CSC3032 PROJECTS BOOKLET (2023-24)

Software Engineering Final Year Project (SE-FYP)

Teaching Team:

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Project Selection Form

Announced via Canvas on WK02

Projects allocated by

WK03

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P01 Campaign Management Tool (CMT)

This project is about the design and development of a Campaign Management Tool (CMT), a standalone full-stack web application to manage (e.g., create, update, and close) the marketing campaigns that our business partners run to promote our services.

SimplyIOA offers insurance brokerage services in the US, this is means that we frequently work with multiple business partners to attract customers and sell insurance policies across the US through marketing campaigns. Partners include Sports franchises, mortgage brokers, and car dealerships. For this, we need a standalone application that non-technical staff from our business partners can use to view, update, create and delete campaigns and related attributes in a data store maintained by the application. This app should also expose an API to publish events which other systems can then subscribe to.

Currently, the management of the campaigns relies on our software developers' support and input, this has an impact on both our developers' time and the smooth running of the campaigns.

The proposed CMT will benefit both business users and software developers: business users will be able to make changes quicker and reduce the reliance on developers; developers will have more time to focus on higher value tasks.

Students working on this project will get the opportunity to take on a greenfield piece of work that covers the full stack including API, Web front end and data access, to present to and learn from a development team and to deliver a solution that significantly improves an organisation current internal process.

Technical Skills (Required or Desirable)

Our Suggested stack would be .NET and MS Blazor to align with existing architecture. Broadly web app and API development, basic UI/UX

About the Organisation

SimplyIOA is a US headquartered online insurance broker serving the US personal lines (home and car insurance) market in multiple states. Part of the larger IOA group (Insurance Office of America) our technology function is solely based in NI and around 50 of us work for SimplyIOA and IOA here in Belfast. We are a digital broker driving insurance online sales as well as using our agents and telephony which is more typically how insurance is sold in the US market. Visit us at www.simplyioa.com

Number of Teams

Just 1 Team

P02 Access Employment Limited

Access Employment Limited (AEL) is a social enterprise. They provide people aged 16-60 who have a learning disability/difficulty with training and employment opportunities, enhancing their lifestyle and thus allowing them to engage more effectively in the community.

AEL is seeking a complete appraisal of their online retail operations, recommendations for improvements and the implementation of a software prototype that can demonstrate the impact (e.g., social, environmental, and economic) for the organisation, their clients and wider society.

This is an open-ended project, for this reason the Software Engineering team will need to place particular attention to the problem analysis as well as the requirements discovery process in close collaboration with the champion.

Tichnical Skills (Required or Desirable)

The choice of the technology is up to the students to agree with the champion. Teams should be mindful that the organisation is a charity and not a commercial enterprise when they design the technological solutions.

About the Organisation

AEL was established as Northern Irelands first social firm to support those with disabilities, health conditions and social disadvantage into meaningful employment. AEL mission is to work in partnership with others to provide a centre of excellence offering opportunities for disadvantaged individuals. Its ultimate vision is to provide a centre of excellence which provides opportunities for disadvantaged individuals to gain work experience and training, enhancing their lifestyle, and thus allowing them to achieve their full potential.

Website: https://accessemployment.co.uk/

(Project contact via QUB Science Shop)

Number of Teams

Up to 2 Teams

P03 Museum of the Troubles and Peace

The People's Museum of the Troubles and the Peace Process is proposed as an exhibition and space to chart the history of the troubles and peace process, explore identity and work towards an understanding of the past.

The challenge is to design an exhibition with a modern, engaging, and interactive experience for all visitors; that will bring the ideas and history to life with an awareness of the deeply traumatising experiences of many involved over the last few decades. Reflection and learning should be at the core of the experience in which visitors can explore conflict and lessons learned from the past.

A Software Engineering team will engage with the project champion and explore ways in which the Museum can be designed with effective use of appropriate technology to enhance and engage visitors. The team will review other museum experiences and propose a solution based on evidence of effectiveness. This project will suit a team who would like to include a high level of creativity in exploring and designing a suitable software solution which will enhance the overall visitor experience.

Technical Skills (Required or Desirable)

The decisions around the technology used is very much up to the students in discussion with the champion. For example, a Media rich, VR, or AR solution may be an appropriate avenue to explore.

About the Organisation

The Museum of the Troubles volunteers are a group of people from a range of backgrounds and perspectives whose collective aim is to bring into being a People's Museum of the Troubles and the Peace Process in Northern Ireland. The museum will create a space for stories to be shared, identity explored and a deep understanding of the past for all visitors to the museum. The overarching Museum project aims to create an exhibition space in an iconic building that highlights three decades of conflict and survival in the North of Ireland, and the evolution of the Irish Peace Process, including an area for remembrance and reconciliation.

(Project contact via QUB Science Shop)

Number of Teams

Up to 2 Teams

P04 Share Village

Share Discovery Village, located just outside Lisnaskea in Co. Fermanagh, Northern Ireland, offers an endless array of possibilities and adventures. Their 60-acre site sits on the shores of tranquil Upper Lough Erne – part of the largest inland waterway in Europe. Share's fully accessible residential activity centre offers everyone the opportunity to have unforgettable experiences and create memories that will last forever. They offer a wide variety of amazing indoor and outdoor activities for children, families, groups, clubs and more. The site and activities are accessible to people with disabilities. experience.

The management team of the Share village is keen to track the visitor experience through the Share village and establish levels of use of different facilities within the site. This will help with the allocation of resources and to identify opportunities or requirements to improve or promote aspects of the village.

Technical Skills (Required or Desirable)

The choice of the technology is up to the students to agree with the champion. Teams should be mindful that the organisation is a charity and not a commercial enterprise when they design the technological solutions.

About the Organisation

The Share Village is a charity which offers a range of activities and accommodation for disabled and non-disabled alike. Opportunities are provided in a wide range of educational, recreational, and creative arts programmes.

(Project contact via QUB Science Shop)

Up to 2 Teams

P05 NI Sports Forum

NI Sports Forum is a voluntary association that exists to exist to promote amateur sport and physical recreation, which results in improved physical and mental health. Their membership encompasses organisations from the major spectator sports such as rugby, football, and golf, through to judo and swimming, right across the sector to yoga and outdoor recreation.

Over the past few years small and informal sport groups have formed and communicate using social media and other informal communication platforms. This gives a great flexibility to the groups, but also come with limitations in terms of resources and facilities (e.g., changing rooms, equipment). The intuition is that these small groups face challenges when they grow as they need more structure and resources to operate. NI Sports Forum is interested in exploring and gain a better understanding of how these small groups work and the opportunities for digital technology to support them as they grow.

This is an open-ended project, for this reason the Software Engineering team will need to place particular attention to the problem analysis as well as the requirements discovery process in close collaboration with the champion.

Technical Skills (Required or Desirable)

The choice of the technology is up to the students to agree with the champion. Teams should be mindful that the organisation is a charity and not a commercial enterprise when they design the technological solutions.

About the Organisation

NI Sports Forum is a voluntary association its purpose is to guide, support and empower their members in their role to govern and promote sport and physical activity in Northern Ireland. Their mission is to promote amateur sport and physical recreation, which results in improved physical and mental health. NI Sports Forum membership consists of more than seventy full members, who are governing bodies of sport (e.g., Archery NI, Athletics NI, and Irish Surfing association), this in addition to over twenty Associate Members and fourteen Individual members with an interest in sport and physical recreation.

Website: https://www.nisf.net/

(Project contact via QUB Science Shop)

Number of Teams

Up to 2 Teams

P06 Healthcare Staff and Burnout: A Solution-Focused Game

Staff burnout which results in stress and anxiety is a common feature in many professions; this is particularly concerning in health-care organisations with reports citing that 92% of the NHS Trusts have concerns about their staff wellbeing, stress, and burnout.

Solution focused interventions, such as those used in Solution-Focused Brief Therapy (SFBT), can help increase resilience to avoid burnout in the workplace. SFBT is a client-centred, goal-directed therapeutic approach that emphasizes finding solutions rather than dwelling on problems.

The key tenets of SFBT involve focusing on what is already working well, setting clear and achievable goals, and using small, incremental steps to reach those goals. Goal setting is also fundamental element in game design.

This project hence proposes to design and develop a prototype for an innovative online platform that combines techniques from SFBT with game-design principles to help health-care professionals manage stress and reduce burnout.

Though SFBT is often used in individual settings, it can also be adapted to teamwork context. Teamwork can be a source of stress, but, at the same time peer-support and collaboration is also a key factor in helping

prevent burnout. A key objective is hence to develop a prototype that can be used by health-care professionals where teamwork is both important in preventing burnout but can also be a source of stress.

Technical Skills – Required or Desirable

This is an open project with no prescribed technical solution; it is however envisaged that it will be delivered in a form of a web and/or mobile application; a familiarity with (or at least a strong interest in the research of) game-design principles is recommended,

About the Organisation

The Lancaster Clinical Psychology Training programme is a collaboration between Lancashire & South Cumbria NHS Trust and the Health Research Division at Lancaster University, in partnership with other Health Service Trusts around the Northwest. It focuses on training Clinical Psychologists to work in the NHS, but also undertakes a programme of research, one focus of which is an examination of the application and training in solution focused therapy techniques and whilst another is exploring and improving the working experiences of health service staff.

Number of Teams

Just one Team

P07 Web Tools for Maths Learning Resources Management

Students in mathematics undertake projects to design learning resources to be used in local schools. As the number of these projects starts to grow, it is necessary to archive and provide access to the materials developed for three distinct groups of users:

1) Students need to be able to browse existing projects and manage the upload and maintenance of many different 'types' of project assets (e.g., PowerPoint presentations, videos, spreadsheets, code repositories)
2) Staff supervising projects need to manage the submission and review of the projects- requiring the system to interface with existing tools (i.e., Canvas via web-API)
3) Teachers who are interested in discovering and using the resources in their classrooms need to be able to find resources referenced across several searchable parameters, e.g., the type of resource (game, worksheet, lesson plan, website etc.), the topic (prime numbers, binomial expansion, etc.), the target audience (KS3, GCSE, A-level etc.)

We would like a web-based solution which meets the needs of all three groups, but with the additional constraint that the finished product should be simple enough that a non-specialist (i.e., mathematics professor with reasonable technical proficiency) can maintain it. This sustainability element is critical to the final success of the project.

Technical Skills (Required or Desirable)

The solution should ideally be built using open-source technologies. The specific programming languages and frameworks adopted would be left to the students to select the best technology for the problem.

About the Organisation

The innovative teaching group is a collection of academics in the School of Mathematics and Physics concerned with using proven educational pedagogies and technologies to enhance the delivery of university mathematics education.

Number of Teams

Just one team

P08 API Catalogue System

The API Catalogue System is a proposed project aimed at facilitating efficient API discovery and utilization within an organization. It involves the development of a system that indexes various APIs, making it easier for development teams to find the APIs they require for their tasks. The system operates by having engineers register their APIs using the openAPI (swagger) specification, which includes a link to the API documentation.

To enhance the process of indexing APIs, the system will leverage Natural Language Processing (NLP) techniques. NLP can be used to extract relevant tags from API descriptions, providing more comprehensive

and accurate indexing. Additionally, there is potential to incorporate machine learning algorithms to automate the tag extraction process, further improving the efficiency of the system.

By leveraging the API Catalogue System, developers can save considerable time that would otherwise be spent searching for endpoints across numerous APIs in a microservice architecture. Additionally, the system aims to reduce duplication of effort, as developers often end up creating similar API endpoints multiple times simply due to a lack of awareness of existing alternatives.

The primary beneficiaries of the API Catalogue System are developers and development teams who can easily locate and utilize the APIs they need for their tasks. Furthermore, the system provides management with a comprehensive overview of available APIs, enabling more effective planning for future work.

Overall, the API Catalogue System aims to streamline API discovery and foster better collaboration within the organization, resulting in increased productivity and improved resource allocation. The incorporation of NLP and potential machine learning elements further enhances the system's capabilities, ensuring accurate and efficient API indexing.

About the Organisation

Pytilia is a fast-growing, Belfast based technology company offering software design & development services to clients around the world; from launch around 3 years ago we have grown to about 40 people today. We've a global customer base including a range from big names to smaller NI-based companies including University spinouts. We provide a full stack service i.e., from UI/UX to low level device driver/operating system development and specialise in enterprise or "mission critical" deployments.

We are engineers at heart and enjoy the challenge & satisfaction of problem-solving for our clients (and our own satisfaction!). We work collaboratively, sharing what we learn via regular company-wide Tech Talks. We work closely with both Queen's & Ulster Universities and our Intern/Placement & Graduate Programmes have been running since Pytilia's launch. We are members of Women in Business NI & Tech Talent Charter and our charity partner for this year is Marie Curie.

Number of Teams

Just one team

P09 Online Business Cyber Threat Game

The purpose of this game is to provide, through an interactive web environment, a narrative around a business that has been hit by a cyber-attack most likely ransomware. Through a series of elements participants would investigate the attack and hit key learning objectives around prevention and security (for example discovering a password was compromised because poor/no password policies were enforced). The precise form is open to definition through discussion and may for example include some relevant training in things such as the Computer Misuse Act.

About the Organisation

The project will be supported by an internal supervisor Dr David Cutting and an external subject expert supervisor Dr Steve Jones who has extensive experience in supporting businesses through cyber-attacks working with the police. The final audience will be companies who wish to raise awareness of the digital threats and important behaviours and policies with their staff and is intended to be released as free open-source software.

Technical Skills (Required or Desirable)

The technical details and concrete specifications will be developed in a series of scoping meetings with the supervisory team and students are welcome to use their creative skills to direct exactly how this project takes form.

Number of Teams

Just one team

P10 Collaborative Standard Setting and Assessment Creation

The professional regulator of Pharmacy, the General Pharmaceutical Council, published newly introduced standards for the initial education and training of pharmacists in 2021. This included requirements for the

assessment of students on the MPharm degree to use an appropriate standard-setting method. This means that the score to pass the assessment is set by staff teams, who will be using methods that require data entry and calculation of the cut score (pass mark) for each assessment. There are a range of challenges, including those with respect to the logistical management of those standard setting process, the robust collation and repository creation for assessments which have been standard set, and the ongoing review of assessments such that continuous quality assurance processes can be undertaken.

The proposed project centres on the creation of a web-based platform which will enable module assessment teams to collaboratively standard set their assessments. The aim is to collate information from staff members' judgement of items used in assessment and use this to determine the cut score automatically for MCQ question types. The platform should also enable the entry of data for assessment elements based on student performance, for example, the recording of average marks, percentage answered correctly, discrimination index and other related psychometric data. This will enable the creation of more effective and robust assessments via the application of agreed evidence-based standards.

About the Organisation

The School of Pharmacy at Queen's University Belfast is a leading research and teaching centre in the areas of pharmacy and pharmaceutical science, ranked in the global top 40 Schools of Pharmacy in the latest QS World University Rankings. The School delivers taught undergraduate programmes in pharmacy, pharmaceutical sciences, and pharmaceutical biotechnology, with each producing leading graduates who enter into a range of roles within the healthcare industry, including clinical pharmacy, pharmaceutical research and development, and governmental and regulatory roles, amongst others.

Number of Teams

Just one Team

P11 Context-modifiable Interval Timer System

As part of its activities, including those related to student selection, teaching, and learning, the School of Pharmacy employs a range of assessments which involve a circuit-based structure, whereby candidates are required to undertake a number of tasks, arranged into "stations" which form part of a wider circuit which has the overall aim of assessing relevant skills, abilities, etc. in relevant areas. The facilitation of these approaches is onerous, with one key element of this being related to the management of candidates' movement around stations at set time points, and the related provision of informative updates to candidates and assessors throughout the circuit.

At present, a range of approaches are used to facilitate this element of circuit operation, each of which require a significant amount of operator input. Further, these approaches leverage support via the use of off-the-shelf solutions, such as rudimentary online timer services, interval timer applications, and so on, which in turn generate further issues, including the inability to automatically provide timely alerts to users with respect to time remaining, circuit status, etc. Further, the alerting systems incorporated within these platforms can often cause distress to candidates, etc., due to the nature of the audio alerts which are employed (ringing bells, siren effects, etc.), which may affect candidate performance within the related assessments.

The proposed project centres on the development of a web-based, flexible interval timer and alert system for the purposes of supporting circuit-based assessment processes, in addition to other relevant situations such as time-sensitive activities at conferences, etc. Such a system would require the ability to create complex timed interval profiles, and further, would provide a sophisticated solution for the provision of alerts to end users at relevant timepoints, including those which are audible (such as text-to-speech) or visual in nature, and which can be customised by those end users in order to ensure that alerts do not cause distress, and indeed, cater to those users' accessibility requirements. Further, the platform would also provide the ability for point in time information (i.e., relevant timing information) to be provided to end users, such that they can be kept fully abreast of the progress of the relevant stations/circuits.

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World University Rankings. The School delivers taught undergraduate programmes in pharmacy, pharmaceutical sciences, and pharmaceutical biotechnology, with each producing leading graduates who enter into a range of roles within the healthcare industry, including clinical pharmacy, pharmaceutical research and development, and governmental and regulatory roles, amongst others.

Number of Teams

Just one Team

P12 Insurance Year in Review

Life events can occur and/or household budget can change that impact the amount of insurance they need and can afford. As an Allstate customer, I want to feel protected and understand my policy coverage, so I have peace of mind. Customers expect an efficient review process where Allstate understands their changing needs and provides timely recommendations. When customers look to understand their coverages, they typically have four main questions around discounts, optimized coverages, how coverages work, and life changes and impact to insurance.

The future of protection reviews will be a digital, non-linear, and unscripted experience that presents complex information in a format that is easy for the customer to understand and act on.

We propose "A Year in Review" which is an automated friendly narrative about your protection needs like Spotify's Year in Review personalization playlist.

By creating a more personal story and connection with existing customers and being proactive, personalized, and engaging, the customer feels great about their coverage based on any past events and understands the value they are getting from their insurance.

Protection reviews are important to Allstate's customers when compared to its competitors. According to JD Power, Allstate's biggest area of opportunity is ensuring customers completely understand their policy coverage. A protection review, in addition to being an important KPI on its own, is the best way to explain coverage. Allstate is best in class on informing customers about other products and services, however less than half of customers receive this information.

Technical Skills Required or Desirable

Allstate will work with participants to provide synthetic data or publicly available datasets that simulate the types of information required to analyze what Allstate knows about a customer over the course of a year.

The existing data should not be a constraint – if the concept would benefit from collecting additional data, let's discuss the types of data, potential sources, and value it would add to the solution!

About the Organisation

Allstate Northern Ireland is the largest IT employer in Northern Ireland, employing over 2400 professionals. Established in 1998, we are an integral part of the Allstate corporation, providing a range of innovative, critical business support services including technology, data, cybersecurity and finance. We create and maintain IT solutions for the business needs of the Allstate family of companies, providing solutions for products such as Auto/Home/Business insurance, Identity protection, Roadside services/assistance, Device protection, Extended Vehicle Warranties, and Telematics insights.

Number of Teams

Just one Team

P13 Manage My Cloud

The proposed project would be to design and build an app/plug-in that would manage your cloud data footprint with the aim of reducing cloud storage by removing unwanted documents, photos, emails etc. If people were able to easily manage down their storage use, they would save money through not having to buy additional storage and, more importantly, reduce the storage used/needed in cloud data centers, which would help with climate change. To get some background the BBC Panorama programme from earlier this year highlighted the impact of data centres - Panorama, Is the Cloud Damaging the Planet? www.bbc.co.uk/iplayer/episode/m001hzb3

The tool would need to connect to users' cloud accounts via APIs and parse the saved images and documents making recommendations for what can be removed based on attributes like image/document origin, creation date, last access, frequency of use etc. There would also need to be some basic AI developed to compare files to remove close duplicates.

A stretch assignment could be to develop a recommendation engine to periodically automatic remove files based on previous actions taken on prior removal recommendations.

The aim of the project would be to build students' knowledge across a range of disciplines – Cloud, UX, AI, Cybersecurity, etc. and suits a team approach as each student could work on a particular component of the tool.

Technical Skills Required or Desirable

There is no requirement to use specific languages or technologies as it will be left to the team to decide what is most suitable for them to use. Obviously, any experience of Cloud technologies, UX design or AI would be beneficial

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Number of Teams

Just one Team

P14 Mental Health Monitor

It is time for a mental break. Employees in the future of workplaces are on Zoom calls back-to-back for 8 hrs. This causes Zoom fatigue, headaches, inability to concentrate, and poor overall health. Our solution is to help employees by recognizing tense moments and providing a mental health break to improve their wellbeing and productivity.

Investing in mental wellness shows Allstate is in touch with societal change while positively impacting productivity and retention. We will use sentiment analysis to flag emotional calls or track if an employee has been in 3 back-to-back meetings without a break. After the call is over, employees will be encouraged to take a mental health break by prompting them to take a break.

The "20-20-20 rule" can help mitigate the effects of screen apnoea, Zoom burnout, and computer vision syndrome (CVS). The rule says that for every 20 minutes spent looking at a screen, you take a 20-second break, move around, and look at something 20 feet away, which relaxes the eye muscles for 20 seconds and gives your brain a much-needed respite.

Technical Skills Required or Desirable

Allstate is preparing to embark on a pilot of Jabra's Engage headsets, which include Engage AI software that can be extended via API to integrate with our own systems. Work with the vendor to understand the capabilities of this software and help Allstate analyse the value-add of these specialized headsets vs. the data available from standard professional headsets.

A custom user interface will be needed that leverages the Windows Notification Service push notification framework along with a portal to provide more details and configuration options. The solution may leverage the Microsoft Graph API to analyse users' calendar information and provide insights about opportunities to take a break.

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products such as Auto/Home/Business insurance, Identity protection, Roadside services/assistance, Device protection, Extended Vehicle Warranties, and Telematics insights.

Number of Teams

Just one Team

P15 On-demand architecture views using C4

IT-based solutions are complex and understanding them is a challenge. Architectural diagrams are a good starting point to understand the scope of components involved and how they interact.   Many solutions are constructed with detailed design documentation, but over time as they evolve the documentation becomes stale and unreliable.

C4 Model (https://c4model.com) is a method for depicting software architectures. Code (and configuration files) are the source of 'truth' for what comprises an IT solution. We want to auto-generate diagrams from code rather than maintain diagrams.   The challenge is to find a way to discover the components of architecture (interfaces, containers, deployments etc.) and be able to generate context diagrams and sequence diagrams from the code and configuration.

We believe there is an opportunity to leverage a Domain Specific Language to describe a solution architecture and use that to auto-generate diagrams. There has been some work done in this area already with Structurizr (https://structurizr.com/products) but there is a missing capability to auto-generate of DSL from code.

This project would enhance and extend any existing solution to enable an engineer to point-and-click and generate architectural diagrams (system context, component hierarchy etc.) on-demand, from the source code and configuration files

Technical Skills Required or Desirable

Understanding of software architecture diagrams and their use.

Domain Specific Language constructs.

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Number of Teams

2 or 3 Teams

P16 Parking Angel

The Parking Angel app will be designed to provide users with valuable location-based data. It will seamlessly integrate with public systems to retrieve essential information such as crime statistics, traffic updates, and maps. This innovative app aims to enhance user convenience and safety by offering a range of functionalities and use cases, examples below.

Key Functionalities and Use Cases (Note not all these functionalities will be required)

- Safe and Convenient Parking Location Finder: Users can quickly locate the closest and safest parking spots when heading out for the evening, meeting friends, or any other activity.
- Data-Driven Decision-Making: For users contemplating a move or new to an area, the app will offer critical data points, including crime rates (categorized by theft, car crime, assault, etc.) and information about available parking within walking distance.
- Personalised Activity Suggestions: When planning events like a girls' night out, the app will suggest activities based on user criteria, considering factors such as activity type, acceptable distance from home, and safety concerns.
- Behavioural Data Collection: The app will collect user data to provide insights into risk management behaviours.

- Crime Alerts: Users will receive alerts regarding changes in crime rates in their frequented areas, as well as notifications about new reported crimes near their location or parked vehicles.
- Calendar Integration: The app will sync with users' calendars to provide relevant data, such as the nearest parking options, suggested travel and park times, and current traffic conditions.
- Personal Locator: Users can send scheduled updates to named individuals, enhancing safety and communication.

In its initial phase, Parking Angel will be available as a free app to build a user base. As its popularity grows, it can be marketed as a premium product. Allstate, as an insurance company, can leverage data collected from the app to assess user behaviours that may impact insurance premiums, offering it as an add-on product with policies.

Objectives

- Risk Awareness: Empower users with information to make informed decisions and adopt safer behaviours.
- Personalisation: Provide users with tailored suggestions based on their preferences and schedules.
- Risk Reduction: Encourage users to make decisions that can potentially reduce their insurance premiums, utilising a point system for achieving specific goals.
- Peace of Mind: Offer guardians peace of mind by providing data and real-time information to keep their loved ones safe.

Target Market

Parking Angel is designed for everyone, regardless of age, gender, or location. It caters to locals, tourists, event planners, and university/college students. Additionally, businesses can utilise the collected data for analysing user behaviours and decision-making patterns, while local authorities can leverage the app's data for crime investigations and traffic management. By focusing on these key areas and user-centric features, Parking Angel aims to revolutionise the way individuals and businesses access and utilise location-based data, promoting safety and informed decision-making.

Technical Skills Required or Desirable

Parking Angel will require

- integrations with other public systems and tools, ensuring up-to-date data is available
- usable on different types of devices e.g., Apple, Android, PC, Car
- should be fast
- interface must be simple, efficient, and appealing
- should not be confusing to use

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Number of Teams

Just one Team

P17 Software tools to evaluate and improve the quality of Fortran 90 scientific software

A group of researchers in the School of Mathematics and Physics have developed and maintain a scientific-software codebase for experimental physics.

The codebase (https://gitlab.com/Uk-amor/RMT/rmt) is written in Fortran 90. It continues to be used by researchers at QUB and elsewhere. Being legacy software, written in a language that lacks many software-quality features of modern languages, there is the need to improve the quality of the Fortran codebase.

A particularly challenging problem is the presence of a sprawling global state. These needs tackling. It will take time. Also, for performance reasons, the code is not object-oriented (nor will it ever be) but instead is an imperative/procedural language (though it can run concurrently). Thus, there is the challenge of handling and then reducing sprawling global state for non-OO code. (There is a way to handle and reduce global state, which we can discuss.)

To support efforts to improve code quality, and tackle global state, there is the need for a suite of software tools. The tools can - no, should - be developed in a modern language, e.g., Python, and be managed under git version control. Prospective tools required include:

- a tool to collect software metrics, e.g., counts of variables, and of types of variables. This is more insightful than it might at first appear, for it gives measures of global state.
- a tool to collect information about dependencies across program units - code-dependencies, obviously, but more importantly *data-dependencies* - and also visualise these. Again, these give insights on global state.
- as a variant of the dependency tool, a program slicer.
- a tool to automatically refactor some code, using a currently manual procedure.
- a tool to generate test data and possibly unit tests.

As well as developing the tools, there is the need to evaluate the use of the tools with RMT and, potentially, with other codebases too.

Overall, the tools will help the research team bring software engineering best practice to legacy scientific software. The resultant tools will need to be made publicly available, under an appropriate open-source license, for others to use and continue to develop.

Technical Skills Required or Desirable

Attitude and skill for following software engineering best practices, and using tools to support best practices; familiarity with git; a preference for Python; willingness to engage with non-OO source code; an interest in scientific software

About the Organisation

About the research team: Dr Andrew Brown leads the research team, having developed the RMT codebase and being its principal maintainer and developer. Sean Marshallsay was a software engineer and is now a PhD student developing techniques for handling global state in the RMT codebase. Austen Rainer has joined recently to bring an academic software engineering perspective. There are others in the team too. We - Andrew and Austen - intend for Andrew, Sean and Austen to all engage with the student team, albeit at different frequencies.

Brief information on RMT:

The RMT (R-matrix with time-dependence) codebase (https://gitlab.com/Uk-amor/RMT/rmt) is part of the UK-AMOR suite of codes for tackling problems in Atomic Molecular and Optical physics problems with the Rmatrix approach. The codebase has been developed, and is maintained, by Dr Andrew Brown and his research group in the School of Mathematics and Physics, here at QUB.

Number of Teams

Just one Team

P18 VR endoscopy simulator levels game

Medical and Nurse Endoscopist training opportunities are difficult to attain in Northern Ireland with limited training places available annually in Altnagelvin and Whiteabbey. Work is ongoing at QUB to deliver a Joint Advisory Group (JAG) accredited endoscopy training course via simulation.

The basic skill of successful endoscopy is steering the scope via use of 'tipping' and 'torquing'. The initial training on scope handling involves learning to steer and requires hand/eye coordination and manual dexterity involving two-handed steering, guided visually on a screen magnifying the image from inside the patient's body. It is a difficult skill to achieve.

Using virtual reality software, we would like to create a virtual colon to enable gamification of the steering required for successful endoscopy. This involves tipping and torquing through a narrow tube (lumen) and

around unpredictable tight corners. Previous surgery and existing bowel conditions can alter the shape and stiffness of the colon which make it challenging.

VR could help to improve a trainee endoscopist's manual dexterity before they begin practice on live patients. Currently trainee endoscopists commence their training on live patients under supervision, and this can often be traumatic for the trainee and the patient due to poor hand/eye coordination and manual dexterity. VR training could increase the opportunities for safe training, reduce negative experiences for patient and trainee, and help refine these skills prior to practice on live patients. The VR model would require a virtual colon and a handset like a colonoscope. The finished product would form the initial phase of a trainee endoscopist's training.

The successful team will have the opportunity to engage with professionals during the project for regular feedback. They will also present their virtual colonoscopy simulator to patients and clinicians at a public engagement event to gain feedback on the usefulness of the virtual reality tool to explain its role in the training of medical and nurse endoscopists.

Technical Skills Required or Desirable

Experience with VR technologies.

Number of Teams

Just 1 team

About the Organisation

QUB School of Nursing and Midwifery. Module coordinator for Endoscopy Nursing course., Yes, Happy to provide any assistance with endoscopy overview and process.

P19 Pokemon Go meets Friel Re-imagined: a mobile-based virtual world.

The proposed project is a variant of Pokemon Go. Users of the mobile application act as inhabitants of a virtual world, can roam that world, and can create (and edit and delete) and search for digital geocaches that contain details about local history and culture, e.g., local to their town. At this stage, we expect the users would be secondary school children from across the island of Ireland. The application would need to have GPS capabilities so that real-world users can physically roam a space which is mapped into the virtual town. As with Pokemon Go, the interface might be a 3D map. A more advanced version might explore the use of VR/AR (but such features may not be appropriate at this of development).

Furthermore, the client is working closely with the National Library of Scotland (NLS) to link the NLS's map information with the Ordnance Survey materials already collected. Maps are of the 1830s and cover the whole of Ireland, so there is a really rich source material. The NLS service allows historic maps to be overlayed onto modern aerial imagery etc, so juxtaposing past and present, useful for researching localities and how these have changed over two centuries. Overall, there may be the opportunity to incorporate mapping resources/assets into the application.

In this way we can help what a generation whose experience of the world is increasingly digital to celebrate their local heritage in a way that is most appropriate to the way they experience the world.

Technical Skills (Required or Desirable)

There are no particular software development technologies mandated or required, though it would make sense to consider how the application might be made available across mobile platforms, e.g., iOS and Android. Students interested in this project must have strong skills in internet-based / client-server programming and have the willingness to engage actively and flexibly with the clients (who do not have a background in software). Ability, or willingness to learn, how to incorporate the NLS map information, and other similar assets, into the application.

About the Organisation

The proposed project is inspired by, and would connect to, the Friel Reimagined project (http://go.qub.ac.uk/friel-reimagined) at Queen's. Friel Reimagined (FR) aims to reinvent the legacy of the most one of the most acclaimed playwrights of his era for a new generation who experience the world predominantly through digital media. FR involved the digitisation of the early drafts of five of Friel's most acclaimed plays to see how he created his masterpieces from scratch to final product. FR also involved a

comprehensive programme of outreach activities and multi-media events to engage diverse and often disadvantaged communities with the aim of engaging Friel's work as a creative catalyst to enhance participant's creativity and wellbeing. Further relevant digital content and information about the Ordnance Survey of Ireland that inspired Friel's play, Translations, is available through the current 'OS200' digital humanities research project (https://www.irelandmapped.ie/) led by QUB and University of Limerick.