

The impact of immersive technologies on the construction industry

Background

The Construction IT Alliance (CitA) held a Technology Trend Event on April 3rd, 2019, which explored the impact of immersive technologies on the construction industry. The event focused on the following three key themes:

- 1. Augmented Reality (AR) for reducing planning objections:** AR is a mixed reality where computer-generated graphics, videos, text, and sounds are layered on top of your physical view. Users can interact with these digital elements via apps on smartphones, tablets, AR headsets like Microsoft HoloLens and AR glasses such as Vuzix Blade. AR is helping the property market to browse, compare, and analyze residential and commercial options. This, in turn, gets potential customers more involved and engaged.
- 2. Aerial Mapping and 3D City Modelling:** Aerial Mapping is a cost-effective way to collect highly accurate data of large project areas in a non-invasive manner, enabling accurate mapping to be undertaken with no site presence. This data can be used to create a 3 dimensional model (3D) of the existing site, that can be linked into the proposed new development.
- 3. Smart Cities:** A Smart city is one that is connected through real-time data whose economy is increasingly driven by tech-inspired innovation and entrepreneurship. This, in turn, will attract businesses and jobs, create efficiencies and raise the productivity and competitiveness of the public and private sectors.

The event hosted three keynote speakers from Property District, D3D and Smart City Dublin who discussed, in turn, one of the three areas. This paper

will provide a brief synopsis of how each of the three organisations have used these technologies within the Irish Construction Industry.

Augmented Reality

Property District provides creative, high impact, digital media content for property developers, and estate agencies. This includes bespoke blogs, infographics, 360 video and photography, podcasts, webinars, virtual reality, and AR. The property industry has seen a rise in these technologies, as they offer consumers a better, faster, more personal, and more interconnected service. This is important as public consultation for property developments has changed, with Communities and local businesses now using social media to discuss proposed developments despite not having the right information. This has resulted in the public becoming fearful and developing skepticism towards planners and contractors. These fears have been expressed through organised planning objections which are costing an additional €11500 per new house build in south Dublin. To try and avoid these costs Property District has championed AR technologies to assist in avoiding costly planning objections, as well as bridging the gap between the construction and property sector. AR can help visualise a potential sited development to the public where they can view proposed green spaces, facilities, buildings, etc. This type of collaboration is critical if we are to reach the target of half a million new homes under Project 2040“.

Property District is now creating an AR app which will help citizens of Dublin city understand new developments in the city while in conception phase and help to understand and visualise these ideas in real time. This platform will use immersive technologies to transform public consultation and

overcome planning objections that are slowing down the delivery of essential construction projects. The app titled PLACEengage is a virtual town hall, designed to inform people and encourage community engagement. This is achieved by allowing people to experience the proposed development through immersive technologies like AR. People can stand on the site of a proposed development and through their smart device, see precisely what is planned, then log onto the platform and share their views, concerns, and questions. Figure 1 provides an overview of the proposed mapping innovation for this app.



Figure 1: PLACEengage mapping innovation.

At present, public consultation is a statutory requirement for property developers, PLACEengage.com can give them a better way to do this.

2. Aerial Mapping and 3D City Modelling

D3D is a tech-enhanced 3D survey and mapping organisation which provides services in the area of photogrammetry, land/GPS survey, civil engineering, computer animation, and computer data systems. The company utilises cutting-edge technology for the production of surveys, digital mapping, and computer modelling.

Aerial surveying provides dynamic mapping of large areas and when partnered with the latest technology can bring cost-effective mapping to projects of any size and any global location. D3D through a

combination of hardware, software, and tested processes can produce a 3D model of an existing site that can be used to visualise how the development will look when complete. This process typically involves a light aircraft with a mounted stereo camera on board to capture images of the site. These images are then calibrated and sent to the photogrammetric engineer to survey the topographical features from the aerial photography. The ground profile is mapped with a 10m grid with the inclusion of any break lines. The Orthophoto is then produced, which is a combination of all the single photos, this allows intelligent information to be added, i.e., ridges of the building, trees heights, road profile, etc. The data collected can then be used by D3D to produce a mathematically accurate mini-movie of the project. The 3D model can enable the public to start to visualise each development as the designs came in and view potential concerns such as building forms and textures, shadow analysis, etc. The model can also be used for marketing purposes by the development team.

D3D has worked on large scale projects such as One Wind Mill Lane, Dublin Port, Dublin Airport and the Slane Bypass. The Dublin Airport project involved the mapping of 128 square kilometers, so as to illustrate to the Dublin Airport Authority the controlled impact for the construction of buildings inside the terminal. The Slane bypass involved an initial survey which was then incorporated into the existing design. This was then applied to illustrate how the final road design would look when one would be driving on it. For the past few years, D3D has been working on a project to help visualise the Docklands when the current Strategic Development Zone is complete. This has meant taking the architects plans as planning was granted and creating a fully rendered virtual model of the Docklands District. This 3D model is generated from traditional paper-based planning documents and designed in such a way that it will provide city developers with instant answers to questions relating to all manner of structural issues. This intuitive 3D model of the city will show what proposed construction projects will look like upon completion, as well as allowing those

involved in the planning process to see the impact of buildings on the surrounding areas and the people living within them. D3D has been experimenting with the model in conjunction with the Dublin City Council and Maynooth University through their 'building city dashboards' project to explore how to get the full potential from new technology opportunities.

Smart Cities

Smart Dublin is an initiative of the four Dublin Local Authorities to engage with smart technology providers, researchers, and citizens to solve challenges and improve city life. The main goals are to provide better services, promote innovative solutions, enhance economic activity, and increase collaboration and engagement. Smart Dublin is delivering a programme that encourages the creation of solutions to address city needs by promoting the opportunities offered by emerging technology and public data. This is very important, as the number of connected devices is predicted to be one trillion by 2035, which will provide an opportunity to use the collected data to influence how Dublin does business. Smart Dublin has identified mobility, environment, energy, waste, and emergency management as priority challenges. The overarching goal is to position Dublin as a world leader in the development of new urban solutions, using an open data approach, and using the city as a test bed for innovation.

One of the challenges faced by Smart Dublin is demonstrating how technologies already play a crucial part in our ecosystem. Some examples include the delivery of real-time passenger information for Dublin's public transport system, in particular on the capital's extensive bus network, with this information now available on signage and also as a real-time data feed to your smartphone. The Traffic Management Centre uses intelligent transport systems, adaptive traffic signaling, and public transport prioritisation as well as an extensive CCTV network to help to keep traffic moving across the city. Croke Park is also one of the world's first carbon neutral stadiums and now the test bed for a suite of cutting edge Internet of

Things (IoT) technologies working with companies such as Intel and Microsoft. To respond more effectively to flooding, there are now sensors monitoring river levels, rainfall, and local weather conditions in real time.

One of the most current initiatives is Dublin's Docklands District, which is one of the largest development projects in Europe, with over €2 billion in investment and construction projects underway. A Docklands Smart District network brings together leading tech companies, research centres, and other agencies with a focus on deploying the latest smart city innovations and connectivity across the district. As discussed previously, D3D has worked with Smart Dublin to produce a 3D model of the Docklands and open source it to the market. This model has recently been used as part of the 3D City Data Hackathon, organised by Dublin City Council, via the Smart Docklands Programme, and the Grangegorman Development Agency. There is also plans in place to test a 5G mobile network within the Docklands, which will make it one of the first in the world to do so.

Smart Dublin has provided a number of challenge-based innovation funds which offer monies to help companies find innovative solutions to existing problems. These funds have provided springboards for prototypes to track stolen bikes, generate real-time bike journey data, and also to better capture the cyclist experience. Figure 2 illustrates a heat map of central Dublin's most used cycling routes as recorded from these sensors. Other innovations include drones to help combat illegal dumping through the application of daily mapping flights that can identify and track new dumping sites. This is complemented through a network of sensors around problem areas, providing An Garda Síochána with live video links to aid prosecution. Another innovation, the Smart ICON light gathers a wide range of anonymised sensor data which will be used to inform city planners of the best ways to improve cycling infrastructure in the city, as well as develop better policies aimed at promoting safer cycling in the city. Smart City Dublin are also investigating using IoT solutions to understand

footpath terrains to enable better disability access. There are solutions being applied to target logistical concerns, such as reducing goods vehicles in urban areas, and changing fixed parking spaces to be interchangeable at required times to best suit that need.

To listen to the audio recording of the workshop please click on the link below

<https://www.cita.ie/cita-technology-trend-event-april-2019/>

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Figure 2: Cycle Heat map of Central Dublin

Through the Smart Dublin and Enterprise Ireland Small Business Innovation Research programme (SBIR), over 40 companies have received funding support totaling over €1.5 million, as well as mentoring and access to city testbed facilities.

Conclusion

As IoT continues to evolve at a rapid rate it is vital that the property and construction sector work in unison to reduce the inherent fear that is installed in the public when it comes to understanding the impact of construction on their environment. Immersive technologies such as AR and aerial 3D mapping can be used in partnership with smart innovations to assist the public in becoming an integral part of the planning, design and construction phase of a development. This in turn will reduce lengthy and costly planning objection that are having an adverse impact on Ireland's 2040 strategy. The CitA Technology Trend Series will continue to promote innovative and progressive technologies that are being used within the Irish Construction Sector. To see more information on upcoming events, please click on the link below.

<https://www.cita.ie/events/>