courses offered by the academic department for which the VR teaching tools will apply, collect inputs from teaching staff of the academic departments and develop the content for the teaching tools system.	• Project Implementation Team meeting with academic staff of different academic department in the faculty of Science and Engineering • Monitor project progress by the Project Implementation Team and the Project Evaluation team • Conduct survey on the content database, questionnaire for academic staff, collect comments for the expected functions and content of the system
13-18	• Generate animation teaching tools software that can match the teaching requirements of the selected courses • System is in operation, provide training workshops and seminars to the teaching staff and students for the uses of the new system. **The workshops will be opened to all other institutions**	• Monitored by the Project Implementation Team and the Project Evaluation team
19-24	• Conduct class sit-in evaluation and questionnaire survey for the teaching staff and the students, evaluate the effectiveness of the system • Preparation of the evaluation report for the VR teaching system	• Monitored project progress by the Project Evaluation team
Publicity Plan *(Please describe all the publicity activities to be organised and materials to be produced to acknowledge the support of Quality Enhancement Support Scheme. Please suitably reflect the publicity activities as key milestones in the implementation schedule above.)*		

Publishing the outcomes of the project in College Web site

- The outcomes and the descriptions of the VR teaching tools system will be published in College Web site

Organizing Seminar and workshop

- Organizing seminar and workshop for the students and academic staff of our College
- Seminar and workshop demonstration and trial run of VR teaching tool system will also be organized for our students and academic staff
- Organizing seminar and workshop for External advisors and guests from industrial sectors for evaluation of the performance of the proposed VR teaching tools systems
- Workshop and demonstration will also be organized for the Secondary school students and teachers for promotion VR teaching methods
- **Workshop will also be opened to the students and academic staff from all other institutions**

Publishing evaluation report in College Web site

- Project evaluation report information will also be published in the College website to be accessed by the public

Part F Cash Flow and Budget

Project Expenditure

	Amount in HK$			
Period	**Year 1**	**Year 2**	**Year 3**	**Total**
Manpower	300,000	522,000	-	822,000
Equipment / Facilities	956,000	-	-	956,000
Services	-	-	-	-
General Expenses	-	-	-	-
Others (e.g. auditor's fee)	-	-	-	-
Total	1,256,000	522,000	-	1,778,000

Project Income *(if any, e.g. fees received)*

	Amount in HK$			
Period	**Year 1**	**Year 2**	**Year 3**	**Total**
Total	0	0	0	0

(Please provide a detailed breakdown of the project budget by completing the following Excel file.)

Grant Sought under the Quality Enhancement Support Scheme	1,778,000
Funding from the Applicant	0
Funding from Other Sources	0
Total Project Value	1,778,000

(Please specify the amount to be funded by each funding source (e.g. donations, contributions from applicant / its parent organisation) and whether the funding has been secured. If not, please provide the plan to obtain the funding.)

NIL

(Please provide the duty lists of manpower to be funded by this project.)

Post	Duties
System Engineer (Infrastructure, system development, and programming)	• Responsible to design architecture and implement the systems and the procurement of the hardware and software, integration, testing and maintenance and evaluation of system performance • Responsible for the software development, visualization, including the image capturing, user-interface, calibration, and rendering • Take up administration duties for organizing the workshop and seminars
Multi-media Designer and Web Programmer (Content development)	• Responsible to develop the system content including animations and making VR movie by using VR camera • Responsible for graphics design and website development • Take up administration duties for organizing the workshop and seminars

Project Sustainability

(Please estimate the amount of recurrent expenditure and describe how you will commit the resources to ensure sustainability of the project. Please put supplementary information (e.g. proof of financial support) at appendix.)

Having complete the VR teaching tools system project, the College will support the further development of the systems

Further development of the VR teaching tools system to other faculty

- The project has the potential to be extended to the faculty of Business and faculty of Arts and Social Science
- The VR technology can be used for providing a Virtual Studio for the Journalism and Communication Studies and the animation of virtual reporters. Potentials for application of VR technology in Journalism Studies can be explored in the future
- VR technology can also be applied in the area of appreciation of Arts in virtual environment, arts appreciation and the introduction to archaeology
- The potential application of the VR technology in Business courses studies can be in the following area: illustration of logistics flow and operation research

Generate Income from other sources in the long term

- In the long run, funding could be generated by offered training workshop in VR technology. Overhead cost can be charged to the applicants for training
- Systems can also be opened to other self-finance institutions as a platform for research and overhead cost can also be charged to other users.