Improvising Prefabrication Construction using IoT

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Abstract:
The Internet of Things (IoT) has been implemented as a component of cyber physical systems across many different sectors in this cutting-edge age of Industrial Revolution 4.0, but its adoption in the construction sector is still limited to a few applications. This study looks at, analyses, and assesses the obstacles to using IOT in construction projects. Prefabricated components have been shown to be an effective and efficient method for increasing production and the construction process, as well as ensuring construction quality and lowering time and expense. However, there are a number of drawbacks with this technique in practise, including initial high building costs, a lack of awareness of the prefabricated method of construction, technical and installation challenges, and an inability to locate local prefabrication enterprises. Recent advancements in the IT sector,such as smart phones and communication technologies, have led in the fast rise of Internetof Things (IoT) technology and related markets.
Keywords: IoT, Industrial revolution, Sensors, RFID, Prefabrication construction
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1. Introduction

People have witnessed huge economic and social upheavals throughout history that were triggered in some way or another by technological developments. These changes, referred to as disturbances by 'Schumpeter,' temporarily pull the economy out of its stable equilibrium and spur progress (Schumpeter, 1934). Each Industrial Revolution brought with it technical advances that profoundly impacted the industrial sector.

During the First Industrial Revolution, the move from crude tools to sophisticated machines made mass manufacturing possible. Because of technologies such as James Watt's steam engine, this revolution is remarkable for breakthroughs in automation. Several technological improvements made possible by electricity characterized the second industrial revolution, which occurred in the late nineteenth and early twentieth centuries. For the first time, electricity is being employed in industries, resulting in more productive production lines and mass production. Many experts think that the introduction of Intel's 4004 microprocessor, the basic component of a personal computer, in the 1970s signaled the start of the Third Industrial

Revolution (Jovanovic and Rousseau, 2005). The three key technologies of this era—the PC, the Internet, and ICT—are still in use today and are frequently referred to as the "digital revolution" due to their broad use in both households and businesses. Surprisingly, the Internet is often recognized as the most disruptive technology to date (Ashton 2010).

According to a German government decree known as "Industrie 4.0," the country's manufacturing plants and other industries were to be completely digitalize (Balasingham, 2016). This essay, on the other hand, will focus on the industrial sector rather than German businesses. It will look on the possibilities for improved growth and productivity in the industrial sector made possible by Industry 4.0 IoT technology.

2. Industry 4.0

The most recent industrial revolution has enabled the integration of people, objects, and software systems for the first time (Roboyo.de). This cross- linking capacity brings up a world of possibilities for improving industrial processes' productivity, quality, efficiency, and flexibility. Simply said, Industry 4.0 aspires to first incorporate information technology into industrial production before delivering on its promise via enhanced data analytics. The structure of Industry 4.0 is commonly characterized as four layers, with the Internet of Things acting as the foundation and key component.

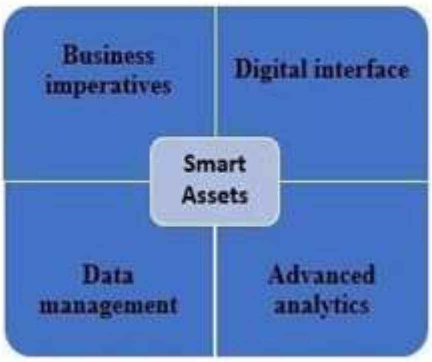

Figure 1 -Industry 4.0 - layer structure. Source: author

3. Internet of Things (IoT)

MIT executive director Kevin Ashton originated the concept "Internet of Things" in 1999. Sensors werebecoming less costly and more digitalize at the time, encouraging Ashton should consider the logical next step in the ICT era: interconnecting objects through the Internet (Ashton, 2009). The main idea was to make use of current Radio- Frequency Identification (RFID) technology by giving all items IDs and wireless connections so they could connect to one another and converse over the Internet. Since then, the word "Internet of Things" has grown in scope, and its connotations have evolved in a variety of ways. Cisco's Internet of Everything (IOE) idea refers to a connected network that includes both people and things, as well as locations and items (Cisco, 2013). Next, there is the Industrial Internet of Things (IIoT), which is IoT in an industrial setting with a focus on linking the machinery used in production (World Economic Forum, 2015). Despite being categorised as an IoT subclass, the IIoT this research will utilize the primaryterm, IoT, because it encompasses all theother categories.

The term "smart" is widely used to characterize the Internet of Things (IoT), smart products, smart technologies, smart networks, and smart sensors. In fact, the Internet of Things is a multi-objective network of intelligent things that, when combined, may augment the intelligence of each item by sharing information and responding to it quickly.

4. Prefabrication Construction

Prefabrication and job simplification in the construction industry are not new concepts; they have been argued extensively since the 1950s. Extensive applied prefabrication has been used all around the world for many years. Prefabrication is a broad phrase that refers to the offsite fabrication of structures or sections of buildings prior to onsite installation or assembly. This style of construction is sometimes referred to by terms such as per- assembly,modularization, prefabrication, industrialized buildings, and system building. Although prefabrication technology produces a better product in a quality-controlled setting, the building sector, sheltered environment will unavoidably gravitate towards greater prefabrication. This is recognized as one of the 21st-century building industry's tenets of improvement. Modular, Complete, Panels, and Pods are examples of prefabricated elements used in the construction of prefabricated buildings, and they include structural buildings modular units, pods, panels, and completely prefabricated buildings. In this project, prefabrication is chosen, with an emphasis on constructing components that are created off-site in a factory. Such industries have greater adoption rates as compared to the permanent sector. As a result, the current study thoroughly examined the existing information about the potential hurdles or problems of prefabricated materials in building construction, with a particular emphasis on the challenges that IoT can address.

5. Challenges

- Improving Construction Productivity
- Complexity and Uncertainty in Construction
- Manufacturing Requirements
- Handling and Transportation Requirements
- Assembly requirements

6. Literature review

Prefabrication and modular construction are two methods used in building and infrastructure development. Prefabrication is the practise of constructing structural components off-site at a warehouse or other facility and bringing the finished assemblies to the building site. Modular construction is a system in which components, or "modules," are built off-site and then delivered to the construction site to be erected and linked together. These methods differ from standard building methods in that basic materials are carried to the construction site and assembled by the project team. Historically, the popularity of various construction technologies has varied by nation and has seen waves of acceptance. Until recently, the common view of prefabrication and modular building was unfavourable, with poor craftsmanship deemed. Today, the potential benefits of prefabrication and modular construction are being recognized, as are developments in technology and workmanship that allow for more sophisticated designs and the use of superior materials.

Prefabrication and modular construction can enhance working conditions and minimize risk by allowing much of the component fabrication to be done off- site. As a result, much of the hazardous work is done in a controlled environment that is particularly built for safety. Furthermore, by working indoors with per-fabrication and modular building techniques, poor weather circumstances that would normally impede the completion of the work on site are avoided. This also reduces the safety issues connected with inclement weather (e.g. rain, fog, ice, wind).. Modular manufacturers will need to spend in developing skills and knowledge in design, operations, and digital technologies. Because current talent is scarce, collaborations with developers, construction businesses, and banking institutions may be necessary.

The use of IOT in construction projects has a number of advantages, some of which include improved project efficiency, safety, and performance as well as the provision of a reliable means for acquiring data and information in real- time. The purpose of this study was to identify and assess the hurdles to IoT adoption in the construction sector, as well as to assess the level of knowledge about the transformation and use of IoT technology in projects. The survey found that a lack of safety and security, a lack of stated standards, a lack of benefit information, an improper introduction of IOT, and a lack of network resilience are the most frequent barriers to IoT in the industry.

The findings call for further inquiry.

One of the challenges is the need for a faster, more reliable, and stronger communications network. 5G roll out might be one of the technological advances required to overcome these difficulties. Future connectivitystandards will priorities connection density to handle the enormous number of IoT devices, extensive coverage to reach difficult-to-reach areas, low-power consumption, and reduced network complexity. These technological barriers, if overcome properly and in a timely way, would provide a supportive environment for widespread 5G roll out. Along with understanding the potential for economic development that the 5G standard may bring, governments and private parties should work together on any required technology advancements.

Even after a decade of building ERP (Enterprise Resource Planning) and comparable technologies to solve interoperability challenges, most firms are unhappy with their present degree of data and system integration. Some challenges will stay unresolved without a proper communication structure as the core failure of a construction management system will prevent companies from adapting to meet changing business requirements. The decision-making process in construction projects has the potential to be considerably enhanced and automated by the Internet of Things. Although it may be argued that the daily project meeting practise incorporates monitoring and control for decision- making, its low temporal frequency is detrimental to project performance in terms of making choices on time based on current field information.

Using IoT ideas and methodologies, project delivery timelines and quality may be improved. This research presents a preliminary analysis of the many possibilities and potential of the application of Internet- of-Things in the construction sector to meet the increased consumer needs in the current technological age. There is a pressing need to put IoT theory into practice in the construction sector with an integrated ecosystem that changes with time.

The Internet of Things (IoT) is a term used to describe networked devices and things that gather and send data via the Internet. The Internet of Things is a developing technology that has the potential to revolutionize sectors while also necessitating far-reaching regulatory reforms (for example, interns of data security and privacy) that will need large resources. This article examines the facts on IoT adoption and economic effect during its early years of existence. It employs a growth accounting approach to assess the potential impact of IoT on productivity. Estimating the influence of new technologies on productivity is a critical step in determining the 'economic value- added,' which justifies resources allocated to enabling innovation adoption. We found that the Internet of Things has a positive impact on security, although a little one given that it is still in its early phases of development.

7. Methodology & Data collection

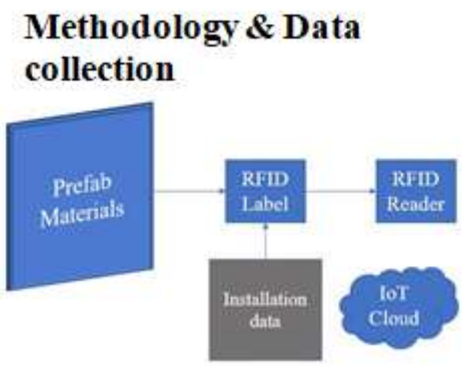

Figure 2. Block diagram of methodology

Methodology describes the operation of the proposed work. The above block diagram depicts the operation or flow of work. Prefabricated materials are difficult to install and hence required strict supervision. Using RFID tag is like using an advanced approach to solving the installation problem by providing details of installation of each prefabricated material such that the installation is error free and quicker. The communication protocol is implementedin the form of RFID, which aid in data transfer to the IoT cloud.

These installation details include details such as direction, orientation and weight to assist in placing the heavy materials error free and hassle free.

Also, through IoT, all real- time data is saved in the IoT cloud, whichis available to remote users through laptops and smartphones. If a remote user wishes to access, it can be made possible to view the real time update of the installation of prefabricated materials.

Communication protocols:

Zigbee: The internet of things (IoT) and machine-to-machine (M2M) networks may now be connected using the low- cost, low-power Zigbee wireless technology standard. Low-data-rate, low-power applications may use the open standard Zigbee. This principle allows for the blending of implementations from different manufacturers, but in reality, businesses have customised and enlarged Zigbee devices, raising questions about interoperability. Instead of using hub devices to connect endpoints to fast networks as Wi-Fi does, Zigbee uses a mesh networking protocol to circumvent them and create a self- healing architecture.

RFID (Radio Frequency Identification): Using Radio Frequency Identification (RFID), which is a kind of passive wireless technology, it is possible to monitor or match an item or a person. The two primary parts of the system are readers and tags. The reader transmits radio waves and picks up signals from the RFID tag, while the tag uses radio waves to transmit its identity and other data.

RFID stands for radio frequency identification, which is a wireless, non- contact method of transmitting data and identifying people, animals, and things. An RFID reader, RFID tags, and antennas make up most RFID systems.

IoT cloud: An IoT cloud is a large network that hosts IoT devices and applications. Included are the servers, storage, and supporting infrastructure needed for real-time operations and processing. Because operations such as data storage and processing take occur in the cloud rather than on the device itself, this has had a huge impact on IoT. The cloud is essential for gathering data and extracting insights from it. The main

objective of implementing IoT in the construction sector is to employ technologically linked equipment and software solutions to enable the most efficient use of available resources with a comprehensive technical plan and regulated building costs.

Research Gap:

Because there are a limited number of review papers linked to IoT in the civil industry and my project. The research need that emerged from my project's literature assessment is that, too far, all articles have focused on how IoT may be used in various industries. What strategies can we utilize in IoT to create new technology? However, none ofthese methods have been adopted in the civil business, particularly in INDIA. So, I'm attempting to incorporate the notion of IoT in the civil sector and make some management changes.

8. Conclusion:

Examining the benefits and drawbacks of today's prefabrication industry reveals a number of issues that must be solved before prefabrication can become the norm. Increased production volume can be utilized to offset prefabricated manufacturing setup costs. Repair issues are unlikely to generate substantial enough time delays to offset the benefits of prefabricated time gained by mass manufacture.The implementation of Iot in prefabrication sector is really help in installation of components.As a result, the ultimate purpose of this study is to alleviate the difficulty of employing prefabricated components at sites by offering a solution that aids in the installation of prefabricated components.

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