Using Mobile Technology for Managing Construction Projects

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Abstract

This essay examines the use and application of emerging mobile technologies in the construction industry. Mobile phones and tablets are discussed in-depth, and can be used to replace office tools, to collaborate, and to bring building information modeling (BIM) technology out into the field. Next, wearable computing technology is discussed, including Google Glass and smart hard hats. This technology provides another avenue for construction information access in the field. Finally, unmanned aerial vehicles are discussed, along with their challenges and potential benefits. Increased technology use will absolutely improve efficiency and profitability in the construction industry.

Allhands Essay

When people are asked to think of an antiquated, backward-thinking, old-school industry, the construction industry is often mentioned. While anyone who has worked in construction knows this perception can sometimes be true, it is not always accurate. Many construction companies have, in recent years, began embracing emerging technologies as an answer to heightened competition among contractors and the increasing demands and expectations of owners. However, the construction industry still lags in technology adoption. A stark example of this is the statistic showing that construction companies spend on average only 1.1-1.6% of their annual revenue on information technology, as opposed to an average of 6% in other industries (Sacolick 1). In fact, the construction industry comes last in the cited study of fourteen industries. Is this acceptable? Many construction industry players, including members of the millennial generation, refuse to accept the "same old way" of going about business. This essay will discuss the role of mobile devices in the construction process and how mobile hardware and software can be used to improve the construction process.

The first and most obvious mobile devices to be discussed are mobile phones and tablets. In the past several years, mobile computing technology has exploded, and one can easily buy phones and tablets that are more powerful than the laptops of five years ago. Nearly every construction manager and superintendent has a smartphone, which is used at minimum for phone calls, text messages, and email. Tablets are present on many construction sites as well, and while they are less common, they are very beneficial for field personnel as they manage the day-to-day aspects of construction projects.

Smartphones, by far the most prevalent and widely adopted mobile devices on construction sites, can be used in a multitude of ways above and beyond their standard uses. When equipped with the proper applications (also known as apps), smartphones can be used to replace office equipment like scanners and fax machines. An app called CamScanner lets the user scan, process, and upload or send documents using only the device's camera. eFax is an app that allows the user to obtain a free fax number for use on a device in addition to the device's standard phone number.

Other ways smartphones will become used in the construction industry is using a suite of applications not typically used by construction professionals, but used extensively by millennials and other young smartphone users. These applications provide increased coordination and collaboration between individuals, and could almost be considered "social media." A key example of this is an app called GroupMe. GroupMe, owned by Microsoft, is used by many students and other young smartphone users to communicate in groups. It is effectively the text messaging version of a mass email or a chatroom. An initiating user can add desired parties to a group chat, and users can effortlessly communicate with the group instead of text messaging individuals. GroupMe users can form unlimited groups and variations of groups. An example of how this could be used in the construction industry would be as follows: A project manager creates one group chat for all of the people in the construction management team, and another group chat only containing members of the field supervision team. She could even create a group chat with the project decision-makers, including the owner's representative and architect. Group messaging in this manner could prove invaluable during all phases of construction, including preconstruction bidding and project planning, as the ability to

rapidly ask and answer questions increases the efficiency of collaboration. This type of communication is likely to become more widespread as more and more millennials move into roles in the construction industry.

Tablets are most commonly used by construction personnel to view drawings and to create punchlists. If properly configured, though, a tablet can be a full substitute for a PC in the field. Tablets can be set up with email and calendar applications, as well as apps that allow the user to view the full set of drawings and specifications or to create and share punchlist items. An extremely beneficial technology available as part of many applications is cloud storage. This feature allows data to be synced between connected devices and remote servers. Applications such as Dropbox and Box.net provide cloud storage capability, while many applications have built-in cloud storage for in-app data. Cloud storage is beneficial because it places data off-site and can create redundancy, with data saved both locally on the device and remotely on the server. Additionally, cloud storage can be used to automatically sync data, ensuring that all devices are always populated with current information. As any construction professional knows, having access to current drawings, specifications, and information is always a challenge, and many problems are avoided when all parties use current information.

Another emerging use of tablets using cloud technology is in the area of preconstruction. An application called Cloud Takeoff has made it possible for estimators to perform digital takeoffs on any device, from Mac or PC to tablets and iOS devices. These takeoffs are based digitally in the cloud, so users can collaborate or work on the documents from different devices. This application performs tasks that were previously only performed by heavy programs such as Onscreen Takeoff. The collaboration and

versatility offered by cloud-based programs like Cloud Takeoff will revolutionize preconstruction, allowing companies to collaborate more effectively and produce more accurate bids in a timelier manner than they can using traditional PC-based software.

A final emerging use of tablets is to access BIM (building information modeling) information in the field. Until the advent of tablet computers, access to BIM models was limited to PCs, which were not typically used in the field. When software like Autodesk's BIM 360 Field and BIM 360 Glue are used, construction management personnel can have 3D models on hand in the field. This increased access to the project model can facilitate rapid problem solving and resolution of issues, and eventually may lead to 3-D model-driven construction. Model-driven construction (as compared to construction from 2-D drawings) may be the future standard in the industry, and tablet computing technology is certainly helping to enable research into this new project management procedure.

This discussion of smartphones and tablets, along with applications relevant to construction management, has covered many helpful uses of these devices in managing construction projects. Most of the technology discussed is already in place, and the only barriers to adoption of these technologies are cost and the disruptive change companies may face by embracing new construction management methods, procedures, and technology. The remaining devices and applications discussed in this paper will be more experimental, less accessible, and even hypothetical at this point in time. However, it is important to discuss these technologies, because rapid advances in both hardware and software bring about swift development of new technologies, and that which is discussed as hypothetical or prohibitively expensive this year may be used by millions of users in only a matter of years.

One piece of hardware that may become widely used in the construction industry is a much talked about, yet rarely seen device: Google Glass. Google Glass is a glasses frame with an onboard mobile computer. Glass can be fitted with different lenses, including ANSI Z87.1 approved safety lenses (P, Josh 1). Glass's mobile computer responds to voice commands, and can take pictures and video on command. Additionally, applications for Glass, called Glassware, are available. Well-known construction software companies including Procore and FieldLens have already created Glassware focused on streamlining construction management activities such as creating punchlist items and assigning responsibilities to different parties. Google Glass or other similar wearable devices can also be linked to other devices, which will be discussed in subsequent paragraphs.

An area that has not been discussed so far in this paper is safety. Construction is one of the most dangerous occupations in the United States, and in 2013 over one-fifth of workplace deaths occurred in the construction industry (Commonly Used Statistics 1). If technology can be used to improve other areas of the construction industry, can it also be used to improve safety? There are companies who have developed devices that answer that question with a resounding "yes"! One such company is DAQRI, an augmented reality developer who has developed the Smart Helmet, a hard hat with built-in features promoting safety and information accessibility and management. The Smart Helmet is manufactured with inertial sensors and 360 degree cameras, as well as a screen in the front evocative of the Google Glass interface. While still in its infancy, a smart hard hat like this can be used not only to display product information and 3-D information in the field, but to track the location of workers, identify and warn of potential dangers on the

jobsite, and to automatically notify management if the helmet detects an accident or near miss involving the wearer. This is an excellent example of technology that will make the construction industry a safer place.

The final device discussed in this paper is a controversial topic in today's world: Unmanned aerial systems, commonly referred to as drones or UASs, have a certain and expanding role in the construction industry. There are many opponents of and advocates for commercial drone use in the United States, but the Federal Aviation Administration (FAA) appears friendly to the idea of commercial drone use, and in October 2014 it loosened regulations for drones used for filmmaking purposes, clearing the way for more industry exemptions in the future. (O'Connor 1). At the time of writing, all other industries must fill out a Special Airworthiness Certificate and file it with the FAA in order to receive permission to use drones commercially. However, despite the procedural challenges that exist, the use of UASs in construction has been very beneficial for the companies who have already adopted the devices, and use is likely to increase as legal barriers are removed and the technology becomes more common and inexpensive.

Unmanned aerial systems offer benefits to many work processes in construction. Generally, they are used for tasks involving photography, videography, and other data collection. UASs can be used to capture aerial photographs of construction sites much less expensively than costly third party aerial photographers using manned aircraft. In addition to capturing progress photographs, UASs can be used for aerial inspections of hard-to-access locations. In the future, as battery life improves, drones may be able to provide constant live feeds from construction sites. Remotely-located decision makers could pilot the drones to view job progress, providing them with up-to-the-minute

information useful in managing the project. As mentioned earlier in this paper, wearable computing technologies like Google Glass have successfully been linked to video feed from UASs, providing the wearer with live video feed from the drone. This capability also certainly reduces safety risks compared to a worker suiting up with fall protection gear and working at great heights to examine aspects of the project.

As a future construction manager, the author anticipates utilizing all of the devices discussed above in preconstruction planning and day-to-day management of construction projects. The forces of change are so rapid that, in a few years, I would not be surprised if the technology described in this paper is used nearly universally. Companies who do not adapt may simply be driven out of business by companies who leverage the benefits of new technology in order to save time and money and work more safely. Some of these devices, such as mobile phones, simply replace old technologies, namely landlines and desktop PCs. However, applications utilizing cloud computing are quickly ushering in a new era of collaboration, where information is accessible anywhere at any time. Construction professionals today often face challenges rooted in the availability of information – a classic problem, for example, is when work is performed without referencing the newest drawings. This problem will be a thing of the past, though, when companies give their field personnel tablet computers which automatically sync whenever new documents are issued. Drones and UASs are another technology that will drastically change the construction management industry. UASs will be used in ways we cannot yet even fully imagine, from surveying and layout to material tracking and even, perhaps, performing actual construction tasks. In short, construction management

as it has been known will rapidly evolve, and the industry may be nigh unrecognizable in five or ten years.

I cannot claim that my educational experience has formally prepared me to work with any of the emerging technologies discussed in this paper. However, as a millennial, I can say that my life so far has certainly prepared me to embrace new technologies and integrate them into every aspect of my life, including my future work. I have attended university at a time when cloud computing and storage sites like Dropbox and Google Drive are exploding in popularity, replacing technology like USB flash drives that was widely used only a few years ago. I have had a mobile phone since I was thirteen, and since high school I have walked around with the entire internet of information at my fingertips, or, more accurately, in my pocket. Members of my generation are excellent at using our resources to find information and solve problems: Even if I do not know the answer to a question, I can nearly always find the answer with a minute or two of research. While I may not be trained in the use of UASs or Google Glass, I am firmly convinced of the merits of embracing new technology as soon as it is available and learning how to make it work for me. I believe that as today's students graduate and move into the construction industry, we will serve as catalysts to introduce and promote new technologies in the workplace, which will greatly benefit the profession we all love and have chosen.

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