

Assoc. Prof. Karl Reed¹

Topics for Sem 1 2018 v01
(I can only supervise 2 students)

(email k.reed@latrobe.edu.au for more details of these projects, and also, I may hev other ideas..)

DETAILS of PROJECTS

THEORETICAL ISSUES

Topic 1: Data Mining, News and Fake News.. How fast does the news change?..

As more and more people rely on electronic media for news, an interesting issue arises. Fake or not, how fast is the news on your favourite news site changing?

How would you measure this, and, could you use it to set up a news channel. Of course, there news bots which can tell you WHEN something changed, but, at what rate is this happeng?

Topic 2: MAKING THE UNKNOWN KNOWN-FORMALISING THE DISCOVERY OF DESIGN KNOWLEDGE

There is a famous one liner by Donald Rumsfeld. "The unknown unknowns" ². One of the big problems faced by designers is.. what is "out there" that we don't know about, but is relevant to the design?" That is, what are the unknown unknowns?

So, what does this mean for system development and design? Can this be formalized? Do we do it already? Where does Domain Expertise come into this?

This sounds hard, but, may not be, and, if you can do it well, it is publishable.

THE NEW WORLD OF REAL WORLD SYSTEMS

Topic 3: HOW SHOULD WE DESIGN SYSTEMS THAT HAVE TO SURVIVE FOR THE NEXT 50 YEARS?

Technology is changing, however, the small system you build today may still be in use in 50 years from now. OK, you are the Government of a country developing a new Social Welfare system³. You want it to survive for the next 50 years. **What exactly does this mean?** How would you do this?

How serious is this problem? What would make it possible? What would make it difficult?

¹ Please contact me by email, or on my phone 9479 1377, and leave a message, I will get it. I am not on campus every day.. but, will be for any meetings we arrange..

² The complete quote is "Reports that say that something hasn't happened are always interesting to me, because as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns- the ones we don't know we don't know."

³ See for example <http://www.itnews.com.au/News/397008,centrelink-it-hindering-welfare-reform-minister.aspx>.

A good version of this will get published.

What we DO know...

FACT 1. Very expensive systems survive for decades even if or especially when they are mission critical. (Find some important examples).

FACT 2. Technology is changing rapidly. How do we cope with this in the above context?

FACT 3. We know a lot about component based design, software re-use and related issue. How do we bring all this together so that systems can deal with change?

WEB BROWSER TECHNOLOGY

Topic 4: WEB SEARCH NAVIGATION AND SUPPORT SYSTEM (become famous)

In today's world, web searches are a major activity undertaken by people for industrial, research and other reasons. They involve searches across a very wide range of web pages in a wide range of sources. The searcher may download pages, extract information from pages, and, in the process, create a history of link activations. The problem people face is...what happens if the searcher has to stop, and resume the process days later.

Purpose of this project is to provide support for people using Google as a search engine. A major problem here is keeping track of the sites and documents visited and viewed, and downloaded. Searches may be spread over several sessions, and users need to be able to resume a search. The project requires the development of software and the design of a complete, zero adoption cost tool.

Topic 5: ESSENTIAL KNOWLEDGE FOR WEB-SITE DEVELOPERS

Given the current IT situation, web-sites are likely to be a major aspect of businesses and organisations for the next 50 years. However, horror stories abound. What are the categories of knowledge that web-site developers should have, if this new business aid is to be genuinely socially useful aid, rather than a public nuisance?

The goal here is the development of degree program, and, the documentation of knowledge collections needed.

Topic 6: BROWSER SEARCH PRECISION IMPROVEMENT

How often does a Google search produce stuff that seems to have no relationship to what you really wanted!?

The purpose of this project is to find some simple means of improving browser precision. That is, I want to find only items which are really useful to me.

To do this, we need to first explore the current query systems, and document them. Then to propose means of getting simpler results, and to implement a prototype. You will need to develop a knowledge of "data mining", to extract classification material from the returns from browsers.

Topic 7 AUTOMATIC WEB-PAGE LINK CLICKING MINIMISATION

Lots of sites I use need several links to display/access very simple information. So, I seem to spend ages linking around hyperspace to see information which would easily fit on one page. Could I build a tool which would allow a user to define a new, single page, that had all the data concerned?

Topic 8 TRACKING USER DISSATISFACTION WITH WEBSITES

We all reply in web-sites.. but, what is our experience with them in reality? This project is to look at the factors that make websites hard to use. There is quite a bit of literature in this area, however, nothing much seems to change. Websites are pretty and awful to use. How can we improve this? Anything we suggest needs to be itself non-intrusive and easy to use..

GAMES TECHNOLOGY

Topic 9 MEASURING IMAGE QUALITY OF GAMES USING DIGITAL CAMERA APPROACHES

The digital camera industry has put a lot of work into image quality assessment, both subjective and objective. Image quality is of course a major concern in the gaming industry, however, they face the problem of high-speed image generation, rather than simply recording images. At the same time, there are now medium resolution (14MP and above) digital cameras that can capture (and, process) up to 10 or even 14 frames per second, at full resolution. (the latest 20mp Olympus OM-d EM-1 Mkii can capture still photos at 60fps using electronic shutter, so, they can render at V. hi speed) As I said, the digital camera domain has various measure of image quality. How do they map onto the needs of games, or don't they? If not, what should we do?

USER Friendliness- ZAIA PROJECTS-ZERO ADOPTION IMPACT APPLICATIONS

Topic 10: DESIGN RULES FOR ZAIA APPLICATIONS

OK, how much time do you waste learning to use a new software package? And, how many computer systems that you know of invisible, or nearly invisible in the sense that they assist you BUT, don't intrude on your non-computer work patterns? Simple examples that you may be familiar with are ABS, Traction Control, automobile engine management systems. But, what other ones can you think of? Of course, this sounds like ubiquitous computing, however, we are going beyond this. Our goal is the production of systems which can be installed in an work environment, either computerised or not, and have almost zero learning effort, but, which make life easier.

How do we design things like this?

THIS PROJECT.. What should the design-rules look like for a system of the ZAIA type look like? One way of doing this would be to design and demonstrate such a tool. such as tabbase⁴
Literature on the use of tables and their automation would need to be surveyed.

⁴ email me on k.reed@latrobe.edu.au for more details of these projects

TOPIC 11: THE USE OF CRNLP AND TAXONOMIES IN USER HELP SYSTEMS “DO I KNOW WHAT YOU ARE TALKING ABOUT?”

Cloud Computing

Topic 12: THE IMPACT OF CLOUD COMPUTING ON COMPONENT BASED DESIGN

Exactly how can a Cloud based systems be used in Component Based design? Develop design rules, and show some case-studies.

See also ST12.01 TEST FRAMEWORKS FOR CLOUD COMPUTING

SOFTWARE TESTING

Topic 13 IMPROVING SOFTWARE QUALITY BY CONSTRUCTING OPERATIONAL PROFILES BASED ON BLACK-BOX TEST RESULTS

It has been suggested by the author that one way of improving product quality is by building a wrapper around a system that blocks those case that were found to be handled incorrectly during testing.

This project investigates this idea and proposes and demonstrates deign rules and tools for achieving this for different classes of software product.

Topic 14: TEST FRAMEWORKS FOR CLOUD COMPUTING

How will developers test cloud applications? What exactly will the changes to Black Box testing for example be for clouds? This project requires analysis of both Cloud systems and testing and also of the way in which Clouds will work?

The thesis topic is to survey this field, define the problem, and produce a simple tool, if possible.

Topic 15: TEST HARNESESS.. DERIVING WHITE BOX COVERAGE ANALYZERS FROM MACHINE-READABLE DESIGNS.

In the past, people have built systems that tracked the execution of a system, checking that the actual procedures/classes etc. executed are those presumed to be the ones that should be executed for a particular test case. In addition, the value of data at specific points in the execution process might be checked against expected values.

However, this requires that there is a close correlation between the design representation and the code. That is, it needs to be possible to easily (and preferably automatically), to generate the “hooks” in the code that will make this possible.

The tester wants to be able to specify a test script in terms of the names used in the design, and have the harness execute the code, doing the required checking.

The thesis topic is to survey this field, define the problem, and produce a simple tool, if possible.

SPECIFICATION SYSTEMS

Topic 16: UNAMBIGUOUS, INFORMAL SPECIFICATION TECHNIQUES

Discussions of specification capture raise the issue of a suitable language for system specification of software systems. This must be sufficiently unambiguous for designers to be sure that a specification has been captured, and sufficiently informal for users to agree that they understand what has been achieved. The goal is to develop a suitable language and to discuss and formalize the issues involved.

Topic 17: THE USE OF INVIVO/NUDIST IN REQUIREMENTS ANALYSIS

NUDIST is a tool developed by QSR, a La Trobe SPIN off company started by Lyn and Tom Richards (Tom was a Reader in this Dept., Lyn in Sociology). The product was initially developed at La Trobe.

Its use is to analyse qualitative data, to find common ideas and threads of evidence. This project would look at its use in Requirements Engineering.

RE-USE

Topic 18: LINGUISTIC ASPECTS OF RE-USE

The purpose of this project is to investigate what, for the want of a better name, I call the linguistic aspects of re-use. Re-use is the process of using existing components to fabricate a system. A major part of the problem (apart from the issue of the existence of re-useable components), is the problem of classifying and then retrieving the components.

Much emphasis is often placed on the classification of the components. However, experience is that components can be hard to retrieve since the classifications do not always match either the application domain or the possible purpose proposed for the module. Alternatively, there may be some implied re-use possible which is not discovered.

One possible explanation for this may be that the form of classification used, the language, may either be too restrictive, or, that there do not exist appropriate mappings from the classification language to the problem space in which the component could be used. Part of this could be due the absence of suitable "Universes of Discourse", i.e., commonly understood meanings which are not stated explicitly. Another could be that specifications may imply their inverses, or, that common functions can be deduced by expanding a specification, making use of the "Universe of Discourse" that is valid for that point in the design.

The purpose of this project is to try to identify some method which might be used to address these issues. It would not be expected that a complete solution would necessarily be discovered.

PROJECT MANAGEMENT AND PROCESS RECORDING

Topic 19: RECORDING PROCESS ENACTMENTS IN STUDENT TEAM PROJECTS (with Dr. Torab Torabi)

Student software engineering projects such as PRJ involve different projects each being undertaken by more than one team. This means that there may be different process models used, and, multiple

instances of similar process models being applied independently by multiple, independent teams. The purpose of the topic is to develop a formal plan for capturing process execution data, and, for its analysis. You will need some familiarity with statistics, however, the results would be REALLY important. You will need to do a literature survey on process recording AND experimental software engineering.

Good results will be publishable, and, the model could become widely used. The history of process recording is interesting.

Topic 20: THE ROLE OF ONTOLOGY CONSTRUCTION IN SOFTWARE DEVELOPMENT PROJECTS

It has been said that software projects are often a process of knowledge gathering. However, this process seems to be covert rather than overt. In addition, the process of construction of taxonomies is quite well known, but the extent to which it plays a role in software projects in terms of domain knowledge is probably known covertly, but is not remarked upon. The purpose of this project is to examine the knowledge acquisition activities in software development and to see how they may be described as taxonomy construction exercises.

MISCELLANEOUS SOFTWARE ENGINEERING

Topic 21: Prescriptive Taxonomy-based Methods for GQM

The Goal/Question/Metric paradigm for constructing programs for measuring software (quality, performance) was developed by Basili in the early 1980's. The idea is simple, and has been the subject of many papers and some tool development. However, in practice, the process of developing questions that lead to metrics is extremely difficult to describe. My view is that the problem may be based upon a knowledge acquisition process which may be assisted by taxonomies of the application and measurement domains.

Topic 22: THE USE OF TAXONOMIES IN SAFETY CRITICAL SYSTEMS DESIGN⁵

Successful SCS implementation depends upon the designers ability to interpret the spec., and to identify unexpected behaviours implied by that spec. Alternatively, we need to ensure the behaviour is predictable given unexpected inputs. However, since the behaviour/input is unexpected, by definition, the people writing the spec. didn't see either. Is it possible that taxonomies may help with this? Obviously, we need some processes that expose possible fault conditions in terms of an external event that was not foreseen, and hence was not considered or checked.

As an example, on July 25th 2000, a Concorde taking off Charles De Gaul airport in Paris crashed killing all on board and four people in the hotel it hit.

The aircraft's tyres hit a piece of metal that had fallen from a DC10 that had departed earlier. This caused the tyres to rupture and fly into the air and rupture the fuel tank in the wing causing large fire. The plane subsequently crashed.

The design issue is..

Would it be reasonable for designers to ensure the fuel tanks are not ruptured by burst tyres? I don't know if it would be.

⁵ Ref karls ideas 16/11/2002

Would it be reasonable to design the fuel tanks so that they would not be punctured by a 50cal machine gun round? Possibly. If this WAS a design requirement, then it would probably mean the fuel tank would survive the debris from a burst tyre.

(This is related to “unknown unknowns”)

TOPIC 23: SAFETY CRITICAL SYSTEMS (SCS) DESIGNERS BUILD COMPLEX SYSTEMS RELIABLY AND WITH LOW ERROR RATES. CAN THEIR TECHNIQUES BE USED FOR GENERAL SYSTEM DEVELOPMENT?

We know that generally, SCS are one of software development’s success stories. Sure, there are problems, however, the SCS developers do very well indeed. Can these techniques be used to normal” system development?