An Expert-Oriented Visualization Approach (EOVA) for Knowledge Management of Software Engineering Interest Group (SEIG) (USM0001204)

Prepared by

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PROJECT IDENTIFICATION

A. **Project number**   USM0001204

B. **Project title**   An Expert-Oriented Visualization Approach (EOVA) for Knowledge Management of Software Engineering Interest Group (SEIG)

C. **Project leader**

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E. **Key words**

    Knowledge Management
    Knowledge Portal
    Visualization
    Software Engineering

OBJECTIVES OF THE PROJECT

A.　Specific objective

1)　To enhance the approaches of knowledge management in existing specialized web portals by combining knowledge-based component with web portal technology.
2)　To utilize a graph drawing technique to visualize levels of expertise to represent the knowledge of web-portal community.
3)　To employ an interactive visualization method for more effective information retrieval of community's interest and expertise.

B.　Type of research

Applied research

C.　Research Cluster and SEO Categories being addressed by the Project

Research Cluster	INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT)
SEO Category	S2090000 - Information And Communication Services
SEO Group	S2090100 - Computer Software and Services
SEO Area	S2090199 - Other computer software and services

D.　Fields of research

Primary Field of Research

-　**FOR Category**	F1050000 - Information, Computer And Communication Technology (ICT)
-　**FOR Group**	F1050300 - Software
-　**FOR Area**	F1050310 - Software engineering

Secondary Field of Research　(if applicable)

-　**FOR Category**	F1050000 - Information, Computer And Communication Technology (ICT)
-　**FOR Group**	F1050700 - Artificial Intelligence
-　**FOR Area**	F1050799 - Other artificial intelligence

RESEARCH BACKGROUND

B. Research background of the project

Project status   Modification to previous porject

Project summary

The idea was initiated in 2005 that involved a Masters of Computer Science (mix mode) project. The project entitled "Applying a Visualization Technique in a Knowledge-Based Web Portal (VisSEIG)" proposed the visualization technique to represent the expertise of a special interest group . Then the implementation of the project was extended in an undergraduate final project in 2006 entitled "Knowledge-Based Special Interest Group Web Portal (KBaSIG). Currently the work has been further refined to classify users' expertise and facilitate the community of a software engineering interest group (MySEIG). MySEIG portal has been launched and it is expected to be actively joined among the software engineering practitioners and researchers in Malaysia once its final version is released by the end of this year (2007). This application of e-Science fund is anticipated will be able to speed up the current unfunded project.

Literature review summary

With the increase of demand for knowledge economy or k-economy, knowledge has become a crucial asset for an interest group, an organization or a nation. Knowledge management will be able to capture individuals' knowledge particularly tacit knowledge in order to be shared with other individuals who will benefit the expertise, knowledge and experience transferred. The growing use of the Internet provides the platform to acquire knowledge via Web portals. This type of portal is also known as knowledge portal. Our focus is on knowledge management for a special interest group.

Most special interest groups (SIG) use Web applications either portal based or not in order to communicate, share ideas and knowledge among the community. Some portals provide very basic information to the community for example by listing relevant activities of the community's interest and providing the search utility or links to other related resources. On the other hand, a number of such portals may also provide the utility to communicate via emails, forum or chatting to seek help from the others. Some instances are ITTUTOR.net [11] and Computerforum.com portal [12].

By incorporating a Web portal with a knowledge-based system, knowledge acquisition will be more efficient. This type of knowledge-based system categorized as knowledge sharing system rather than an expert system. According to Niwa [8] a knowledge-sharing paradigm perceives knowledge suppliers as the same set of system users who use the knowledge base. This differs from expert systems that require suppliers to be the experts while users are the novices.

A knowledge sharing system requires an inference engine that will draw conclusions and respond to users' queries. Most Web portals request users to register in order to be a part of the community. The registration may acquire users to notify their field of interest, level of expertise and experience. The information will be stored in a database as the knowledge of users or community of the knowledge portal. Based on the data, the system can classify the users' level of expertise in their field of interest in software engineering either as an expert, an intermediate or a beginner based on the ratings given among the community. When a new user has registered, he might need to know who are the expert users in a particular area. By categorizing the existing users into corresponding levels of expertise, it will be easier to the new user to seek help from the experts of the concerned area or to discuss the problem with other users of the same level. In addition, existing special interest groups' Web portals provide the information by listing the names of the related people in a textual form. Some Web portals reveal the level of expertise of the members but the textual representation does not manage to highlight the different level of expertise among the community explicitly. We believe the utilization of a visualization approach to represent the information of the users' field of interest, expertise and experience will make knowledge acquisition and sharing to be more effective among the knowledge portal community.

Thus we propose the application of knowledge sharing paradigm and graph drawing technique in a SIG portal to improve the sharing of expertise and knowledge among a knowledge portal community. We have chosen software engineering community or software engineering interest group (SEIG) as the domain concerned. A

prototype of the portal was developed to realize the proposed idea. A number of research work have been conducted in order to improve functionalities of web portals such as in [13] and [14]. We can hardly find SIG web portals implemented with a knowledge-based approach although there is a number of work on knowledge-based document retrieval has been conducted such as in [15]. Furthermore none of existing SIG web portals apply visualization techniques to represent different areas and levels of expertise of the members.

Some knowledge-based systems focus more on knowledge management that provides the mechanism to communicate and share knowledge among workers in an organization for instance in [16]. Some work such as in [17] applies knowledge-based to support self-directed search in selecting suitable courses to enter higher institutions. This does not relate to SIG web portals. Other related work include [18,19,20,21] that will be discussed in the related work section. The problems previously discussed motivate us to propose an expert-oriented visualization approach (EOVA) to represent knowledge portal for SEIG community. The research question is: How to produce a knowledge portal that can enhance knowledge sharing among the community? The aspects to be improved in the proposed approach include searching of members by interests and level of expertise, integrating graphical visualization to represent the expertise of community members besides textual information, classifying users' expertise based on their interests and experiences, and finally providing better personalization and user interface. The hypothesis to be proved is: Applying EOVA in an interest group knowledge portal will significantly improve information retrieval and knowledge sharing among the web portal's community. The three main modules involved in this project are knowledge-based component (KB), SEIG knowledge portal (KP) and graphical visualization component (GV) as illustrated in Figure 1 (See the attached file in the e-Science Fund System).

Related research

A lot of approaches related to knowledge portals are available to support the online community in knowledge sharing and disseminating among the group members. Referring to the main research question indicated earlier: How to produce a knowledge portal that can enhance knowledge sharing among the community? The main issues include what aspects to be improved in terms of searching of members, integration of graphical visualization to represent the expertise of community members besides textual information, classifying users' expertise, and finally providing better personalization and user interface. These aspects have been partly elucidated by [18, 19, 20, 21].

The work of Wingyan Chun et al. [18] proposed a knowledge portal approach to enable cross-regional search of information in Web pages of different languages by multinational organizations. One of the components is visualizer that applies a Kohonen self-organizing map (SOM) algorithm to categorize and allocate Web pages onto a two-dimensional jigsaw map. This approach allows the related Web pages to be placed to adjacent region to improve information gathering. The knowledge portal is not for SIG but focuses more on visualizing the searched Web pages of a particular domain. A more related work of Barackskai and Velencei [19] proposed DoctuS knowledge portal that supports decision makers of organizations to acquire related information using C-map or concept map static representation. DoctuS provides data mining that suggests which data was used and its usage, knowledge angling that suggests relation used for the data and type of new knowledge to be developed, and experience fishing that indicates experience used, who knows the leading experience and its use. The portal uses deduction method by asking experts to give attributes and its values and visualize the attributes using a multi-step graph and attribute values. The knowledge required is then represented using C-map to support decision makers' knowledge acquisition. Large information can cover huge region of display that may disrupt users' focus while gaining concerned information. The C-map prototype should provide interactive graphical visualization with zooming capability that allows users to view information hierarchically and focus on the details of concerned knowledge only.

Wimmer [20] proposed the use of semantic net in eGovernment Intelligent Portal (eip.at) that manages knowledge of diverse topics, areas and disciplines in government projects in Austria. The target group of users includes public administration, private sector, academia and the public. The study found that the search using semantic knowledge map reduces the searched output based on sustainability and appropriateness of results compared to traditional methods. However the user interface does not provide graphical representations and navigation through the knowledge portal. In addition, Billig et al. [21] highlights the importance of evolutionary Web portals in terms of functional, architecture, induced contents, and the overall evolution process. They developed BaSeWep (Basic Support for Evolutionary Web Portals) to assist information contributors in structuring and publishing the contents and information seekers in finding and navigating information. The

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portal uses semantic net to categorize the content in which the matching function calculates the similarity between the concept paths of information and the query made by information seeker. The work focuses on the evolution aspect but no consideration on graphical visualization of the information.

The literature study shows some effort in searching and visualizing methods for knowledge or Web portals. However there is no knowledge portal specifically for SIG that concerns the aspects of visualizing the expertise community members graphically and the mechanisms to classify the members' expertise to improve the finding of information and community expertise in order to share and disseminate knowledge among the community. Other related work that is important as the foundation of the proposed EOVA includes the methods that should be the basis of the approach. They are knowledge-based systems; graph drawing technique, and interaction and distortion technique.

In knowledge-based system the knowledge acquisition is divided into three categories that are procedural knowledge: often referred as knowledge that has sequence steps, declarative knowledge: knowledge that knowing something is true or false and tacit knowledge: cannot be expressed by language like 'how to move hand' [3]. The other component in knowledge-based system is inference engine, which is used to draw conclusions [8]. Methods to represent the knowledge include rules, semantic net and frames [3]. We have chosen semantic net to represent the SIG knowledge because it is suitable to represent different field of interests in software engineering. In term of visualization, there are various techniques such as tree-map, icon-based, daisy chart and graph drawing [10]. Graph drawing technique is chosen because it focuses more on positioning nodes and edges; suitable to represent members of a SIG portal community. Koschke [7] depicts that graph is the most often used kind of visualization because a graph represents a generic way to represent information. Buchsbaum, et al. [1] and Gansner, et al. [2] outline the properties for graph layout algorithms or the aesthetic criteria. Interaction and distortion techniques are required to allow interactive navigation of the graph layout. Existing navigation techniques include focus+context such as fisheye view [9] that allows users to view a particular data concerned yet they are still able to see other data but not in detail. Another technique is zooming+filtering [5] that implements interactive zooming with higher level of zoom may lead to more detailed information being shown. This technique enables the users to focus on the selected or zoomed information of the community members. EOVA will be applied to existing Web portal for Malaysian Software Engineering Interest Group (MySEIG) that is available at www.cs.usm.my/smarts/myseig. We anticipate knowledge management of the portal will be more effective when we manage to integrate the approach in the Web portal to improve it as a knowledge portal.

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PROJECT SCHEDULE

Activities	2008 (J F M A M J J A S O N D)	2009 (J F M A M J J A S O N D)	2010 (J F M A M J J A S O N D)
Initiate project	■		
Enhance existing approaches	■		
Conduct comparative study	■		
Design database for knowledge based module	■		
Enhance the interface of web portal module	■		
Enhance hierarchy graph drawing algorithm for graph visualization module	■		
Perform integration testing	■	■	
Conduct a usability study		■	
Analyze statistically and derive the findings		■	
Publish findings and compile documents		■	

Milestone	2008 (J F M A M J J A S O N D)	2009 (J F M A M J J A S O N D)	2010 (J F M A M J J A S O N D)
Completion of comparative study to justify the research problem	■		
EOVA has been implemented and tested		■	
Project Completion		■	

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SUMMARY OF RELEVANT PAST RESEARCH PROJECT

A.   Project title

Knowledge-Based Special Interest Group Web Portal (KBaSIG)

B.   Research Team

Programme head   (if applicable)   :

Project leader

Name   :   Shahida Sulaiman

Institution   :   Universiti Sains Malaysia

C.   Description of the project

Ouput: Bachelor of Honours (Computer Science) Final Year Project report, system document, user manual and the web-based system.
Beneficiaries: Currently the beta version is available at www.cs.usm/smarts/myseig and is expected to be fully released by end of year 2007 to be used by software engineering practitioners and researchers in Malaysia.
Approach: knowledge-based and visualization technique.

D.   Description how it is relevant to the proposed project

The previous project provides the interface for the proposed project.

E.   Other collaborator that were involved in the project

F.   Source of Funding

None - None

SUMMARY OF RELEVANT PAST RESEARCH PROJECT

A.   Project title

Applying a Visualization Technique in a Knowledge-Based Web Portal (VisSEIG)

B.   Research Team

Programme head (if applicable)   :

Project leader

Name   :   Shahida Sulaiman

Institution   :   Universiti Sains Malaysia

C.   Description of the project

Output: Masters of Computer Science (mix mode) final project report.
Beneficiaries: Special Interest Group (SIG) that join the community of the portal.
Approach: knowledge-based search engine and hierarchy graph drawing algorithm.

D.   Description how it is relevant to the proposed project

The visualization technique will be further enhanced in this proposed project.

E.   Other collaborator that were involved in the project

F.   Source of Funding

None - None

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RESEARCH APPROACH

A.   Research methodology

The research methodology comprises the following components:
(i)   Initiate project by recruiting research officers and purchasing the equipment.
(ii)   Enhance existing approaches of knowledge management for SIG web portals either with or without knowledge-based including the techniques used to retrieve and to represent information.
(iii)   From (ii) produce the requirements of improvement that can be made by the proposed approach in terms of information retrieval and graph drawing in a knowledge portal.
(iv)   Indicate all areas in software engineering SIG that should be the knowledge domain of the project.
(v)   Select the most suitable software package to develop the web portal, database and graph drawing algorithm in the client-server architecture.
(vi)   Design the database for KB module and represent the knowledge derived in (iv) using the semantic net representation and enhance existing information retrieval technique.
(vii)   Develop the interface of WP module including the basic utilities of electronic mail, forum and announcement for SIG community.
(viii)   Enhance existing hierarchy graph drawing algorithm for GV module in order to represent information retrieved by the SIG community.
(ix)   Integrate the 3 modules of the project and conduct the integration testing.
(x)   Perform a usability study by announcing and distributing a questionnaire among SIG community via the knowledge portal.
(xi)   Analyze statistically and conclude the findings based on the hypothesis tested.
(xii)   Produce one paper for international journal and national conference proceedings respectively.
(xiii)   Compile the documentation for the whole components of EOVA project.
(xiv)   Close down project.

See also the flow of the research methodology illustrated in Figure 2 (See attached file).

Specialised Equipment	Description
1 unit of LCD projector	New
1 unit of computer server	Existing
2 unit of personal computers	New
1 unit of notebook	New

Facility	Description
Network facilities	New

Infrastructure	Description
Carpets	New
Furniture	New

B.   Project activities

Activities	From Date	To Date
Initiate project	01/01/2008	01/01/2008
Enhance existing approaches	01/02/2008	01/03/2008
Conduct comparative study	01/04/2008	01/05/2008
Design database for knowledge based module	01/06/2008	01/07/2008
Enhance the interface of web portal module	01/07/2008	01/09/2008

Enhance hierarchy graph drawing algorithm for graph visualization module	01/10/2008	01/12/2008
Perform integration testing	01/01/2009	01/02/2009
Conduct a usability study	01/03/2009	01/04/2009
Analyze statistically and derive the findings	01/05/2009	01/05/2009
Publish findings and compile documents	01/06/2009	01/06/2009

C. Key milestones

Milestones	Date
Completion of comparative study to justify the research problem	01/05/2008
EOVA has been implemented and tested	01/02/2009
Project Completion	01/06/2009

D. Risks of the project

Factor : (i) Not able to derive full co-operation from the project members.
(ii) Integration of EOVA with MySEIG web portal is not able to work as anticipated hence it needs more time to
troubleshoot the errors.
(iii) Turn over rate of contract staff could be higher.
(iv) The fund is not given even though the project has been approved and started.
(v) Delay in open of accounts cause delay of purchase of equipments and recruitment of contract staff.

Technical risk : Medium - The contract staff appointed do not have strong technical skills.

Timing risk : High - The fund is given later yet the schedule and milestone cannot be changed.

Budget risk : Medium - The budget is slashed yet the benefits of the project cannot be changed, hence need to re-adjust budget as permitted.

E. Time schedule

Starting date : 01/01/2008

Completion date : 01/06/2009

Duration : 18

BENEFITS OF THE PROJECT

A. Outputs Expected from the project

Research	Quantity	Details\Remark
New/improved software	1	Enhanced knowledge management among MySEIG online community
New/improved service	1	Enhanced approach applied in knowledge portal to provide better service
Method/technique	1	Expert-Oriented Visualization Approach (EOVA)

Human capital and expert development

	Quantity	Specialisation Area (specific area)
Bachelor	1	Software engineering
Masters degrees	1	Visualization
Research staff with new specialization	2	Knowledge management

B. Economic contributions of the project

Revenue from consultancies

Other (please specify) - MySEIG knowledge portal will improve knowledge sharing using EOVA

C. Infrastuctural contributions of the project

New/ improved facility

Other (please specify)

RESEARCH COLLABORATION

A. Institutions involved in the project

Organisations Involved	Other	Role
UTM - Universiti Teknologi Malaysia		Co-researcher

B. Industries involved in the project

Industry	Role
Motorola Technology Sdn Bhd	End-users

C. Project Team

Project Leader	Organisation	Man-Month
Shahida Binti Sulaiman	Universiti Sains Malaysia	5.00

Researchers	Organisation	Man-Month
Sarina binti Sulaiman	Universiti Teknologi Malaysia	1.00
Cheah Yu-N	Universiti Sains Malaysia	1.00
Ahamad Tajudin bin Khader	Universiti Sains Malaysia	1.00
Rosalina binti Abdul Sala	Universiti Sains Malaysia	1.00

Support Staff Type	Number	Man-Month
Technical Assistant	1	1.50

Contract Staff Type	Number	Man-Month
Research officer (Degree)	2	36.00

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DIRECT EXPENSES ESTIMATION WORKSHEET

Expense Categories and Items	Year 1	Year 2	Year 3	Year 4	Total
Travel & contract personnel (V 11000)					
CONTRACT STAFFS	54,634	30,326	0	0	84,960
Travel & transportation (V 21000)					
National presentations for 2 persons	3,500	0	0	0	3,500
International presentation for 2 persons	0	20,000	0	0	20,000
Rental (V 24000)					
Nil	0	0	0	0	
Research materials & supplies (V 26000)					
Books	800	0	0	0	800
Journals/proceedings	1,000	1,000	0	0	2,000
Consumables	2,500	1,000	0	0	3,500
Minor modifications & repairs (V 28000)					
Computer preventive maintenance	2,000	1,000	0	0	3,000
Special services (V 29000)					
Contract staff training	5,000	0	0	0	5,000
Honororium for respondents in usability study	0	12,000	0	0	12,000
Special equiment, accessories (V 35000)					
Personal computer	10,000	0	0	0	10,000
Notebook	7,500	0	0	0	7,500
Network facilities	3,000	0	0	0	3,000
Furniture	3,000	0	0	0	3,000
Carpets	2,500	0	0	0	2,500
LCD projector	3,500	0	0	0	3,500
Visual Studio 2005 Professional Edition (Full Version)	24,628	0	0	0	24,628
Total direct expenses	**123,562**	**65,326**			**188,888**

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SPECIAL EQUIPMENT AND ACCESSORIES

Item	Justification	Similar Equipment available	Justification to purchase	Estimation Cost
Carpets	The carpets in the existing research labs are wear out.	Y	Need to improve working environment among the staff.	2,500
Furniture	Existing research lab has no locked cabinets, lack of utility racks, bookshelves, and ergonomic computer tables and chairs.	Y	Need locked cabinets to keep researh materials or consumables, and need to improve productivity by providing comfortable chairs and computer tables.	3,000
LCD projector	LCD projector is required to support group discussion and presentations.	N	No existing LCD for the research group.	3,500
Network facilities	Network facility is required to connect existing server with the new 2 PCs.	Y	Network environment improves team work among team members especially contract staff.	3,000
Notebook	Notebook is required to allow mobility for any team members who need to work outstation such as present papers or meeting clients for a demo.	N	No existing notebook available to support mobility among team members.	7,500
Personal computer	Existing PCs are used by other projects' research officers/assistants.	Y	New PCs are required by the appointed research officers.	10,000
Visual Studio 2005 Professional Edition (Full Version)	Enhance development environment for the web portal.	N	Professional edition provides a lot of features that support commercialization of the system produced in this project.	24,628

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PROJECT COST

A.   Salaried Personnel costs

Staff Category	Year 1 (RM)	Year 2 (RM)	Year 3 (RM)	Year 4 (RM)	Total (RM)
	2008	2009	2010	2011	
Salaried personnel (V111000)	28,490	18,830			47,320
Total salaried	**28,490**	**18,830**			**47,320**

B.   Direct Project Expenses

Expense Category	Year 1 (RM)	Year 2 (RM)	Year 3 (RM)	Year 4 (RM)	Total (RM)
	2008	2009	2010	2011	
Temporary and contract personnel (V11000)	54,634	30,326	0	0	84,960
Travel and transportation (V21000)	3,500	20,000	0	0	23,500
Rentals (V24000)	0	0	0	0	0
Research materials and supplies (V26000)	4,300	2,000	0	0	6,300
Minor modifications and repairs (V28000)	2,000	1,000	0	0	3,000
Special services (V29000)	5,000	12,000	0	0	17,000
Special equipment and accessories (V35000)	54,128	0	0	0	54,128
Total direct	**123,562**	**65,326**	**0**	**0**	**188,888**

C.   Total project cost

Year 1 (RM)	Year 2 (RM)	Year 3 (RM)	Year 4 (RM)	Total (RM)
2008	2009	2010	2011	
152,052	84,156	0	0	236,208

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Summary of Project Funding

A. Funding Sources

Funding Sources	RM	% of Total Funding
Science Fund	188,888	79.97 %
Internal Fund	47,320	20.03 %
Other Sources	0	0.00 %
Total Funding	236,208	100 %

B. Disbursement schedule for ScienceFund, by participating research organisation

Organisation	Year 1 (RM)	Year 2 (RM)	Year 3 (RM)	Year4 (RM)	Total (RM)
	2008	2009	2010	2011	
Universiti Sains Malaysia	123,562	65,326	0	0	188,888
Total ScienceFund	123,562	65,326	0	0	188,888

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CONTRACTUAL MATTERS

A.   Contractual obligations under this project

None

B.   Ownership of intellectual property rights

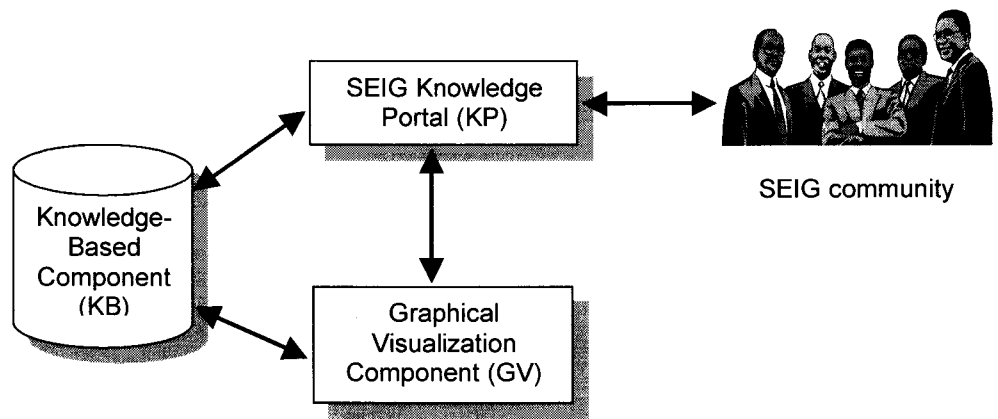USM   -   Universiti Sains Malaysia

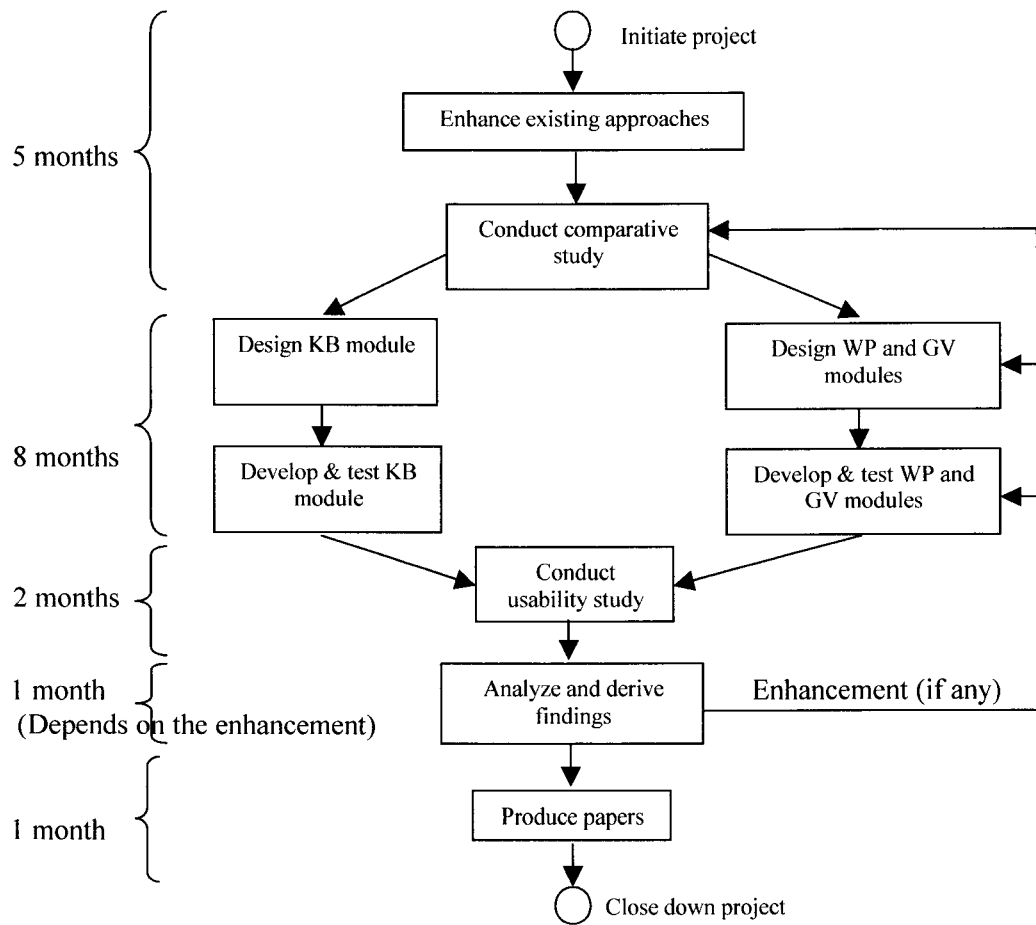Figure 1: The 3 main modules in the proposed EOVA project

Figure 2: The flow of EOVA project and its estimated months to perform the main tasks

Staff Cost Estimation

Project Identification	Project Objectives	Research Background	Relevant Past Research	Research Approach	Project Schedule	Project Benefits
Research Collaboration	Contractual Matters	**Staff Cost Estimation**	Direct Expense Estimation	Project Cost	Project Funding	Curriculum Vitae	Upload Files

Daily Rate

Role in Project	Project Leader	Researchers	Support Staff	Contract Staff
Daily Rate (RM) *	168	350	84	118

Update

Research Activities

Research Activities	Man-Days[1]				
	Project Leaders (V11100)	Researchers (V11100)	Support Staff (V11100)	Contract Staff (V11000)	Year
		Edit			-Select- ▼

Add

Staff Cost Estimation Worksheet

Year 1 (2008)

Research Activities	Total	Project Leader	Researchers	Support Staff	Contract Staff		
1. Initiate project	6.00	3.00	3.00	0.00	0.00		
2. Enhance existing approaches	94.00	17.00	12.00	0.00	65.00		
3. Conduct comparative study	70.00	15.00	12.00	3.00	40.00		
4. Design database for knowledge based module	60.00	10.00	10.00	2.00	38.00		
5. Enhance the interface of Web portal module	167.00	10.00	7.00	0.00	150.00		
6. Enhance hierarchy graph drawing algorithm for graphical viewer module	185.00	10.00	5.00	0.00	170.00		

Role in Project	Total	Project Leader	Reseachers	Support Staff	Contract Staff
Total Year 1 (2008) Man-days	582.00	65.00	49.00	5.00	463.00
Total Year 1 (2008) Cost (RM)[2]	83,124.00	10,920.00	17,150.00	420.00	54,634.00

Year 2 (2009)

Research Activities	Total	Project Leader	Researchers	Support Staff	Contract Staff		
1. Perform integration testing	110.00	10.00	8.00	12.00	80.00		
2. Conduct a usability study	86.00	3.00	4.00	5.00	74.00		
3. Analyze statistically and derive findings	62.00	5.00	4.00	8.00	45.00		
4. Publish findings and compile documents	90.00	17.00	15.00	0.00	58.00		

Role in Project	Total	Project Leader	Reseachers	Support Staff	Contract Staff
Total Year 2 (2009) Man-days	348.00	35.00	31.00	25.00	257.00
Total Year 2 (2009) Cost (RM)^2	49,156.00	5,880.00	10,850.00	2,100.00	30,326.00

Year 3 (2010)

Role in Project	Total	Project Leader	Reseachers	Support Staff	Contract Staff
Total Year 3 (2010) Man-days	0	0	0	0	0
Total Year 3 (2010) Cost (RM)^2	0	0	0	0	0

Year 4 (2011)

Role in Project	Total	Project Leader	Reseachers	Support Staff	Contract Staff
Total Year 4 (2011) Man-days	0	0	0	0	0
Total Year 4 (2011) Cost (RM)^2	0	0	0	0	0

Role in Project	Total	Project Leader	Reseachers	Support Staff	Contract Staff
Total Project Man-days	930.00	100.00	80.00	30.00	720.00
Total Project Staff Cost (RM)	132,280.00	16,800.00	28,000.00	2,520.00	84,960.00
Total Man-months^3	46.50	5.00	4.00	1.50	36.00

Notes
1. For each research activity, estimate the man-days required by each staff category.
2. Compute the staff cost for each year by multiplying the total man-day by the daily rate of the corresponding staff category. For daily rate computation, refer to the Guidelines.
3. Compute the total man-months required for the project by dividing the total project man-days by 20. Numbers in parentheses are expense codes as shown in Form VII.