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Review about IoT in Construction Works

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Abstract

The Internet of Things (IoT) had grown in popularity over the last several years. There is still much to learn about the use of IoT in building and civil engineering. The goal of this research is to describe an IoT monitoring system that can be used to enhance safety in these industries. Real-world construction and civil engineering projects have been used to test the system. Construction and civil engineering industries are likely to benefit considerably from its adoption.

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Introduction

Throughout the history of the construction industry, there have been several incidents of worker mishaps and equipment failure. It is much more difficult to prevent catastrophic failures like the unexpected collapse of buildings and structures than it is to prevent construction accidents caused by workers' carelessness. Despite high safety standards of practice and laws, structural collapses continue to occur. An industrial building in Hong Kong collapsed, killing six construction workers and injuring 10 others; a landslide in 1994 claimed the lives of five people and injured three others; and an apartment building in Shanghai toppled over due to excavation work that was not properly monitored. Large-scale failures have a negative impact on people's lives as well as the economy. If structural collapses are avoided, it is important to alter current norms of behavior and laws based on current technologies (Sisinni, et al., 2018; Rest Devices Inc, 2017; Perkash, et al., 2013).

Structures often go through a transition period before they fail, during which time they show aberrant changes. As an example, structural instability can be detected by looking at changes in the stress on and elevation (inclination) of supporting components. Changes in the subterranean water table level can sometimes occur that aren't expected. Eventually, structural breakdown occurs as a result of these changes intensifying past the point of no return. If aberrant changes are discovered and examined quickly, suitable cautionary signals can be provided and corrective steps can be taken in time. However, even in the worst-case situation, there will still be enough time for an evacuation. As a result, structural breakdown accidents can only be prevented by constant real-time monitoring. Using Internet of Things (IoT) technology, we provide a novel approach to enhancing construction and civil engineering work site safety. The following is the page arrangement for this document: The 2nd section provides background information on the subject as well as a survey of relevant research. Third section then focuses on an IoT-based monitoring system for building sites. After that, the report comes to a close with some thoughts on where the research might go next.

State of art

Construction and civil engineering monitoring have always been intertwined. Underground water levels, structural member forces, harmful gases, settlement and tilt of structures, ground movement are just a few of the things that are commonly monitored. It is common practice to place a water level sensor into an existing standpipe on a construction site and take readings from it to monitor the subterranean water table. This means that even during peak periods, changes are undetectable because measurements are only made twice a day at most. Site surveys and classical surveying procedures are still used in the same way as monitoring works for ground movement, settling, and tilt. Measures are rarely taken more than once a day in practice. Constant monitoring would be prohibitively expensive if it were done using traditional methods, which are time consuming and labor intensive. Furthermore, the results of these tests cannot be provided in real time due to their lengthy nature. Even while using data loggers can save time and money, they cannot enable real-time processing or analysis.

Enabling technologies, including wearables, residential applications, and commercial infrastructures, have helped move the Internet of Things (IoT) paradigm forward. Two and three Devices that measure heartbeats and posture as well as skin temperature and breathing are now readily available. The Internet of Things (IoT) is also heavily utilized in smart home monitoring systems (Kelly, et al., 2013; Tao, et al., 2014). IoT technology can also be applied to new industries, such as cloud manufacturing, according to (Tao, et al., 2014).

Agriculture and dam monitoring are examples of large-scale IoT uses that have been mentioned (Zhao, et al., 2010; Yao, et al., 2011). Many industries could benefit from using Internet of Things (IoT) technologies, which can enable real-time access to data and allow for automated responses. Consider how IoT technologies could be employed in building and civil engineering projects, where they have yet to be properly investigated. An Internet of Things monitoring system is the focus of this study because construction and civil engineering are large-scale enterprises.

Internet of thing concept

According to the IoT concept, everyday objects and equipment will be connected to a variety of networks, including corporate intranets, peer-to-peer networks, and the global internet. As a result, the advancement of this technology is critical to the wireless communication sector. Every available structure within well-known firms will be encountered, and the root for completely new possibilities and business models will be developed, Mobile and internet networks have achieved a new level of interconnectivity with the Internet of Things (IoT). Enablers based on strategic high-tech are used. Radio-frequency identification (RFID), wireless sensor machines, and nanotechnology are all examples of enablers. Sensors and RFID allow the evolved version of the internet to monitor and detect changes in the physical status of linked objects in real time. Increases in industrial ubiquity can be facilitated by smaller process expansions. Things and networks are becoming “smarter” as "smart technologies" continue to expand. A novel concept, the Internet of Things (IoT) has been around for a little while now, but its supporting technologies have been moving around from place to place for some time now, established in relative isolation from one another. Near-field communication (NFC) was invented in the middle of the previous century, and nanotechnology-based materials have been on the market for over a decade. No one should underestimate the power of such a combination of abilities. Because of this, it is critical to understand the current telecommunications landscape in order to assess the IoT's potential for commercial use in the future. In order for the network to respond to external incentives, sensors must be used to identify and monitor its surroundings. Intelligence at the network's perimeters will increase its ability to respond. For enterprises and governments alike, the expanding IoT has a number of critical, well-considered ramifications, as shown in Figure 1. Researchers will be looking for a market that is both user-friendly and cost-effective as they imagine and innovate for the future (Mezaal, et al., 2018).

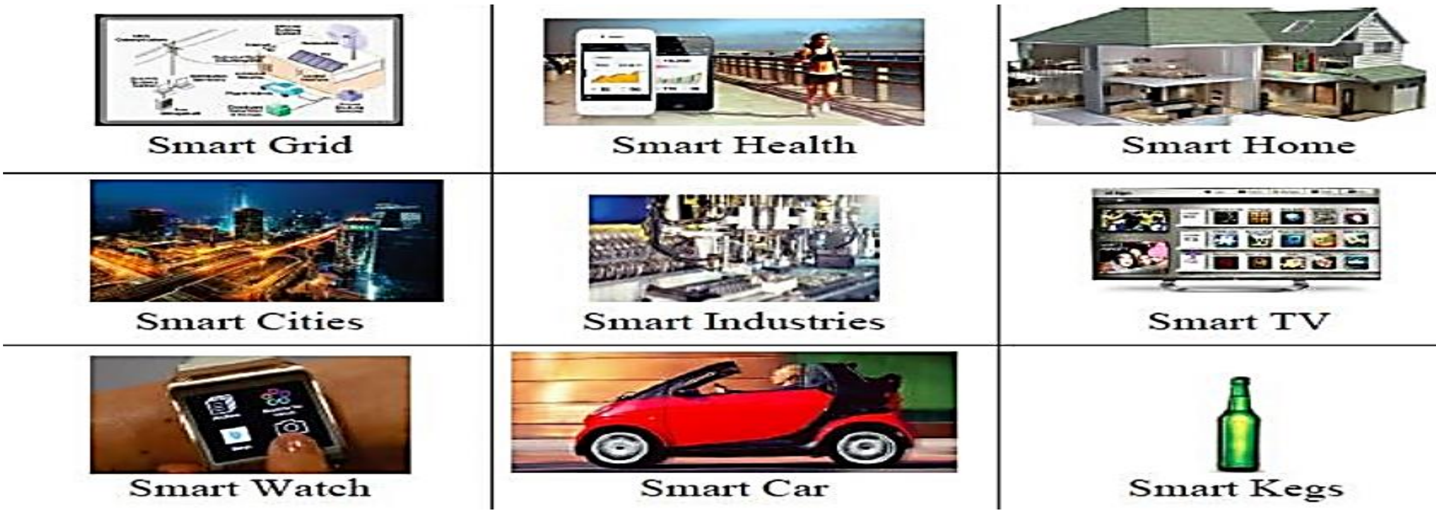

Figure 1 Several IoT applications

IoT monitoring scheme in civil engineering applications

Internet of Things (IoT) in Construction refers to the employment of technological equipment or Internet of Things (IoT) and modern-day internet software in the construction process in order to increase the project's efficiency (Analytics Steps, 2021).

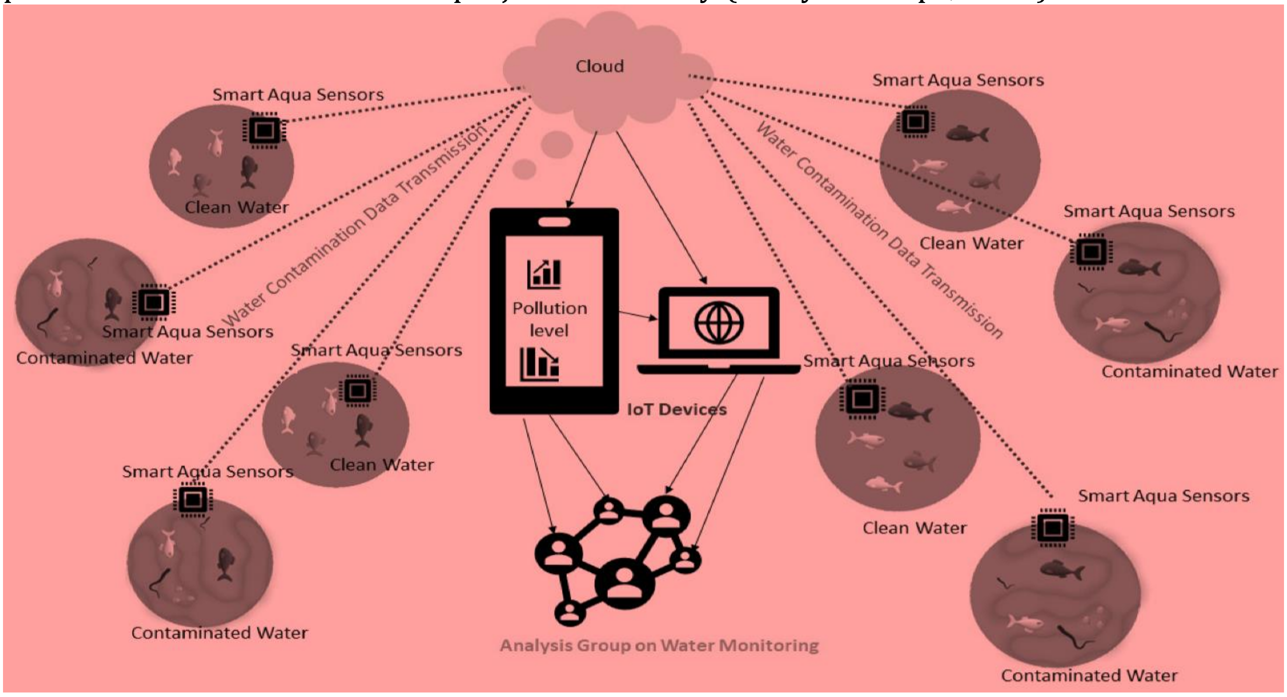

Figure 2. IoT and cloud in construction sensors (Ullo, et al., 2020)

A sensor unit, a communication backbone, a server, and a variety of user devices are all discussed in this paper as part of an Internet of Things (IoT) surveillance system. Site-based communication coordinator CCs receive encrypted digital measures from sensor devices and send them to the CC for further processing and analysis. Backbone of the system is the CC and communication channel that connects coordinator to server and to user's devices. The CC transmits sensor data to the server through WiFi or cellular network, which keeps the sensors operational. The server sends the most recent measurements and warning signals (if pre-set safety standards are exceeded) to the user's devices in order to keep them informed of real-time site conditions (Sun, et al, 2012).

Conclusion and future work

Laborers, in particular, need to wear these devices when on the building site. When a worker gets too close to an unsafe area, this might be utilized to alert him. In the event of a disaster or injury to a worker, this can also be used to track the location. Modern portable wireless application like Zigbee technology can be employed for alerting to nearest rescuer centers. IoT monitoring system could deliver reliable measurements, independent of time of day or weather conditions, was proved in real-world testing for the length of the experiment, there was no additional maintenance required for the devices. Due to government and commercial support, this strategy is gaining traction in the local market. This field's most recent developments will be taken into account while revising existing standards for civil engineering and building. It is expected that the monitoring system will significantly improve construction safety, avoiding accidents and casualties due to structure failures, while at the same time reducing the related economic losses. Adding more sensors to the IoT monitoring system and testing it under various site conditions in the future would help validate the system even further. In addition to ground settlement, noise, and structural load, the system's monitoring capabilities should be enhanced to include additional areas of construction and civil engineering.

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