

# **Gamifying the Industrial Engineering Profession**

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## **Abstract**

An age-old problem facing higher education institutes is the verification that the knowledge taught in class was actually learnt and internalized. Many consider that the quality of education is to be measured on this basis. Historically, institutions have developed knowledge assessment mechanisms and resources which are aligned with the type of knowledge being transferred. Yet, in many cases, the time-bound nature of these assessments, the broader applicability of available resources, as well as the lack of appropriate opportunities (to learn from failure) can result in certain knowledge retention abilities instead of genuine understanding and life-long learning. The importance of dealing with this problem is further highlighted when considering generation Y and Z students who, unlike most of their lecturers, have spent most their life exposed to the internet, mobile applications and other technologies. Although several literature resources and commercial software packages deal with elements of this problem through gamification and education dashboards, a holistic system is yet to be proposed. This article consolidates the various needs of high school students, undergraduate students, lecturers and industry sponsors using system analysis and engineering tools. These inputs were used to prototype a gamified web based platform providing work & networking opportunities and linked mobile application that help provide continuous learning & assessment. A small-scale pilot was conducted ahead of the SAIIE 27 conference to solicit feedback.

## **Keywords**

Industrial Engineering, Gamification, Generation Z, Degree of Attainment

## **1. Introduction**

### **1.1 Holistic Overview**

The work world is becoming more and more demanding in terms of transferable skills (Greenan et al., 1997: p.193-204). Part of the problem associated with teaching these types of skills is they are often seen as very personal. Additionally, changes in technology can often make it seem as if the skills taught during an entire course or semester at university are rendered 'useless'. A brief look at various engineering curriculums/teaching methods can highlight why this is the prevailing perception. The methods of assessment are often overly focused on recollection-based skills. Additionally, the curriculum can often limit the transferability of skills not because the skill itself is limited but because the student's perception of the usefulness of the skill is not integrated into teaching activities (Stukalina, 2010: p.75-93). Changing this on a course by course level is often deemed ineffective because changes can be short-lived if not championed. Moreover, changes in lecturers, technological forces or public regulation return the system to square 1. Also, lecturers will often have to sacrifice part of their lecture time or course content in order to focus on such skill building activities (which cannot always be expected of them). Yet, in this knowledge era, many argue the role of the lecturer should be to direct students to the appropriate and relevant knowledge/resources that can assist their development (personally and academically), especially in higher education (Stukalina, 2010: p.81).

Adding to the problem discussed above is the irrelevant or inaccurate educational content and resources that spam web searches. Some websites have done filtered data well. However, very few sites create specialization-relevant resources (especially templates) for specific professions. More importantly, the few websites that do provide such resources can often alienate users through complex interfaces/processes or create a leeching effect where some users

give and others simply take. This problem is most likely shared by various professions but the focus of this article is the field of Industrial Engineering. Industrial Engineers must typically find the linkage between different knowledge areas (ranging from engineering to business to law) taught at University instead of viewing them as silo knowledge fields and very often require specialized content to do so (Darwish & van Dyk, 2016: p1-6). To date, however, there is no prominent and dedicated Industrial Engineering (IE) platform for resource and content sharing. There is no doubt that some content is available on LinkedIn and other sources. However, it remains somewhat disconnected and inaccessible to some. Moreover, IE knowledge, data and the application of IE tools remains infrequently visualized in an appealing and user-friendly manner. Simple bar charts and graphs do not give students as much information as one might think. Advanced visual interactive dashboards, charts and documents hold better promise amongst the younger generation (Bertagni, 2015: p.201).

The lack of such a platform can be said to have hindered the could-be value of Industrial Engineering students who could have attained and retained more applicable knowledge (Darwish & van Dyk, 2016: p1-6). The idea is that students need to understand how to conceptualize their Industrial Engineering as well as general strengths, skills and abilities (Darwish & van Dyk, 2016: p.14). This can help them create skill development plans and evaluate themselves against a benchmark of real individuals in industry. The potential lies in providing IE with resources and connections that can assist them in keeping up to date, continuously improving their knowledge and learning from the best in each industry.

## 1.2 Stakeholders

Due to the complicated nature of this problem, it can only be resolved by understanding and satisfying the relevant stakeholders. After all, without their engagement and buy-in, any potential solution is destined to failure from the start. The stakeholders for the problem identified above are:

Table 1. Needs of Different Stakeholders

<b>Stakeholder</b>	<b>Need</b>	<b>Comments</b>
<i>High School Student</i>	A platform to learn more about Industrial Engineering	The main objective with this group is to raise awareness and attract talented individuals into the field by providing them access to relevant and realistic views of their expected work environments.
<i>Undergraduate University Student</i>	A comprehensive platform to enhance learning	Existing learning/resource platforms used by institutions vary in quality and functions. Thus, a national or international platform that looks beyond university and company borders is required. This platform will not replace the students traditional learning environment, but rather merely supplement it.
<i>Recent Graduate</i>	A link and opportunity to contribute to academia	Many recent graduates are in search for relevant topics for their postgraduate studies. A unified platform can give them access to a community to share and improve ideas with. Additionally, various recent graduates often package parts of the workplace problems they face in industry in the form of projects to allocated to final year students and can use such a platform for recruitment.
<i>University Staff Member</i>	A less resource consuming method to provide students with experiential learning	Many lecturers require the help of the broader community (including fellow lecturers, their own students and professionals) in transforming their courses to be more industry relevant and transferable-skills focused. This can be done through gamification and experiential learning activities.
<i>Industry Sponsor</i>	A more transparent method to select and sponsor talent	Industry sponsors are constantly searching for a better way to select the right candidates for graduate programmes, improvement projects or scholarship/sponsorship opportunities. Since most universities make it mandatory to get practical experience, these needs can be made to be mutually beneficial relationships.

## 1.3 The Problem

In short, the problem is that while various resources and content are available; they are not coordinated and leveraged appropriately in a consolidated platform. An evaluation of stakeholders' needs highlights that an intuitive system that better reflects the relationships in the real world and provides more relevant content is an absolute necessity.

## **2. Surrounding Literature**

### **2.1 Engineering Education**

The first major area to consider is the nature of education and knowledge. Knowledge can be expanded to the set of skills, experiences, information and capabilities individuals apply to solve problems (Hanisch et al., 2009: p.148-160). Knowledge is something universally true but needs to be acknowledged by a person's belief system or his aspiration to seek the truth. Bratianu (2010: p.194) quotes Nonaka's works by describing "knowledge as being 'justified true belief' and as 'a dynamic human process of justifying personal beliefs as part of an aspiration for the truth' (Nonaka, 1994, p.15). Thus, knowledge becomes a relative concept as personal belief, a view which limits very much its status of objectivity and its role in science". Although education and learning are often seen as coming hand in hand, providing education does not necessarily mean anything has been learnt and learning does not only come through education. Education is "The process of receiving or giving systematic instruction and information about a body knowledge, especially at a school or university" (Oxford, 2014). It is commonly accepted that this role (at least until secondary level) is the responsibility of government. Learning, however, is "the acquisition of knowledge or skills through study, experience, or being taught" (Oxford, 2014). This is commonly viewed as the responsibility of the individual. Various research seems to suggest that the core issue at play is the lack in continuity and difficulty in teaching reflection skills to engineering students (to increase their ability in conceptualize abstract concepts and apply them to problems) (Burke et al., 2005: p.132-144). Yet, this is not at all because of a lecturer's poor understanding of the concept taught in class. In fact most students, upon consulting 1 on 1 with the lecturer, will praise the way they guided them through understanding the concepts and highlight the depth of the lecturer's subject specific knowledge. Rather, it is the product of an ineffective knowledge transfer methodology that limits the perception of the value of that knowledge (Burke et al., 2005: p.132-144). This is much like transporting 200 tons of goods between warehouses with a motorcycle; it can be done (in theory) but would unimaginably ineffective.

Modern society needs more 'complete' engineers and this needs a shift in our engineering education system. This means that engineers should develop social skills and develop the capability to thinking about ethics and sustainability. This will serve as a better response to the increasing complexity of engineering problems. Also, this needs to take place at a middle and high school development age (De Graaff and Ravesteijn, 2001: p.419-427). This is not to diminish engineering problem solving skills but to rather proposes that engineers "will have to understand some of the non-technical concepts in order to become more complete engineers" (De Graaff and Ravesteijn, 2001: p.419-427). Gattie (2011: p.521) argues that "the traditional engineering education model, while analytically rigorous, is characterized by properties that, although necessary, are insufficient for preparing students to address complex issues of the twenty-first century". He believes that engineering education needs to be analyzed as a complex system. He argues that the traditional course structure on problem solving fails to immerse its recipients in the complex aspects of engineering problems and the holistic nature of human condition. Many pedagogies exist on how to approach this issue. Some argue that peer evaluation is the best way, while others insist on the role of projects or task-based learning. Most of these methods have yielded positive results; they were all able to resolve a problem bigger than the issue at hand by convincing students of the value of the learning taking place. This broke down perception barriers and allowed the students to receive quality learning by absorbing the entire activities.

However, when these activities become mundane and are done solely as part of meeting, marking or other criteria the quality would drop. This is because "holistic education [should] encourage a cooperative, egalitarian, mutually respectful relationship between adults and young people... The education environment should be a community of cooperative inquiry, discovery and learning" (Miller, 2000: p.382-393). After all, teaching a thought process requires more than lecture slides and an exam; it requires an experience. This is especially true for complex concepts which require a developed trained eye. Industrial Engineering has various examples that mix between the method and the abstract. Concepts like TOC, Lean, and Optimization...etc can take on very different meanings depending on the environment. Additionally, the way in which the concept is taught can sometimes place mental barriers on applicability. In addition to the above, communication amongst Industrial Engineers needs to be improved. Industrial Engineers apply the concepts differently and place different limitations based on their perception or point of view. Thus, a tool that would allow to them to debate, share, discuss and develop concepts can help show the broad applicability of such concepts. The problem lies in the fact that Industrial Engineers require more practice on some of the concepts taught in class and their broad applicability.

## **2.2 Generation Y & Z**

A second major area considers whom is receiving the knowledge. Misunderstanding the type of student can yield the same negative results as teaching the wrong material. The upcoming generation entering higher education is often classified as Generation Y or Z since “researchers and others who have written about Generation Z have found it difficult to classify this generation precisely. Some say that it began [with people born] as early as 1991... Others argue the generation began as late as 2001” (Brotheim, 2014: p.16). While “Generation Y, known for its widespread civic involvement and lack of independence compared to previous generations” it is commonly thought that “Generation Z employees come from a generation accustomed to entitlements” (Brotheim, 2014: p.16). It is not unlikely for them to “e-mail or text the agency head directly to opt out of an assignment or question a policy... The Z Generation is highly connected. Many have had lifelong use of such communications and media technologies as the Internet, instant messaging, text messaging, MP3 players, mobile phones, and YouTube” (Brotheim, 2014: p.16). These factors show the need for a different method of interaction.

The two key areas of relevance to this article, however, is the relationship this generation will have in relation to their workplace as well as the education institution. For this generation, it would seem a more appropriate educational conception is that “learning is a process not of knowledge transmission but of meaning making... learning is a dialogue, a process of internal and social negotiation, a socio-dialogical process” (Jaleniauskiene, 2015: p.40). Adding to this is the fact Generation Z students “are all ‘native speakers’ of the digital language of computers, video games and the Internet... [that some hypothesize caused] a change in the brain structure that means young people think and process information in fundamentally different ways compared to older generations” (Helsper & Enyon, 2009: p. 1). These disruptions are being felt by educational institutions and have started rippling into the workplace. It is important to mention that these waves affect different countries, sectors and institutions differently but this does not mean that the waves will not reach virtually these systems in time.

## **2.3 The Modern Workplace**

Recruiting talent and providing an appropriate environment to grow is at the heart of concern of the modern workplace. Generation Z individuals have a different perception of work which requires special attention since it simultaneously facilitates and complicates the conception of a workplace. For Generation Z “The effect of social environment is an important factor... [it is] the duty of employers is to target setting up more chatty and hearty relations out of the business culture... This generation is self-confident and wants to guarantee their future. They know that working has an important role to make true their dreams, and if it doesn’t become they would be unhappy. Happiness is very important on the business area” (Ozkan & Solmaz, 2015: p.479-480). Yet, this can have both positive and negative effects. On the positive, “internet usage by generations Y and Z will assist them to perform searching, researching, and completing their tasks rapidly in a professional way. Via the Internet, generations Y and Z can communicate, collaborate, become involved, and gain new knowledge to become more aware of global and local issues” (Issa & Isaias, 2016: p.595). Predictably, the negative is that this generation can also be seen as ‘attached’ or even ‘addicted’ to their mobile phones and see it as an extension of their social life and would predictably want it to form part of the workplace (Ozkan & Solmaz, 2015, p.95-96) (Issa & Isaias, 2016: p.595). This can be a problem when considering the fact that different generations work in the classroom or workplace and this can create sensitivities if the culture is not adapted to understand/mitigate these effects and creating collaboration out of them (Srinivasan, 2012: p.48-66). There is a “differences in work values among employees from different generations exists. Awareness of those differences among generations can help managers to create a more pleasant and productive workplace... Boomers live to work; Millennials work to live. Boomers are willing to wait their turn for promotions and rewards, and they are very loyal. On the other hand, younger generations want immediate recognition through title, praise, promotion, and pay” (Gursoy et al, 2013: p.47).

## **2.4 Gamification**

A source of hope in resolving the above complexity comes in an unlikely form: Games. Historically, games have proven to be one of the few methods that truly consolidates social interaction and skills development. “Learning practices in the form of games between teacher and students or trainer and trainees can be traced back to ancient Greece” (Markopoulos et al, 2015: p.118). Yet, modern understanding has differentiated between Game Based Learning (GBL) and gamification as a means of implementing games. Gamification is “using game-based mechanics,

aesthetics and game thinking to engage people, motivate action, promote learning and solve problems” (Spina, 2013: p.7). Whilst “GBL provides students with games that have an educational objective that are achieved through the game play... These games can supplement direct teaching or replace it, but it is clearly a game. The essence of gamification is that it occurs in a non-game context; therefore, it would be applied in such a way that would not change the existing practice of learning and instead focus on making it more engaging and challenging for students” (Codish & Ravid, 2014: p.132). The worry is that increasing the playfulness too high can result in a system where there is no perceived link to responsibility and thus would render activities being seen by generation Y and Z individuals as merely a consequence-free game (Codish & Ravid, 2014: p.132-144). It is also important to mention that creating a point system can create problems of its own where “rather than improving outcomes, gamification runs the risk of actually decreasing motivation if it solely on a rewards system to encourage participation” (Spina, 2013: p.7). Thus, when considering higher education and recruitment activities it is important to balance the playfulness of the system as well as the level of engagement.

The suggested platform must consider specific applications of gamification since the platform aims to be a mix between an electronic resource library, opportunity posting area and social network. Research conducted found that the gamification method has gained traction in public libraries, recruitment processes, business processes and engineering education. For example, libraries are using gamification “to highlight library features or services... [which] helps libraries understand how patrons use the library and allow patrons to more easily share their library experience with their friends” (Spina, 2013: p.8). Whilst recruitment uses gamification to “stir peoples interest in job openings, project an innovative image of an employer and deliver accurate previews of applicant’s future job performance” (Zielinski, 2015: p.59). Although it requires massive investment in resources and thought, it has the potential to create a true micro environment that can change behavior, create unique experiences that assist with engineering education and improve transferable skills (Perryer et al, 2016) (Rodrigues, et al, 2016) (Scoeck et al, 2013) (Sosa-Vieira, 2016). These can help a certain group of similar minded knowledge seekers (professionals and individuals) to create a small world that caters to their disciplines specific needs (de-Marcos et al, 2016: p.320).

### 3. Concept Development/Design Methodology

Given that designing the proposed platform can be seen as a mix of a software and societal project, a mix between the spiral iterative model and v model were used in consolidating the requirements into the design. Section 3.1 decomposes the problem identified in section 1 further using the insight from literature while section 3.2 as well as consultations with Industrial Engineering professionals. The scope identified at the North-West University and from the South African Institute for Industrial Engineers was merely to develop a concept system based on the identified needs. Thereafter it can be developed into a full solution.

#### 3.1 Needs Analysis

In order for the system to develop social meaningfulness and quality content there needs to be a balance between what the stakeholder receives (output) for their contributions (input) while maintaining transparency in the process. Table 2 below explores the requirements [R] stemming from needs [ON] arising from the different user types [UT] and their roles [UR]:

Table 2. Input and Output of Different Users

Stakeholder	Input	Output	System Process [Platform]
<i>User Type 1: High School Student</i>	Is expected to fill in surveys (to gauge perception) and participate in simple IE games [UR1]	Would receive personalized feedback on whether IE is appropriate for them from quizzes [N1.1], consultations [N1.2] and interaction [N1.3]	The system will thus be required to automate certain responses [R1.1] and suggest relevant content [R1.2]
<i>User Type 2: Undergraduate University Student</i>	Is expected to be an active participant in networking [UR2.1] and partake in relevant activities [UR2.2]	Higher quality networking interactions [N2.1], IE relevant templates [N2.2] and educational content [N2.3] to develop one’s self [N2.4]	The system will thus be required to provide relevant resource databases [R2.1-2.3], a networking portals [R2.4] and personal profile [R2.5]

<b>User Type 3:</b> <i>Recent Graduate</i>	Is expected to post relevant opportunities (research, work or experiential) [UR3.1-3.3]	Will receive relevant recognition for contribution [N3.1] and ability to gather relevant data [N3.2] or resources [N3.3] to solve research or workplace problems [N3.4] and develop themselves [N3.5]	The system must provide a transparent posting of opportunity [R3.1] and recruitment process to facilitate selection of appropriate candidates [R3.2]
<b>User Type 4:</b> <i>University Staff Member</i>	Is expected to use the platform as an enhancement to class based learning [UR4.1] and contribute to available content [UR4.2]	Will receive automated assessment feedback [N4.1] as well as access to other educators' content [N4.2] which reduces workload on lecturer and shares creative perspectives [N4.3]	The system must provide templates that suit various types of educational content [R4.1] that can be easily integrated with existing content on different universities knowledge platforms [R4.2]
<b>User Type 3:</b> <i>Industry Sponsor</i>	Is expected to post relevant sponsorship, reward and career opportunities [UR5.1-5.3] as well as professional templates used in industry [UR5.4]	Will receive shortlists of relevant candidates from the system based on given criteria [N5.1] or achievements [N5.2] and promote their industry relevant template contents [N5.3]	The system must provide a way to distinguish and filter candidates through IE relevant metrics [R5.1] as well as a resource sharing functionality [R5.2]

Upon review of the formal requirements listed in table 2, it was found that an additional hidden requirement of kick-starting this platform would be necessary [R6.1]. The idea is that having a platform without a critical mass of users will create less meaningful interaction and reduce the perceived value.

### **3.2 Prototype System Design**

#### **3.2.1 Design Inspiration**

Perhaps one of the best gamification methods uncovered during the research was by using the Baader-Meinhof Phenomenon. The Baader-Meinhof Phenomenon is the familiar phenomenon of “when you hear something for first time it seems to appear everywhere”. It can be used in strengthening the student’s ability to identify and understand the concept. Although it is quite a simple concept, its essence can be used for the benefit of experiential learning. It triggers the development of transferable skills in teaching students to learn about a phenomenon or piece of knowledge, to keep an eye out for phenomenon, to experience it in various environments and lastly to record that experience in a way that matures over time. Two important things to consider when designing a platform is that “straightforward mechanics of leaderboards and points work well for introverts, but can have negative effects on extraverts. Similarly, rewards work well for extraverts and less well for introverts. To achieve overall increased playfulness, a correct combination of mechanics should be used and, if needed, changed throughout the course, to ensure success” (Codish & Ravid, 2014: p.132). Additionally, two points highlighted by de-Marcos et al (2016: p.320) are that “(1) Social gamification tools driven by motivational affordances promote the creation of meaningful learning communities in terms of the overall structure of the network. (2) Student's position in the network seems to influence learning performance”.

#### **3.2.2 Concept Design**

Upon relevant consultation with a sample of stakeholders, the proposed concept was two interlinked systems. The system description along with the requirement and need they answer along with the user type they require are discussed below:

**1 - Eye for Industrial Engineering:** The first is social media game (to be used on linkedin and twitter) codenamed I-4-IE. This is a simple game that requests users to take a picture or data of a relevant IE concept, term or idea in action and then label it according to the disciplines/sub discipline of IE and post it to a common social media platform. A variation of this is weekly challenges where followers are requested to find the IE idea in a posted picture or data on social media platforms. This would be developed to answer the requirement [R6.1] while fulfilling needs [N1.1,1.3,2.1, 6.1] with most input coming from [UT1,2,3].

**2 – IE Res-Base Platform:** The second system is a networking portal specialized to **Resound** IE interested individuals and professionals. This portal caters for the various educational, **Research** and **Resource** requirements of the IE community on it. The system is made of the following key portals and pages:

### **Key Portals**

**P1 - Personal Portal:** Accessible to all user types [UT1-5]. Aim is to provide visually acceptable dashboards for exploring IE socially and personally.

**P1.1 Overview Dashboard:** A page designed to provide an overview of the activity [R1.2] on the entire platform while suggesting content to user

**P1.2 Social Dashboard:** Several pages designed to provide a blog and discussion boards to various topics [UR2.1] [N1.3,2.1] [R2.4].

**P1.3 Profile Dashboard:** A page designed to explore one's personal image, badges and achievements on the platform [UR2.1] [N2.4,3.5] [R2.5].

**P1.4 Mail Dashboard:** A page for the receiving and sending of intra-portal mail using that follow certain processes for requesting mentors, requesting content...etc [UR2.1] [N1.3,2.1] [R2.4] to cater for need for transparency and efficiency.

**P2 – Resource Portal:** Accessible by user types [UT2-5]. Aim is to provide visually acceptable dashboards for exploring IE socially and personally.

**P2.1 Eye for Industrial:** A page designed to create a continuous update from the I-4-IE App and social media linked platforms [UR2.2] [R1.2]. Users can use this to see what others see from their perspective, broaden their horizons and discuss/debate with others regarding specific images.

**P2.2 Mentors and Specialists:** A directory of professionals on the platform with the relevant way to contact them (from their input) filtered by profession area, type of assistance they can offer...etc [UR2.1,2.2,3.1-3.3,5.1-5.3] [N1.2,2.1,3.1,3.3,3.5,4.2] [R3.1,2,4]

**P2.3 Sub Disciplines:** Several pages designed to explore educational content surrounding each sub discipline of Industrial Engineering. Developed in a peer reviewed wiki format. [UR2.2,3.1-3.3,4.1] [R2.1-2.3,4.1,4.2,5.2]

**P2.4 Contents & Templates:** Several pages that package resources required for certain project types, initiatives...etc. Sponsored content by industry is branded [UR2.2, 3.1-3.3,4.2,5.4] [N2.2,2.3,2.4,3.3,3.4,5.3] [R2.1-2.3,4.1,4.2,5.2]

**P3 – Projects Portal:** Accessible by user types [UT2-5]. Aim is to provide a transparent method to share available development, work and sponsorship opportunities.

**P2.1 My Project Dashboard:** Several pages that highlight the team, tasks, files, calendar and metrics of projects which the user is enrolled in/manages [UR2.2,3.1-3.3,4.1] [N2.3,2.4,3.4,3.5,4.1] [R2.1-2.3,3.2,4.1,5.1]

**P2.2 Surveys and Quizzes:** Several pages that vary in function from knowledge testing to feedback requesting [UR1,2.2,3.1-3.3,4.1,5.1-5.3] [N1.1,3.1,3.2,3.3,3.5,4.1,4.2,5.1] [R1.1,2.5,3.2,4.1,5.1]

**P2.3 Current Project List:** Several pages where available opportunities and projects are posted by [UR3.1-3.5,4.2,5.1-5.3] [N2.4,3.2,3.4,4.2].

**P2.4 Completed Projects:** A gallery of achievements of platform members that highlights what is possible with collaboration [N3.1,4.3,5.3]

### **3.2.3 Available Design Tools**

Given that the request was a conceptual system design, prototyping tools were used to develop the concept. Bootstrap was found to be an excellent tool for rapidly prototyping and designing dashboard application. Admin platform templates available online were customized using the pine grow software package to develop the relevant platforms identified in table 2. The memento database android app was used to prototype the Eye 4 IE mobile application.

## 4. System Concept

### 4.1 Eye 4 IE Application

#### 4.1.1 Description of System

The solution encourages the student to identify and record data from the world around them when they see a link to a concept taught in class. In many ways, it is methodologically the same as giving mathematics exercises to encourage practice. However, in this case, since some IE concepts can be quite complicated and not objectively solvable like mathematics problems, the aim is to train the eye in identifying problems and the brain in resolving them. Even if the solution is not implemented, the student gains the ability to go through the motions of problem resolution. That is why the app will be called “Eye for Industrial”. The idea is to train the undergraduate students to develop this specific “eye” to capture real-world manifestations. This will, in turn, support their theoretical knowledge. The application itself will have a collection of templates that can record certain types of data. For example, one of the templates might simply require students to take a picture of an event which reminded them of a specific concept. Lecturers can update the concepts on the template and see how much feedback they can obtain after teaching a certain concept. Other templates might be more course specific or complex. For example, a template can require students to record number of people in queues and perform time studies

#### 4.2.1 Eye 4 IE Application

Figures 1-3 showcase the proposed application. As can be seen, a strong focus was placed on visual appeal. Figure 1 displays the homepage of the app showing the IE-Spy social media game along with several sub-disciplines specific templates for queuing times and statistical process control. Additional mini portals for connecting with IE professionals are included. An additional dashboard for the mobile application is shown in Figure 2. On this page, helpful reflection tools are given to the user to reflect on their experience. Figure 3 shows a sample form for the IE Spy game where a simple survey allows the user to record a picture that relates to an IE idea or upload a visual representation of collected data.

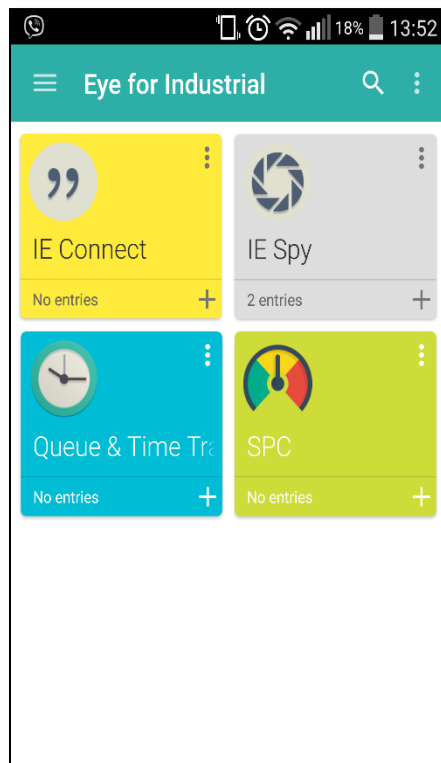


Figure 1: Main Dashboard Eye-4-IE App

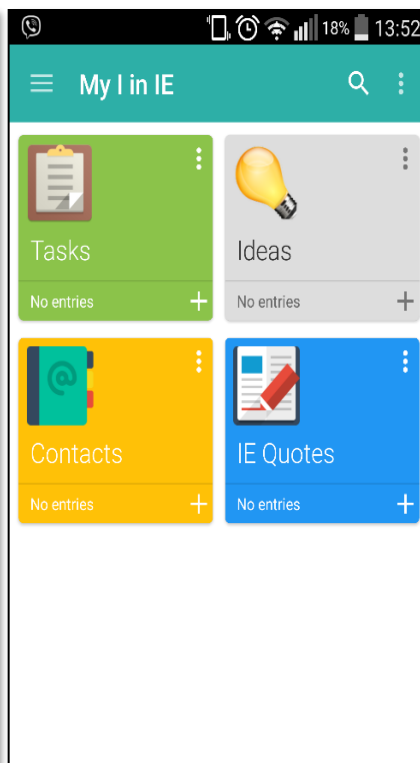


Figure 2: Personal View Eye-4-IE App

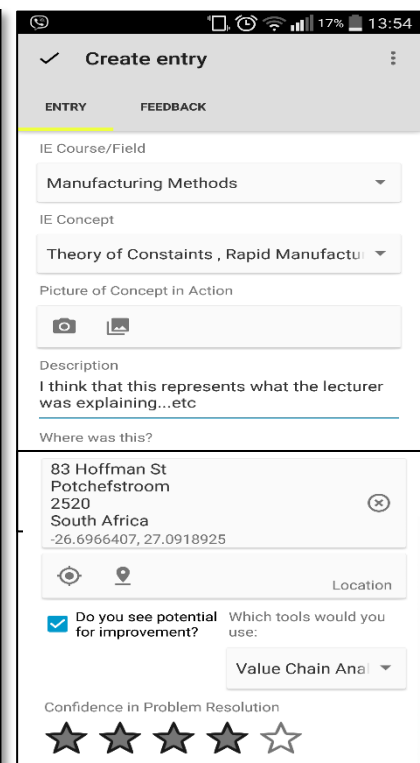


Figure 3: Sample Eye-4-IE Form

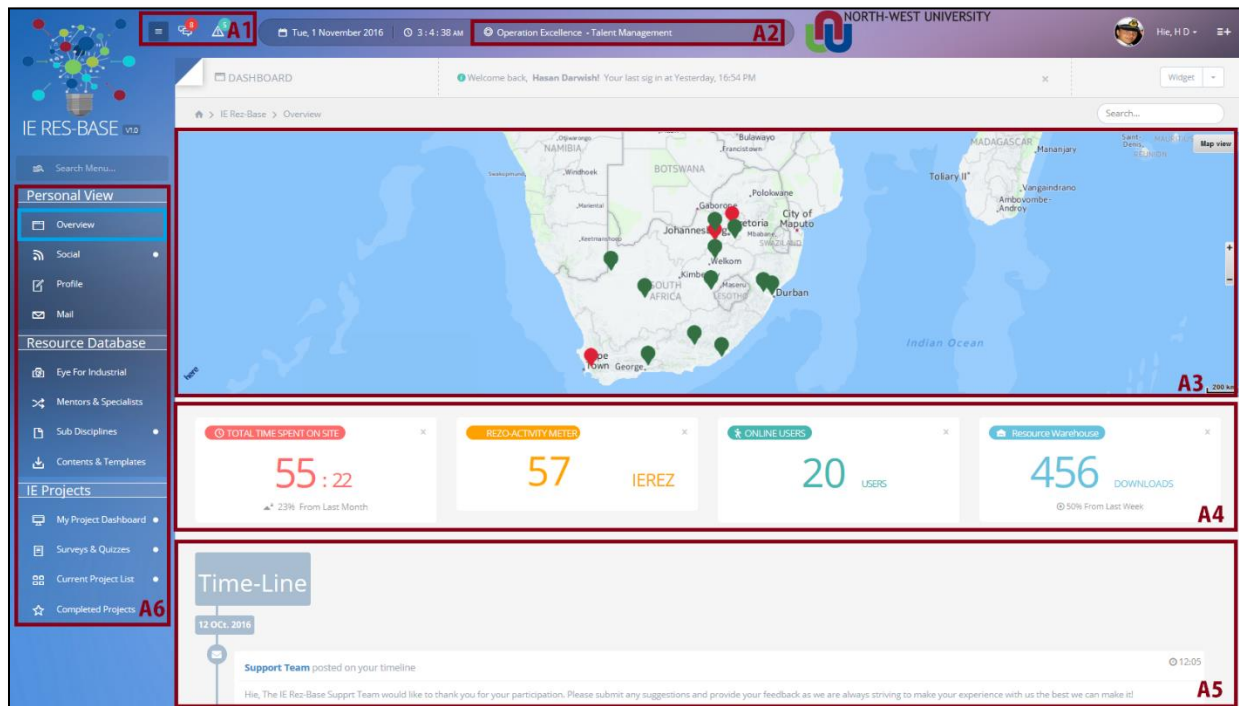
## 4.2 IE Res-Base

### 4.2.2 Description of System

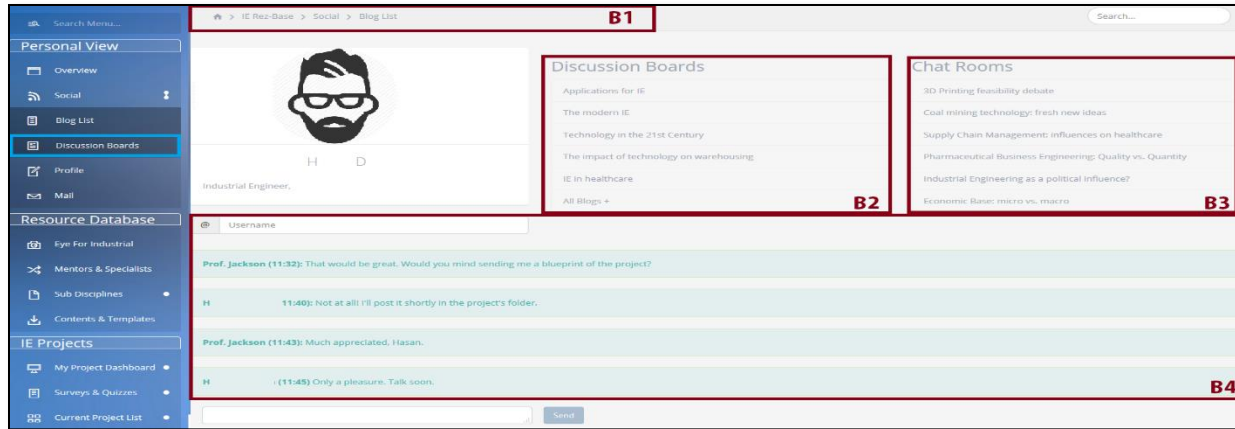
The platform is a multifunctional resource-sharing solution. It takes the meaning of resource in the broadest sense (time, networking, template resources, content...etc). The proposed final solution aim is collect data from surveys posted on the website, interaction between members and content posted. Industry might also be kind enough to share IE relevant data within their companies. Additionally, it can potentially provide resources and templates suited for IE use. Additionally, customizations of these will be available on the website for different Industries or cases. Educational content can be packaged into courses for strengthening certain skills, specialties or capabilities in a standard video or text format. A strong focus is needed on visualize Industrial Engineering knowledge, specializations and spread in Industry. Also, the interface with other bodies of knowledge can be depicted. Final solution should be a fun and interactive place where students can spend some of their time. Alumni of undergrad programmes will be encouraged to participate. Lastly, it should promote postgraduate research for IE in Industry by removing some perceptions about academia. This is primarily done by creating collaborative efforts that mix between the positives of the private sector and education sector

### 4.2.2 Visual Design

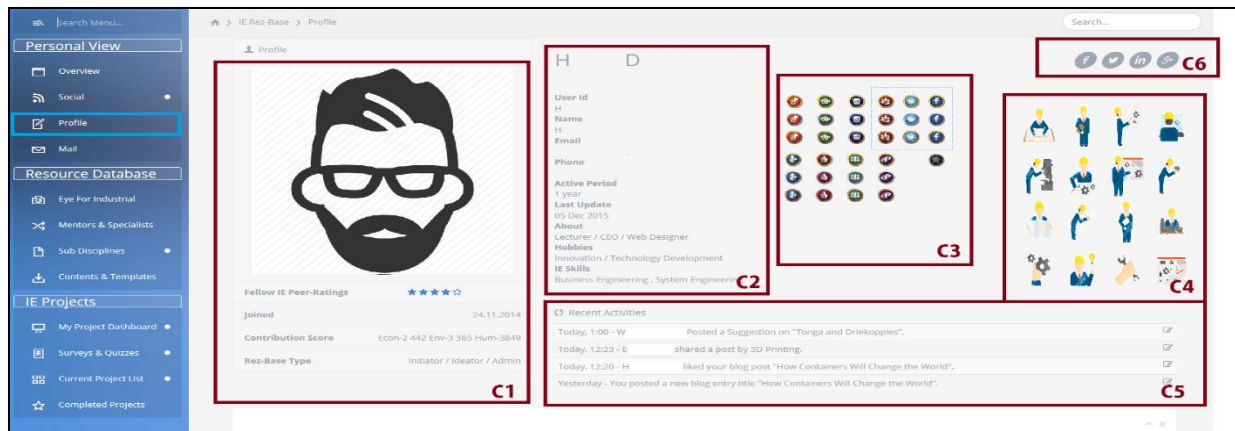
Figures 4-10 below showcases the most important pages/portals of the platform. Pictures are marked with maroon boxes with a unique ID to enclose certain app objects. Descriptions of app objects are provided below the figure.



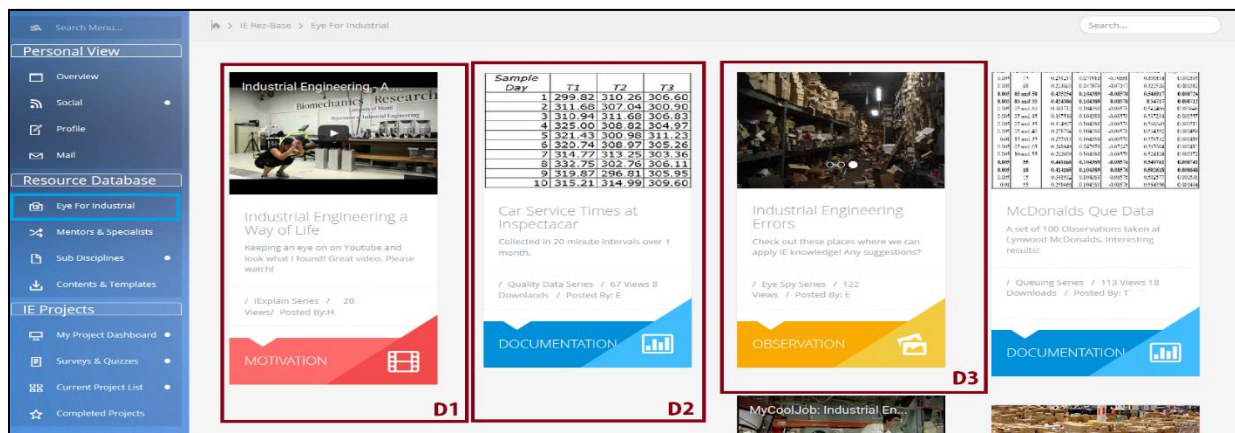
**Figure 4:** IE Res-Base Main Dashboard (Overview) [Own Work] **A1:** Notification and messaging applet. **A2:** Randomized IE term (on click will direct to wiki page) **A3:** Map of active and inactive users (red and green) **A4:** Website activity statistics and resource availability **A5:** Timeline of user relevant activity on platform **A6:** Navigation panel between 3 sub portals



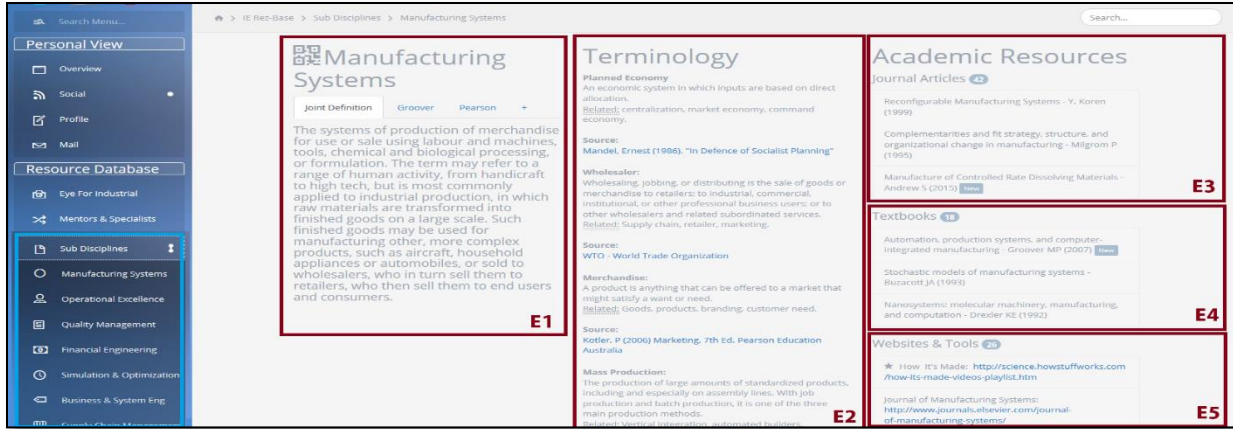
**Figure 5:** IE Res-Base Social Page (Blog List) [Own Work] **B1:** Navigation Bar **B2:** Available Discussion Boards **B3:** Available Chat Rooms **B4:** Chat with IE platform user



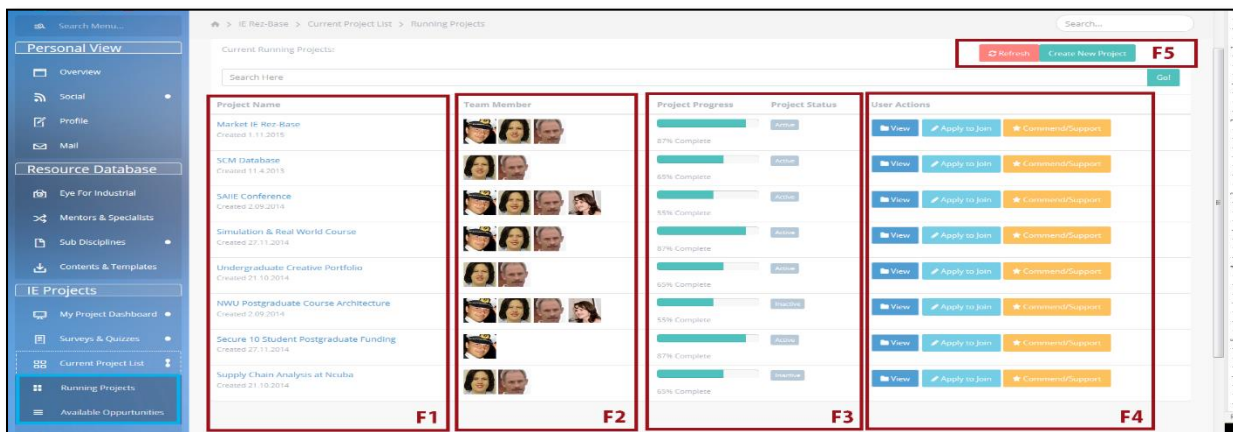
**Figure 6:** IE Res-Base Profile [Own Work] **C1:** Profile overview and picture **C2:** Profile information and contact details **C3:** Unlocked badges and rewards **C4:** IE Lifetime achievements/Type of IE **C5:** Recent activities **C6:** Social media links



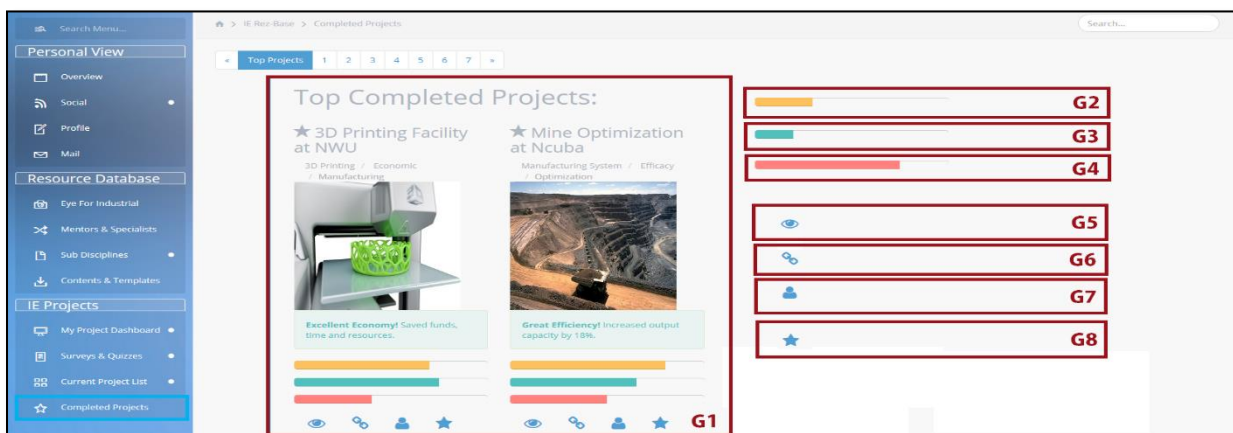
**Figure 7:** Eye 4 IE Page [Own Work] **D1:** Motivation video content post **D2:** Documentation data content post **D3:** Observation picture content post



**Figure 8:** IE Res-Base Sub Disciplines Knowledge [Own Work] **E1:** Definition from multiple sources **E2:** Sub-field terminology and related concepts **E3:** Academic resources (journal articles) **E4:** Textbooks relating to sub-field **E5:** Websites and tools used in sub-disciplines



**Figure 9:** IE Res-Base Available and Running Projects [Own Work] **F1:** Project name **F2:** Team members involved in project **F3:** Project progress and status **F4:** User Actions with regards to project (Apply to join, view details, comment/commend. Etc) **F5:** Create a new opportunity (project/research project/concept)



**Figure 10:** Eye 4 IE Completed Projects [Own Work] **G1:** Completed project overview **G2:** Economic focus achievement bar **G3:** Environmental focus achievement bar **G4:** Social focus achievement bar **G5:** View project details **G6:** Share project on social media **G7:** View project team/contact team **G8:** Comment/comment project

## **5. Conclusions and Recommendations**

### **5.1 Conclusions**

This article proposes a comprehensive platform concept which is, in many countries, a massive improvement on existing professional development and recruitment platforms. The concept recognizes the importance of considering literature surrounding both the actual problem associated with education (from high school through to the workplace) as well as surrounding technological and generation forces which naturally impact the final solution. A preliminary pilot of the Eye-4-IE application was performed with preliminary feedback indicating a positive outlook. It also provided valuable improvement opportunity in the form of simplifying the forms and getting started process.

### **5.2 Recommendations**

It is recommended that collaboration amongst various international student and professional Industrial Engineering societies be conducted to roll this system out as a global initiative that links IE professionals worldwide. This would allow for a truly diverse small world community that can share valuable insight into the differences of IE academics and application in practice.

### **5.3 Future Research**

A full system development is currently underway after concluding formal requirements analysis with relevant stakeholders at SAIIE, the NWU and with students and young professionals at various educational institutions and workplaces.

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## **Biography**

**Hasan Darwish** is a lecturer and industry coordinator at North West University. Hasan is tasked with marketing related aspects of setting up the new Industrial Engineering department and is responsible for Industry relationships. In the past few years he has completed his BEng Industrial Degree, MEng Project Management (Sustainable Development) and MA Applied Ethics for Professionals. Currently, Hasan is busy completing his PhD in Engineering focusing specifically on the Industrial Engineering Identity. As part of his industry work, Hasan is also developing an innovative model that has the potential impact to resolve youth unemployment through decentralized modular structures. Hasan has operated several initiatives in rural and low income communities since 2013 which assist in developing this model.